Teacher Implementation of "Bring Your Own Device"

At a Suburban High School Serving High SES Students

by

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ABSTRACT

As students gain access to personally-owned Mobile Communication Devices (MCDs), schools have begun to embrace MCDs as mobile-learning (m-learning) teaching and learning tools. A research gap currently exists for the innovation of m-learning with student-owned devices, which this study attempts to fill by answering the following Research Question: What are the Bring Your Own Device (BYOD) Levels of Use of teachers at a high-performing, high SES suburban high school? To answer this question, I answered 5 sub questions: (1) What instructional decisions did BYOD user-level teachers make with regards to m-learning? (2) How did teachers collaborate on BYOD with colleagues during implementation? (3) How did teachers participate in voluntary professional development for BYOD and m-learning? (4) Was there a difference in Levels of Use between early career and veteran teachers? (5) What barriers to successful implementation did teachers at this school report? To answer these questions, I conducted a Levels of Use interview with 2-3 teachers from each academic department (n=28), at a school that was in its third year of BYOD implementation, as well as observed 18 of the teachers during instruction. I triangulated data from a first and second interview with observation data, and analyzed these data sets to profile the different Levels of Use among the teachers, and present recommendations for research and practice. I rated all participants between Level 0: non-use and Level IVB: refinement; no teachers in this study were above Level IVB. The findings indicate that teachers made instructional decisions based on their Level of Use, and although they did not participate in ongoing professional development specific to BYOD, they did work with others based on their Level of Use. Few teachers participated in voluntary professional development,

and cited time as a factor. This study also finds that personal experience with technology and lesson planning for student-centered learning is a greater indicator of successful BYOD implementation than age or teaching experience. Finally, the most commonly reported barriers to successful implementation of BYOD were time, equity/access, and student behavior.

DEDICATION

This study is dedicated to Janice Ross for her constant love and support, and for showing me the world of education.

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CHAPTER 1

INTRODUCTION

Overview

"Essentially every person on the planet that has running water—also has a mobile phone. There are approximately 6.8 billion people on the planet. Approximately 2.6 billion people do not have proper sanitation facilities—they do not have water for drinking, for example. There are approximately 4.18 billion mobile phones in circulation worldwide" (Norris & Soloway, 2011, p. 3). Although it is not a literal truth that every person on the planet who has running water also owns a mobile phone, the image is strong: 4.18 billion mobile phones in circulation. The Speak Up! National Research Project in 2010 determined the statistics for student mobile device ownership in the United States (Table 1).

Table 1

Mobile Communication Device Ownership, United States, 2010

Type of Device	K-2nd grade	3rd-5th grade	6th-7th grade	9th-12th grade
Cell Phone (w/o internet access)	18%	29%	59%	67%
Smartphone (w/ internet access)	14%	17%	24%	31%
Laptop/tablet PC	27%	32%	53%	60%
Netbook or mini-notebook computer	n/a	n/a	11%	10%
MP3 player	36%	55%	80%	85%
Hand-held game player	47%	60%	64%	48%

(Project Tomorrow, 2011, p. 5).

Schools have entered a new era in instructional technology; an era in which people can stay connected to each other full-time, with anytime, anywhere access to information. This new era has strong implications for the field of education, as schools start to experiment with how to best leverage new technologies.

In 2010, the United States Department of Education released a report on the importance of technology in education, stating that "technology is at the core of virtually every aspect of our daily lives and work, and we must leverage it to provide engaging and powerful learning experiences and content, as well as resources and assessments that measure student achievement in more complete, authentic, and meaningful ways" (p. 7). Part of this leveraging of new technology involves the use of mobile phones in the classroom; in particular the use of student-owned mobile communication devices such as smart phones, iPods, tablets, eReaders, and laptops. Programs such as these, sometimes referred to as Bring Your Own Technology (BYOT) or Bring Your Own Device (BYOD) (Project Tomorrow, 2012; Norris & Soloway, 2011), are beginning to appear in schools all over the United States. These new teaching and learning strategies, however, are relatively unexplored with little empirical research.

Purpose of the Study

BYOD programs across the country have been enacted by forward-thinking administrators and teachers, of which the majority are usually mobile technology users themselves (Project Tomorrow, 2012). There is no shortage of studies about mobile-learning. There is a significant gap in research literature however, about the BYOD

innovation, which this study attempts to fill by looking at the reality of a voluntary BYOD program in action, in a technology-rich environment.

Self-proclaimed "mobilists" Cathleen Norris and Elliot Soloway (2011) have predicted that by 2014 more people will be using their mobile devices to access the internet than their computers, and that a year later every student in grades 1-12 will be using a mobile device to learn in school. If their predictions come to fruition, studies in mobile-learning may have a strong significance in education. Specifically, there are several areas in the research for which this study is purposeful in addressing; chief among them is the manner and degree of innovation implementation, including changes in education practice and the principles of change that affect teachers who are implementing change.

Statement of the Problem

The purpose of this descriptive study is to examine the implementation of a mobile-learning teaching and learning strategy that utilizes student-owned mobile communication devices at a high SES, high performing suburban high school in the Southwestern United States to answer the following research question: What are the Bring Your Own Device (BYOD) Levels of Use of teachers at a high-performing, high SES suburban high school? This type of strategy is defined as a program in which teachers design lessons that utilize student-owned mobile communication devices (MCDs) such as Wi-Fi enabled smart phones, tablets, eReaders, and laptops, for the purpose of improving student learning and teaching 21st century digital skills. Specifically, the degree of implementation for this study will include Levels of Use,

instructional decisions, collaboration, professional development, student ownership of devices, frequency of student use, and teacher experience. To answer this research question, I will answer the following sub questions:

1. What instructional decisions did BYOD user-level teachers make with regards to m-learning?
2. How did teachers collaborate on BYOD with colleagues during implementation?
3. How did teachers participate in voluntary professional development for BYOD and m-learning?
4. Was there a difference in Levels of Use between early career and veteran teachers? (+/– 6 years teaching)
5. What barriers to successful implementation did teachers at this school report?

These questions will be answered by conducting CBAM Levels of Use interviews with 28 teachers from across the departments at this school, as well as observations of the user-level teachers with their students in a BYOD lesson.

Definition of Terms

For the purposes of this study, I will use several key terms and phrases. Bring Your Own Device (Norris & Soloway, 2011) refers to a strategy that uses student-owned devices, called Mobile Communication Devices (MCDs) or Information and Communication Technologies (ICTs) (Robinson, Brown, & Green, 2010; Anderson, 2005), to enhance the instruction in the classroom. These types of programs are sometimes called Bring Your Own Technology (Project Tomorrow, 2012). The

population in this study uses the term BYOT, but as BYOD is more commonly used in research literature I use that term. This study is framed in Hall and Hord's (2011) Concerns-Based Adoption Model, which is used to measure the implementation of a new innovation. As such, I used instruments referred to as the Levels of Use interview, which in this case assesses the degree to which a teacher is using student-owned devices, as well as Innovation Configuration mapping, which identifies key components of an innovation.

Abbreviations Used

ASU: Arizona State University

BYOT: Bring Your Own Technology (Project Tomorrow, 2012)

BYOD: Bring Your Own Device (Norris & Soloway, 2011)

CBAM: Concerns-Based Adoption Model (Hall & Loucks, 1977).

M-Learning: Mobile Learning (Peng, Su, Chou, & Tsai, 2009)

IC: Innovation Configuration (Hord, Stiegelbauer, Hall, & George, 2006)

ICT: Information and Communication Technology (Anderson, 2005)

IDT: Innovation Diffusion Theory (Rogers, 2003)

ISTE: The International Society for Technology in Education

IT: Instructional Technology

ITTLC: Instructional Technology Teaching and Learning Coach

LoU: Level(s) of Use (Hall, Dirksen, & George, 2006)

MCD: Mobile Communication Device (Robinson, Brown, & Green, 2010)

SES: Socio-Economic Status

TAM: Technology Acceptance Model (Straub, 2009)

Wi-Fi: Wireless internet connection for mobile devices

Limitations

One threat to interpreting the data collected in this study is that I, in my leadership roles within this school district, was personally responsible for bringing the concept of BYOD to this school, and I am known to the participants. As Director of Instructional Technology for the school district, I expanded the implementation of BYOD to other schools within the district. The threat is that, knowing this is a program that is important to the district , the participants might give self-serving responses during interviews in an attempt to make their performance look better. However, the familiar relationship between the participants and me can also serve as a benefit, as I am a trusted person to the population, and do not have an evaluative role with these teachers. In addition, as I am certified to use a validated interview tool, I used appropriate probing questions during the interviews to elicit the accurate responses from the participants, and the observations of participants served to triangulate the data (Stake, 2010).

Delimitations

This study was conducted at a high SES suburban high school with a focus on post-secondary matriculation, where student-ownership of mobile devices is nearly ubiquitous. As such, findings of this study may or may not be generalizable to other school populations. I provide basic information about the school and district, and readers will need to make their own decisions on comparability across sites and settings.

Significance of the Study

If the future holds that every student in the United States will be using an MCD for instructional purposes in schools, the significance of this study may be great. The United States Department of Education in 2010 made many recommendations about the importance of technology in education, among them the need for schools to help ensure 24/7 access to information via the internet, and using student-owned mobile devices to do so. While many schools have taken the step toward BYOD by applying best practices learned from other areas of teaching and technology implementation, BYOD is still a fairly new topic of research. This study will help other schools and school districts to understand and predict how different types of teachers will respond and implement BYOD. It will also help schools understand how to support collaboration and professional development for BYOD, and the obstacles that need to be overcome for these types of strategies to be successful, by revealing the issues that this population faced, and potential for overcoming them in the future.

Summary

BYOD is a relatively new topic in education, but one that has growing importance each year. As schools try to cope with the influx of devices that the students are bringing to school, and attempt to integrate them into lessons, they face challenges, both logistically and with the change implementers: the teachers. Researchers, mobile learning advocates, and even the United States Department of Education are recommending that schools embrace this new era of learning.

In Chapter 2 of this study, I report on the relevant research literature for this topic, including the role of schools in the 21st century, student access to technology in school and at home, implementation of mobile-learning programs, and teachers' response to new innovations. In Chapter 3, I outline Research Questions and Research Methodology used to answer the questions. In Chapter 4 I present the Findings, and in Chapter 5 I discuss the importance and implications for this study.

CHAPTER 2

REVIEW OF LITERATURE

Introduction

Emerging technologies in mobile communication are changing the way people live, work and learn. With the rise of the smart phone and mobile communication devices (MCDs) (Robinson et al., 2010), mobile learning (m-learning), or ubiquitous, on-demand mobile e-learning (Peng, Su, Chou, & Tsai, 2009) has expanded the learning environment; students are no longer confined to learning within the classroom walls. The benefits of anytime, anywhere learning (Bailey, Henry, McBride, & Puckett, 2011) are further explained by m-learning advocates Kolb and Tonner (2012):

> Mobile learning enables the user to access information, interact with materials, create and share learning, and communicate with others without, to a certain extent, being location dependent....M-learning also enables instant access to information and collaboration with others. (p. 160)

This instant access to information is no longer tethered to a desktop computer wired to the wall, but is being brought into classrooms in the pockets of students and teachers. "In order to benefit from convenience, expediency, and immediacy, mobile learners use ubiquitous computing technologies to learn the right thing at the right time at the right place" (Peng et al., 2009, p. 179), making MCDs and m-learning an ideal model for instant access to knowledge.

To prepare students to live and work in the 21st century, schools are incorporating m-learning into their classrooms, for everything from research to productivity to

improving literacy skills. Many researchers believe that if "leveraged properly, mobile devices can complement and add value to the existing learning styles or models" (Liaw, Hatala, & Huang, 2010, p. 446). Because schools are unable to purchase new technologies as quickly as the general public, and therefore the students and parents, many schools are considering strategies in which teachers incorporate the digital devices that students already possess. "The term coming to be used to describe this phenomenon is BYOD—Bring Your Own Device" (Norris & Soloway, 2011, p. 9).

BYOD lessons are as intimidating as they are attractive. While many educators believe in the ability of m-learning with BYOD to increase engagement and student achievement, there are concerns about funding these programs, access to technology for all students, and student safety. In addition, as with any innovation, not all teachers adopt innovation at the same time or place (Rogers, 2003). Many schools have taken the plunge into m-learning with BYOD innovations, but is m-learning changing the way teachers teach, or is it creating what Lawrence Tomei (2002) calls the Technology Facade: "The use of technology in a school or school district without benefit of the necessary infrastructure to adequately support its use as a viable instructional strategy" (p. 6). To consider BYOD, the following questions emerge in the literature: What is the role of schools in the 21st century? How do schools fund technology and ensure equitable access for all students? How is technology implemented in schools? and How do teachers adopt new innovations such as m-learning, particularly involving student-owned MCDs?

The Role of Schools in the 21st Century

Shifts in the Role

Teachers and schools have always played a critical role in the development of children into members of society, regardless of the century or the country, but this role has changed over time. Prior to the Industrial Revolution, much of student learning occurred in the home, and prepared students for the skills they needed to help their parents run a household. However, during the Industrial Revolution, "parents started working more outside the home, and so children were gathered in schools to learn things they would need later in life" (Collins & Halverson, 2009, p. 99). This change carried through the turn of the century, with schools focusing on preparing students to become citizens in an industrial society. Classrooms were formal, with rows of student desks and teacher-centered lessons that required students to move as a whole though the curriculum. By the turn of the century and beyond, some reform began to shift to student-centered instruction, but in limited capacity (Cuban, 1993). Today, schools prepare students for a world of:

> Economic opportunity and improvement if people can learn to work more flexibly, invest in their future financial security, reskill or relocate themselves as the economy shifts around them, and value working creatively and collaboratively. (Hargreaves, 2003, p. 1)

In his book, Andy Hargreaves (2003) reported that in order to make a change to student-centered learning, schools cannot operate in the old method of teaching just what the teacher wants to teach and how, but instead focus on the varied learning styles of

individual students, including teaching in new ways. A more contemporary example is a study by Archambault, Wetzel, Foulger, and Williams (2010), which focused on university faculty integrating new Web 2.0 tools and social media to change the focus to student-centered learning. They found that the role of the teacher changed to more of a facilitator, and communication and feedback between teacher and student and among students was greatly increased. This is an example of leveraging new teaching methods to mirror the evolving world in which students live, work, and study.

Learning Environments

Whether the job of education has been teaching students to be successful in the current world, political indoctrination, teaching ethics and mores, reading and writing, or any other skills that a community of people have deemed important, schools have been on the front line of instruction, but the learning environments of students have expanded beyond the walls of the classroom. As technology has improved, and its presence increased over time, parents and teachers are forced to focus on what students learn inside and outside of school, and in the home (Collins & Halverson, 2009). Historian and education professor Larry Cuban (1986) cautions that new technologies introduced by school leadership rarely last beyond the initial novelty stage of introduction, or are met with skepticism by school leaders. As such, since technology has been introduced in schools over time, the school has begun to take a back seat in teaching students technology skills. Cuban (2001) found this to be the case in his study in Silicon Valley, where even this technologically advanced city was slow to successfully integrate technology in schools, as did Meneses and Mominó (2010) in Catalonia, Spain, where

their research revealed that schools are beginning to play a secondary role in technology training for students, as well as providing opportunities for practicing and developing basic digital skills. In a report from the MacArthur Foundation, Ito et al. (2008) found that "youth using new media often learn from their peers, not teachers or adults" (p. 2). Research studies have therefore sought to determine how environments affect learning, especially with regards to technology. Kent and Facer (2004) determined that students are beginning to have more access to computers at home, and as such home use is becoming more formalized. The school can therefore become a place for more informal learning using computers. In a 2006 study Brigid Barron found that "It has become easier for those with computer access to find resources and activities that can support their learning on their own terms" (p. 2). The concept of learning on one's own terms has become the basis for m-learning in the 21st century, and has led to new roles for schools.

New roles. Schools are now entering a new age of instruction, an era that Norris and Soloway (2011) term the Age of Mobilism, characterized by 3 traits: connectedness, affordability, and globalness. As schools enter this new era, researchers warn of the importance of adapting to new roles. For example, Selwyn (2005) suggests that "learning to use new information technologies...such as computers is considered to be a fundamental aspect—even an obligation—of citizenship and employment in contemporary society" (p. 122). The role of schools has changed over time, but as it has become important for schools to teach students technology use, it is increasingly important for teachers and administrators to be at the forefront of teaching responsible and quality use. As author Alan November (2010) notes, students may very well be able

to teach themselves how to use computers and other technologies, but "what our students cannot learn on their own, and what makes teachers more important than ever, is the urgent need to teach critical thinking and global communication skills" (p. 32). This cannot take place in the United States if the students' only source of contact with technology, and especially MCDs, is outside of the school.

In addition to the teachers, administrators play an important role in 21st century technology integration. As the instructional leaders of their campus, it is their duty to ensure that technology is being integrated appropriately. As Lecklider, Britten, and Clausen (2009) find, a technology plan that does not emphasize how technology will be used appropriately will underutilize the innovation, and "there is a critical need to educate school leaders in how technology can support school improvement, change instructional practice, and improve student learning" (p. 31). The International Society for Technology in Education (ISTE) has developed standards for education technology for students, teachers, and administrators that outline what should be taking place in schools. For administrators, ISTE identifies the following:

> Educational Administrators create, promote, and sustain a dynamic, digital-age learning culture that provides a rigorous, relevant, and engaging education for all students.
>
> a. Ensure instructional innovation focused on continuous improvement of digital-age learning
> b. Model and promote the frequent and effective use of technology for learning

c. Provide learner-centered environments equipped with technology and learning resources to meet the individual, diverse needs of all learners
d. Ensure effective practice in the study of technology and its infusion across the curriculum
e. Promote and participate in local, national, and global learning communities that stimulate innovation, creativity, and digital age collaboration. (ISTE, n.d.)

These standards illustrate the new roles facing school administrators with new technologies that are being introduced, but sometimes schools and school leaders are slow to adopt new innovations.

Technology as basic as a television set was not a standard classroom fixture until the 1990's, whereas they were beginning to have a place in households decades earlier. Schools do adopt technology, but when they do Cuban (2001) believes that they are slow to do so. Pop culture has been more influential with technology than schools; "entertainment technologies fueled the development of pop-culture–record players, radios, TVs, and eight-track car stereos are the clear precedents for cell phones, PCs, and iPods" (Collins & Halverson, 2009, p. 125). But, as much as pop-culture and technology have had a symbiotic relationship, has this really affected how school operate? As Cuban (2001) illustrates:

> No one who attended schools in the 1950s and then visited schools in 2000 could fail to note many important differences in classroom practice. It is untrue that schools or teachers cannot change. Those visitors however, would also note

> strong, abiding similarities between classrooms and teaching practices a half century apart. (p. 195)

Classrooms still have rows of desks, with a teacher in front, delivering teacher-centered lessons. It seems that although they do change, schools are slow to accept and adopt new technology to change the way they teach. How many of America's classrooms are still teacher-centered, with emerging technologies treated as passing fads?

Like other new forms of instruction and technology innovations, schools have likewise been hesitant to include MCDs, and as a result students have been learning how to use the Internet and their MCDs elsewhere; from friends, experimenting on their own, and other sources. While some schools may consider it their duty to be leaders in technology education, some policy makers and education reformers have chosen to focus on other areas for student growth, such as standardized testing that promotes rote memorization and lock-step teaching standards rather than innovation. Alternatively, there is a level of distrust from school leaders about innovation or a desire to protect an already smooth operation (Cuban 1986). These types of "educational improvement efforts now in place are aimed at bringing back the education that America offered its students in the 20th century" (Prensky, 2011, p. 1). This is no longer an option as computers, the internet, and other forms of technology have become ubiquitous in the workplace and other aspects of society (Cuban, 2001).

Many workplace environments and households have been embracing innovations in technology. Just like the modern workplace, the 21st century school could be a place of innovation, experimentation, and collaboration, and schools need leadership that

embraces society's new goals for education (Collins & Halverson, 2009), but many schools are stuck in an outdated model where MCDs and m-learning are viewed as a distraction. School reforms should be focusing on preparing students to live and work in the 21st century. Just as Pereyra et al. (2009) have concluded about education reform in Spain, reform should be "adapting the school to social change and as a means, as well, of constructing a new, competent, and competitive citizen ready for the times in which we are living" (p. 3). Part of creating this new competitive citizen means creating students who are able to compete and live in a global society; "International knowledge and skills are no longer just a luxury for a few would-be specialists but are a new basic for all students. Preparation for a competitive global job market and for citizenship in the interconnected world of the 21st century is critical for all young people" (Stewart, 2010, p. 101). This interconnected world includes the use of MCDs, and this is the duty of schools, because if schools continue to operate in an outdated model, they deny students the means to be successful in the 21st century (Prensky, 2011). With this responsibility of schools in mind, the discussion can then turn to the duty and role of schools specifically with regards to inclusion of MCDs and m-learning.

Hesitancy for Mobile Communication Devices

There are legitimate concerns about inclusion of MCDs in classrooms, including equity for all student access, professional development for teachers and students, and the need to protect students while using the internet on campus (CIPA, 2001); these concerns represent some of the reasons that MCDs have been kept at bay for so many years. However, as responsible educators in the 21st century, it is the school's responsibility to

balance the application and proper training of new technology with student safety (Robinson et al., 2010).

If schools play a secondary role in educating students in MCD use, many students learn to use their devices solely for gaming and communication with friends, and unfortunately for more negative activities such as bullying and harassment. As Garland (2010) notes, the addition of still and video camera functions to mobile phones have raised issues of student privacy, where they have been used to take and circulate inappropriate photos of students, or for cheating. Phones have been used to bully other students, either directly via text message or posting to online social media sites. Online chat rooms have been a hunting ground for sexual predators, and now that smart phone application platforms allow chat rooms to be mobile, the threat is increased.

All of these risks are undeniable. However, simply banning the devices from schools will not solve the problems. Robinson et al. (2010) believe that "we cannot protect students by stifling all technology-based communications" (p. 7). MCDs are not the cause of these negative behaviors; they are a tool, just like any other. If students are trained and empowered to use them in positive ways, it is more likely that they will be used positively and appropriately. If the students' only option is to use them for negative behaviors, the result will be negative behavior. MCDs did not spawn cheating, bullying, or off-task behavior. However, since educators are increasingly seeing these devices used for the negative behaviors, a negative association begins to form. As Robinson et al. (2010) argue:

> With the current level of student access to MCDs and with the level expected to rise each year, it is inevitable that the number of incidents of student misuse will most likely increase. This thinking, we believe, leads to a common misperception that MCDs in the hands of students-especially at school-naturally leads to unwanted student misbehaviors. (p. 42)

A catch-22 develops, because these are the very activities that schools have sought to avoid by banning MCDs. However, educators and parents know that these devices are capable of so many more productive functions.

MCD Potential in 21st Century Schools

Project Tomorrow (2010, 2011, 2012) is a national research organization focused on technology in education. As of 2009, the project had surveyed almost 2 million students, parents, and educators about the use of technology in schools as part of the Speak Up research project (Project Tomorrow, 2011). In 2009, 91% of the parents surveyed said that they use instant messaging (IM), text messaging, and email for their professional and private lives. However, only a third of the respondents thought that these functions were a "good investment" for improving achievement in schools (2010). This statistic outlines the disparity in thinking about the importance of MCDs. If 91% of parents believe in the importance of digital communication, why would they not believe that these same functions would be important for their children to learn? One possible explanation could be that they shared the opinion of other educators across the world that MCDs in schools are little more than a tool used for distraction or cheating.

The following year however, the surveyed parents seemed to change their opinions about MCDs being a good investment for improving achievement in schools, as 70% of high school parents said that they were willing to buy smart phones for their children, if they would be used for instructional purposes at school (2011). This is an important shift in thinking about MCDs, because it demonstrates a change in thinking about the usefulness and importance of them to students as future members of the 21st century work force. As parents, school administrators, and teachers start to make this shift in thinking, it is time to consider how and why MCDs would be used in class, and what issues will arise from their inclusion. "While legitimate concerns exist regarding the place of mobile phones in the classroom, focusing on issues such as ownership, control, intrusion, bullying and safety, could it be time to encourage texting in class?" (Markett, Arnedillo Sanchez, Weber, & Tangney, 2006, p. 281). It is time to consider how the schools should use texting and other functions in the classroom to teach students proper use of their devices, since it should be the goal of schools to prepare students for the world in which they will live and work. However, since the students and their use of phones are at the center of this discussion, schools and parents should start by looking to them for what they want to do with their MCDs. As Norris and Soloway (2011) state, "while all other technologies in K–12 have been brought into the classroom by adults, this time it is the students themselves that are bringing in their own personal technology" (p. 10).

Table 2 represents how students surveyed said that they wanted to use their MCDs in school in the following manner.

Table 2

MCD Uses Desired by Students, 2010

Check grades	74%	Access online textbooks	44%
Take notes in class	59%	Send e-mail	44%
Use the calendar	50%	Learn about school activities	40%

(Project Tomorrow, 2011, p. 5)

In addition, students said they saw value in MCDs for doing internet research, communication and collaboration via email and text, creating and sharing documents, and recording. The responses of these students demonstrate that they understand MCDs can be used in creative ways that will benefit them as learners. In an earlier study about student perceptions about computer use in schools, Danzig and Aljarrah (1999) recommended "that student perceptions and attitudes about computer courses be shared with teachers and counselors as a basis for curriculum development and improvement" (p. 103).

Yet despite what students say about how they want to learn, many schools continue to insist that the students leave behind their MCDs and step into the darkness of an old-fashioned classroom (Prensky, 2008). Instead, schools would better serve students by designing curriculum and policies that foster innovation and critical thinking using these devices, as well as empower students to use them to their fullest potential. For example, Bailey et al. (2011) recommend that schools enable teachers to leverage technology, as well as create an engaging experience for students. In speaking of

engagement, they warn that technology should be used to increase student engagement, not just replicate the old ways of teaching in a digital format.

In order for schools to provide appropriate training for students, DeWitt (2007) identifies two primary goals for the inclusion of computers in schools: providing students with necessary job skills to work in the 21st century, and preparing students to participate in social and political life. Considering MCDs as computers, Dewitt's goals extend to their inclusion; the goals of schools should be to prepare students to use their devices to live, work, and be productive members of the 21st century global society. In addition, "because computer skills are important in most jobs today, school-to-career programs should increase student computer literacy, and educators should strive to integrate computer applications into their curricula" (Danzig & Aljarrah, 1999, p. 96). In the span between Danzig and Ajarrah's (1999) work and 2013, MCDs have come to be used by many students, parents, and teachers in lieu of computers, and as such skills with MCDs can be considered similar to computer skills as necessary job skills. However, given that all schools are not created equal, there are other factors to consider.

Funding and Access to Technology

Funding Technology in Schools

Any discussion of technology in schools, whether about m-learning or otherwise, is dependent upon funding. In a survey of school leaders, Lecklider et al. (2009) found that school administrators place high value and priority on technology in schools, in the areas of teacher and student use, school improvement, professional development, and of course budgetary concerns. However, are these reported preferences reflected in actual

expenditures? Or, as leaders identify technology as an important aspect of schooling, are they allocating money properly? Farenga and Joyce (2011) found that school districts rival corporations in terms of spending on technology hardware, and reported that teachers also feel that the majority of funding is spent on technology hardware, not training or professional development, once again reminding leaders that simple inclusion of technology is not sufficient.

However, Bailey et al. (2011) disagree with the assertion that school districts rival corporations in technology spending:

> Technology spending still accounts for only a tiny fraction of overall education spending around the world, lagging far behind expenditures on salaries and other current expenses...Such spending has been far lower in education than in industries in which technology has had more impact.
>
> (p. 6)

They go on to conclude that this lack of appropriate funding for technology has left schools with broken, out of date computing equipment. So if the money spent on technology and training is insufficient, there is a disparity between what educators say they value about technology in schools, their goals, and the monetary ability to support their goals (Lecklider et al., 2009). A lack of school funding is not the only barrier to technology access however, as students from different socioeconomic categories also have different abilities to access their own technology; a key component of a student-owned m-learning program. This causes educators to remain reluctant about

implementing new technology programs, unless they can be certain that all students have access to the technologies (Henshaw, 2008).

SES and Access to Technology

One of the contributing factors to whether a student has access to technology is their socioeconomic status (SES); a low SES student might not have access to the same type of technology as a high SES student. Does socioeconomic status make a difference in how technology is implemented in schools? The place to start looking is not in the schools, but in the homes of the students, and how this relates to the school. Not every student, even in an affluent school, will have access to the same technologies outside of the school environment. There is a positive relationship between computers at home and achievement in school, and students in high SES households benefit more from having technology in the home than low SES students (Attewell & Battle, 1999). Ching, Basham, and Jang (2005) also found that students from higher SES households tend to use computers more for a full spectrum of use, including entertainment, communication, and construction, and that family income, not ethnicity, is predictive of technology use. Students with regular access to technologies therefore will be better prepared to harness these skills in a classroom setting or at home for high level critical thinking and analysis. However, a lack of computers in the home for low SES students not only affects their technology knowledge and readiness, but also how the teachers make decisions about how to incorporate technology.

Technology Use and SES in Schools

In recent years, several studies have focused on the relationship between SES and technology use in schools. Anderson (2005) found that "many students living in areas affected by socioeconomic disadvantage have only one 'shot' at using ICT to enhance their educational development, and that 'shot' is at school" (p. 148). Although some early studies have suggested that low SES schools generally use technology for basic skills, others have found that low SES schools can also use technology for high level critical thinking (Warschauer, 2000; Dewitt, 2007). Warshauer's (2000) study compared two schools, high and low SES, that both had the same focus of reform, with the idea that new technologies produce little results without a plan that allows students to use technology for high level inquiry. The study found that students at high SES schools were using technology in a manner that prepared them for postsecondary education, and that the schools' technology decisions are related to its student expectations. In other words, if a school has high expectations for its students, for example the expectation that students will progress from school to university as opposed to the workforce, the school will integrate technology in a way that prepares students for the university. However, this is not always the case, and the students at affluent schools are not all high SES students.

While it might be clear that there is a gap between the technologies that students have at home between the different SES levels, the effectiveness of technology use in schools to close the gap is less clear. Selwyn (2005) states that:

> Formal computer education is primarily benefiting the "usual suspects"—increasing levels of computer skills within the social groups that were already proficient rather than widening the skills base to social groups who were not previously skilled. (p. 133)

There are, however, successful programs that are specifically designed to close the digital divide that are successful (Cakir, Delialioglu, Dennis, & Duffy, 2009), but these programs are not easily replicated due to funding. Some high SES schools and districts make higher investments in professional development for teachers to incorporate technology than their low SES counterparts, but even with this stronger influence of professional development many teachers focus merely on the completion of a technology-related task as the goal, not the critical skills or learning goals that are related to using the technology (Warschauer, Knobel, & Stone, 2004). So, even in high SES schools, the mere inclusion of technology is not always enough to improve its use. Bielefeldt (2012) found that "classrooms in wealthy districts with lots of technology and a history of professional development did not necessarily provide more hands on ICT activities for students" (p. 208) than schools located in less affluent areas. So, regardless of the SES level of the students or the school, the effectiveness of technology in schools is dependent on the decisions that the school makes.

In addition to the decisions that a school or school district makes in relation to technology, the best laid plans are still in the hands of the individual teacher. Teacher perceptions of social class and citizenship affect their instructional choices with computers (DeWitt, 2007). Dewitt found that students in high-SES schools are using

technology for higher-level critical thinking, but a key finding in his study is that teachers used technology to support their current models of instruction, rather than to change their instruction. An interesting research question for another study might focus on these beliefs, and willingness to change instruction in different learning environments. For example, are teachers in affluent, highly performing schools less willing to change their teaching strategies to incorporate technology, than teachers in underperforming schools where what they are doing is not working? There is also the issue of varied access to computers outside of school, as Kent and Facer (2004) found in the United Kingdom, that "those young people with home computers are more likely to experience particular computer activities at school and to use school computers more frequently for these activities" (p. 447). If, as Dewitt (2007) finds, teachers make decisions about technology implementation based on their perception of computer use at home, as well as their perception of social class, the SES of a school's students could have an influence over the teachers' decisions to incorporate a program such as m-learning and Bring Your Own Device (Norris & Soloway, 2011).

Mobile Learning and SES

Bailey et al.'s (2011) study was further analyzed by Loertscher (2011), who concluded that many progressive districts are starting to focus on student-owned devices and budgeting for network access and cloud-based computing that is necessary to support m-learning. Does m-learning have the ability to mitigate effects of SES? Mobile technologies and MCDs are certainly cheaper than computers, both for the device itself and the cost of usage. Several studies have also shown that m-learning projects can be

very successful in low SES environments due not only to the relatively cheap cost, but also the intuitive nature of the devices that can be understood quickly by users (Kim, 2009; Kim et al., 2011; Valk, Rashid, & Elder, 2010). As Valk et al. (2010) find, the ubiquity of MCDs is also an advantage because schools can draw on existing resources, i.e. utilizing devices that students might already own. They found that m-learning programs do increase access to learning, especially in rural areas where access to computers and the broadband internet access required to power them are not only cost prohibitive, but also logistically difficult. M-learning programs in these environments can provide a cheaper, wireless means of connecting students to blended learning programs which other areas of literature have already identified to help mitigate location and environment factors. However, Valk et al. (2010) also found that most m-learning projects have been tested in North America, Europe, and Asia-Pacific countries where m-learning is financially feasible.

A key selling point of m-learning in the United States is the potential to reach students who might not otherwise have access to technologies, due to the decreasing cost of MCDs. M-learning might be a cheaper alternative to computers, not only in schools but also at home where low SES students might not have access to a computer or high speed internet. A study by Magolda (2006), which studied how a lack of computing access would impact the career options of students, found that a structured program, in this case the Critical Fusion Initiative, could provide enhanced literacy, improved life-skills, enhanced understanding and interest in postsecondary education. However, at the time of publication it was too early to tell if the CFI was successful, and it only focused

on one population: low SES students. In addition, not all schools in the United States might have access to such a program, which was experimental. The other drawback to this type of program is that it is reliant upon computers.

In an affluent school with a majority of high SES students however, mobile phones could possibly be ubiquitous among the students given their ability to afford the devices. For the students at an affluent school who are lower SES, there could be a stronger likelihood that they will possess an MCD instead of a home computer. Lenhart, Ring, Campbell, & Purcell (2010) found that "teens from low-income households...are much more likely than other teens to go online using a cell phone" (p. 4). This was echoed in the UK, where Kent and Facer (2004) found that "young people from the lower socio-economic areas are more likely to use mobile phones to access the Internet" (p. 447). Therefore, lower SES students might be using their MCDs at home to access the internet more than higher SES students who have access to a computer, and these devices could therefore be leveraged to increase student achievement by leveraging their access and encouraging these students to use their devices at home for academic reasons. If teachers at an affluent school embrace a concept such as BYOD, the ubiquity of MCDs could make this type of school a perfect environment for m-learning and BYOD. In addition, low SES students who have neither a home computer nor an MCD can still gain experience with these devices while in school, further preparing them to live and work in the 21st century.

Technology Implementation and Mobile Learning

Ubiquity of Mobile Technology

By 2005, nearly all public schools in the United States had internet access via computers (Wells & Lewis, 2006), leading to increased functionality of computers in schools. As Cuban (2001) states about education reformers, "increasing access to computers in schools will lead to more classroom use which, in turn, will transform teaching and learning to produce the desired outcomes in graduates and the economy" (p. 34). Today, the advanced functionalities of the two devices (computers and MCDs) are incredibly similar, yet as Prensky (2005) has noted, cellular phones have traditionally not been viewed as computers, especially at schools, even though they have become a more popular computing device for students than computers. Smith (2010) reports that 96% of Americans age 18-29 own a cellular phone, and Lenhart et al. (2010) found that 75% of students age 12-17 now own cellular phones. Despite the ubiquity of MCDs in the world, Educators still "see the computer and the cell phone as very different devices, with the tiny cell phone being a much more personal (and ubiquitous) accouterment, especially among young people" (Prensky, 2005, p. 1). In recent years, school leaders in the United States have begun to recognize the power of these tools, and have encouraged teachers to incorporate student-owned MCDs into instruction.

As of 2009, there were 223 million mobile phone users in the United States over the age of 13, and over 20% of homes were cellular-only (Nielsen, 2010). This statistic continues to grow each year, and Norris and Soloway (2011) predict that by 2014, more people will be using their mobile phones to access the internet than a computer. Initially,

cellular phones were expensive to purchase and use, and their primary purpose was placing and receiving phone calls. However, the "use of cell phones has evolved as the devices have become more versatile through the integration of increased functionalities such as web-browsing, sending and receiving e-mail, and audio/video capturing" (Engel & Green, 2011, p. 39). The versatility of modern MCDs, coupled with a decrease in the cost of purchase and data usage, have made them increasingly popular. Once viewed as an extravagant and perhaps unnecessary device, these new functionalities have made MCDs a very necessary tool for living and working in the 21st century. They are used for a variety of functions, including communication, planning, productivity, research, photography, and many others. The email, internet, and calendar functionalities alone have led many people to use cellular phones and other MCDs in place of computers. Presnky (2005) notes that "one and a half billion people, all over the world, are walking around with powerful computers in their pockets and purses. The fact is they do not realize it, because they call them something else" (p. 1). For the quarter of a billion people in the United States who own cellular phones, the importance of these devices is clear. MCDs have changed the personal and professional lives of American society, with the exception of an important area: the schools.

Mobile Learning in Schools

M-Learning and Bring Your Own Device (BYOD) initiatives harness the power of the devices that students own, increase engagement and provide anytime, anywhere access to information (Peng et al., 2009).

> Mobile technology is dramatically changing how we communicate, share content, and retrieve information, especially for a generation of youth who are used to the immediate and collaborative nature of the informal learning they engage in outside the constraints of their formalized learning in schools. (Kolb & Tonner, 2012, p. 161)

Many researchers have found that there are many benefits to m-learning. The use of MCDs in instruction, specifically the use of text messaging, can increase student engagement (Markett et al., 2006) as well as build knowledge through linking formal and informal learning and answer guiding questions to share with classmates (So, Seow, & Looi, 2009). Kadirire (2007) also provided "evidence to show that learning using mobile devices reduces the formality of the learning experience, and helps engage reluctant learners and raise their self-confidence" (p. 1). In a study of undergraduate students, Dyson, Litchfield, Lawrence, Raban, and Leijdekkers, (2009) found that m-learning "can improve the learning experience of students in large lectures by allowing them to interact with the lecturer, contribute to joint class responses shown on the screen, and make learning more interesting and fun" (p. 262). In addition to increasing engagement and making class more interesting, Brand, Kinash, Mathew, and Kordyban (2011) found that "a large majority of students feel there is benefit in blended learning with internet-connected devices used during class" (p. 174). An m-learning environment can therefore utilize tools that students are frequently using to "best provide support for learning in context. There, learners are asked to apply knowledge and not just consume it" (Frohberg, Göth, & Schwabe, 2009, p. 323). There are many benefits cited in these

studies, but there are still many roadblocks that can be mitigated through effective implementation of m-learning programs.

Effective Implementation

Simple inclusion of MCDs in instruction is not sufficient to ensure engagement, as "engagement is higher as student technology use-time increases and lower as teacher technology-use time increased" (Bielefeldt, 2012, p. 216). In other words, if technology inclusion was primarily in the hands of the teacher instead of the students, the effect on student engagement was lower. Lowenthal (2010) found that if users of m-learning feel it increases their ability to succeed in a learning environment, they will use it. But, it is incumbent on the teachers to show the students the value of MCDs in the classroom. In many cases, teachers are aware of the capabilities of MCDs, but they still do not use them in class (Murphrey, Miller, & Roberts, 2009) even though, as Dyson et al. (2009) found, inclusion of mobile technology by the teachers was "not disruptive as each activity takes about 2 minutes for the students to complete, with the results instantly available to the lecturer, and to the class at her or his discretion" (p. 259). In order for initiatives such as m-learning to be effective, schools and districts must put proper support systems in place, including professional development and the opportunity to collaborate with other teachers (Looi et al., 2010). In addition, Passey (2010) found that it is necessary for programs to have someone with expertise in the area of m-learning, as well as a need for:

> A range of different learning activities to support learners, teachers, and parents at different stages of implementation, starting with those that account for the skills

and capabilities of all the stakeholders at early stages, moving through to later activities that rely upon wider and deeper operational and learning skills. (p. 77)

As with all types of technology, teacher beliefs and attitudes are large predictors of usage and implementation (Russell, Bebell, O'Dwyer, & O'Connor, 2003). So although the teachers and community members at a school might use MCDs in their personal lives, and might understand their capabilities to various degrees, their personal beliefs and attitudes might prevent the teachers form implementing lessons that utilize MCDs.

Various other studies report on factors and conditions for effective m-learning programs. Cochrane (2010) found that "various m-learning trials undertaken have illustrated that pedagogical integration of m-learning into a course/curriculum requires a paradigm shift on behalf of the lecturers involved, and this takes significant time" (p. 144). Other critical factors cited by Liaw et al. (2010) include "enhance learners' satisfaction, encourage learners' autonomy, empower system functions, and enrich interaction and communication activities" (p. 453).

Bring Your Own Device

As MCDs become more affordable and ubiquitous among students, the research base on m-learning continues to grow. Norris and Soloway (2011) believe that by 2015, every student in grades 1-12 in the United States will have their on MCD, and that schools will no longer ban these devices. They believe that schools will follow a trend set by corporations, and allow students to bring their own devices to school for use in learning. However, although many schools have already taken this plunge, there is a

paucity of studies dealing specifically with student-owned devices in schools. Dyson et al. (2009) recommended that m-learning environments that engage students in instant-access learning are possible, and that "this can be achieved by paying attention to economic sustainability – for example, by minimizing costs through the use of student owned devices" (p. 263). In addition, Oncu, Delialioglu, and Brown (2008) found:

> Availability/accessibility issues were some of the most important factors affecting their (teachers) decisions about which instructional technologies to incorporate into their classrooms. Usually up-to-date items are expensive and school systems often do not have enough funding to purchase such tools. (p. 29)

At a school where funding may not be available to stay ahead of the technology curve, but where the students are coming to school with innovative new MCDs in their pockets, teachers could tap into the anytime, anywhere potential of m-learning with a BYOD program. Additional research is needed for m-learning programs that utilize student-owned devices, including how teachers adopt this new teaching innovation.

Teachers and Adoption of New Technology

Adoption Models

Many factors influence the decisions that teachers make regarding new innovations and change, and there are many different methods to study technology adoption in schools (Straub, 2009). As Anderson (1997) points out, sometimes teachers change in response to professional development or personal choices to change, but many times they change as a result of mandates from school or district leadership for which they were not consulted. There is no shortage of studies addressing how teachers respond

to change. In E. M. Rogers' (2003) Innovation Diffusion Theory (IDT), diffusion of an innovation is made up of individual adoptions by teachers. To demonstrate this idea, IDT studies place the number of adopters into categories on an S-curve over time, with the adopters at five stages: Innovators, Early Adopters, Early Majority, Late Majority, and Laggards. Studies have used Rogers to research the factors that place educators implementing technological innovations into these five stages (Fuller, 2000; Kebritchi, 2010; Lai & Chen, 2011; Metzler, Lund, & Gurvitch, 2008; Murphrey et al., 2009; Oncu et al. 2008, for example). There are also a number of other studies using a model called the Technology Acceptance Model (TAM) that have helped identify key factors affecting teachers' acceptance of new technology (for example Loraas & Diaz, 2011; Holden & Rada, 2011). Many of the TAM studies have inherent flaws, for example Straub (2009) cautions that TAM studies focus solely on perception instead of the reality of adoption, and they do not acknowledge the individual differences in adopters. Legris, Ingham, and Collerette (2003) also caution that the TAM "is a useful model, but has to be integrated into a broader one which would include variables related to both human and social change processes, and to the adoption of the innovation model" (p. 191). For technology and innovation adoption, a more appropriate model is needed.

Many studies have used the Concerns-Based Adoption Model (CBAM) (Hall, 2010; Hall & Hord, 2011), which, like Rogers' IDT is a stage-based representation of adoption, to identify the Levels of Use and Stages of Concern that teachers face when integrating technology (Donovan, Hartley, & Strudler, 2007; Oncu et al., 2007). Although Levin and Wadmany (2008) argue that the stage-like CBAM model is too rigid

to accurately describe the technology adoption process in schools, these studies have all added to the collective understanding of how teachers respond to change regarding technology. Although CBAM is the model of choice for this study, Metzler et al. (2008) caution:

> Inquiries into teacher change/constancy must carefully consider both a lens and a set of potentially influencing factors. The selection of the lens can inform researchers about how, when, and where to examine change; choices about whether to study organizational or individual/small group factors (or both) will determine what factors get the most scrutiny.
>
> (p. 457)

Individuals and Change

The process of change in itself is discomforting, and initially with technology implementation teachers will want to know how the change affects them personally (Donovan et al., 2007). Selwyn (2005) similarly found that most computer learning is informal, and is therefore "subject to the individual's context of computer use at the time" (p. 130). School leaders need to be mindful of the teachers as individuals and the school's culture, as the culture appears "to affect the degree of transformation and the readiness for technology adoption" (Kitchenham, 2009, p. 6). If the culture is resistant to innovation and change, new programs such as m-learning and BYOD will be difficult to implement. In addition to culture, leaders need to be aware of the perceptions of teachers. Oncu et al. (2008) cite 5 criteria affecting teachers' decisions about technology: accessibility and availability, applicability, influence of colleagues, teacher's

skills/knowledge, and student's skills/knowledge. All of these criteria can affect a teachers's perceptions, and can add to resistance of an innovation. As Lai and Chen (2011) find, user resistance can doom a technology program to failure; teachers may band together in resistance if they perceive a program to be ineffective or difficult to adopt. Holden and Rada (2011) determined that perceived ease of use is a prerequisite to acceptance of a new innovation, and found a positive correlation between perceived usability of a new technology and teachers' affective response. Similarly, Loraas and Diaz (2011) also found that if technology is perceived as easy to use, the mere suggestion from leadership is enough to get the teachers moving toward integration.

Teacher Experience

This perceived ease of use is relevant in schools where there is a full spectrum of experienced and novice teachers. "There are important differences between the comfort levels, beliefs, and practices with technology between new and more veteran teachers" (Russell et al., 2003, p. 308). In this study they define a new teacher as one with less than 6 years in the profession. Which group, novice or experienced teachers, is more likely to accept technology into teaching? Oncu et al. (2008) found that experienced teachers are more likely to accept new technology because they feel it will make their jobs easier, while novice teachers believe it will require more preparation on their part. In a contradictory study, Metzler et al. (2008) found that although novice teachers are more willing to accept technology, they will suppress their desire to integrate new technology if the experienced teachers are resistant; veteran teachers having more wherewithal to decide not to participate in an innovation. Williams, Foulger, and Wetzel (2009) found

that preservice teachers have a lack of confidence with technology integration, but gained confidence as they learned about the usefulness of the innovation, and with peer collaboration. Russell et al. (2003) concluded that although new teachers (less than 6 years experience) might be more comfortable with using computers for example, this does not mean that they will necessarily incorporate technology into instruction more than their veteran counterparts. P.L. Rogers (2000) focused on teacher experience using technology, and found that new users are more likely to report barriers to technology integration, and that the barriers decrease as technology use increases. Further research into the area of teacher experience, both in terms of years in the classroom and experience with a technology innovation, is needed.

For evaluating technology programs such as m-learning and BYOD, Zambo, Wetzel, Buss, and Padgett (2003) recommend that "evaluation designs should rely less on participants' self-reported attitudes and more on observations of participants' actions within learning contexts" (p. 2). A CBAM study will help to determine this by coupling interviews with observations, since CBAM interviews have been tested to have a correlation coefficient of .98 to observation (Hall, Dirksen, & George, 2006). However, all of these studies have an element that is missing: because instructional programs that use student-owned devices are still relatively new, a gap in literature exists with regards to student-owned technology, and how teachers adopt this new innovation.

Conclusion

M-learning is a robust topic in need of a greater research base. Studies specific to BYOD m-learning are lacking and contradictory to each other. With computers in

general and in education, Larry Cuban (2001) predicts that their effect will be measured on a very slow curve, and that over time their influence will be small. However, m-learning was not yet a part of his research. This present study seeks to close the literature gap on m-learning and BYOD by examining the Levels of Use of BYOD.

CHAPTER 3

METHODS

Introduction

In this chapter I will restate the problem and purpose of this study, as well as provide an overview of the Research Design and Procedures, including the Research Methodology, Population and Sample, Instrumentation, and Data Collection Procedures and Analysis.

I approached this study with a Constructivist world view, seeking to understand the world in which I live and work (Creswell, 2009). As such, I will explain why I chose a descriptive study as my strategy of inquiry, the rationale for choosing a high SES suburban high school for my population, and the use of the Concerns-Based Adoption Model to frame the study.

I conducted this study in partial fulfillment of the requirements of the degree of Doctor of Education from Arizona State University, specifically as a member of the Dynamic Educational Leadership for Teachers and Administrators (D.E.L.T.A.) program. This cohort-based program is specifically designed for working teachers and administrators to provide social relevance to their studies, and have a direct impact on education in the Southwest United States. Prior to beginning the D.E.L.T.A program, I began the implementation of BYOD at the school presented in this study. This innovation was supported by various leaders within the school district, including the superintendent as well as several district-level administrators who earned Doctorates in previous D.E.L.T.A. cohorts. Because they understood the mission behind our program,

they also understood the importance of this study to the field of education, and my personal interest in studying an innovation that I brought to the school district. In this process, I helped secure training in the Level of Use interview described in this chapter for myself as well as other researchers from ASU. I want to understand the world in which I live and work, and as such the intent of this study was not to determine if the innovation that I introduced to the school district was successful or not, but instead to better understand its implementation by teachers. In the following sections of this chapter I further explain the purpose of the study, as well as the process by which I conducted my research.

Restatement of the Problem

The purpose of this descriptive study is to examine the implementation of mobile-learning teaching and learning strategies that utilize student-owned mobile communication devices at a high SES, high performing suburban high school in the Southwestern United States. This type of strategy, referred to as BYOD m-learning, is defined as a program in which teachers design lessons that utilize student-owned mobile communication devices (MCDs) such as Wi-Fi-enabled smart phones, tablets, eReaders, and laptops, for the purpose of improving student learning and teaching 21st century digital skills, and is not sufficiently present in research literature. Specifically, the degree of implementation for this study will include Levels of Use, instructional decisions, collaboration, professional development, and teacher experience.

Research Design and Procedures

Based on the research literature and the gaps therein, I will conducted descriptive analysis of the implementation of a BYOD m-learning program at a high SES, high performing high school in the Southwestern United States to answer the following research question: What are the BYOD Levels of Use of teachers at a high-performing, high SES suburban high school?

To answer this research question, I will answer the following sub questions:

1. What instructional decisions did BYOD user-level teachers make with regards to m-learning?
2. How did teachers collaborate on BYOD with colleagues during implementation?
3. How did teachers participate in voluntary professional development for BYOD and m-learning?
4. Was there a difference in Levels of Use between early career and veteran teachers? (+/– 6 years teaching)
5. What barriers to successful implementation did teachers at this school report?

These questions were answered by conducting CBAM Levels of Use interviews with 28 teachers from across the departments at this school.

Research Methodology

Descriptive study. Creswell (2009) identifies several characteristics of qualitative research, including data collection in the field, the researcher as the instrument for data collection, multiple sources of data, participant meaning, interpretation, a

theoretical lens, and an attempt to develop an understanding of the issue being studied. These characteristics are represented in this study, and will be explained in this chapter. Stake (1995) defines case studies as a strategy of inquiry in which researchers use multiple data collection procedures to explore a program, process, or one or more individuals. Although this is not a true case study as it does not include all groups of stakeholders such as students and parents, it does follow Stake's suggestion of using multiple data collection procedures to tell the story of BYOD at this school. The goal of this study is to tell the BYOD story of this school, using descriptive details. Corbin and Strauss (2008) write that "description is the basis for more abstract interpretations of data and theory development" (p. 54). In order to develop theories and ideas relative to BYOD, descriptive studies such as this one are necessary and important. As Stake (2010) suggests, descriptive researchers do not study subjects because they make an interesting story, but because the researcher wants to understand the subject better. In this case, I want to understand the teachers who make decisions about BYOD, and the school system which supports these instructional decisions.

Theoretical framework. This study was framed by Hall and Hord's (2011) *Implementing Change: Patterns, Principles, and Potholes.*

> The Concerns Based Adoption Model, better known as CBAM, is arguably the most robust and empirically grounded theoretical model for the implementation of educational innovations to come out of educational change research in the 1970s and 1980s. (Anderson, 1997, p. 331)

The CBAM is a stage-based model used to evaluate the degree of implementation of a new innovation. Although the model is appropriate for any type of innovation, Hall (2010) believes that it is well suited for evaluating technology in education, stating "The CBAM offers several research-based constructs and tools that can be used to understand, facilitate, and evaluate the more complex efforts entailed with introducing technology innovations in classrooms and schools" (p. 234).

Hall and Hord (2011) identify the following 10 principles of change:

1. Change is Learning
2. Change is a Process, Not and Event
3. The School is the Primary Unit for Change
4. Organizations Adopt Change – Individuals Implement Change
5. Interventions are Key to the Success of the Change Process
6. Appropriate Interventions Reduce Resistance to Change
7. Administrator Leadership is Essential to Long-term Change Success
8. Facilitating Change is a Team Effort
9. Mandates Can Work
10. The Context Influences the Process of Learning and Change

(pp. 6-15).

All of these principles are relevant, however the most relevant to m-learning and BYOD are:

(1) change is a process, not an event; (2) change is accomplished by individuals; (3) change is a highly personal experience; (4) change involves developmental

> growth in feelings and skills; and (5) change can be facilitated by interventions directed toward the individuals, innovations, and contexts involved. (Anderson, 1997, p. 333)

Although Anderson was speaking of CBAM in general, these principles are well suited for a BYOD program because the teachers are acting as individuals, and if they are at different Levels of Use they require different interventions. And, as Levin and Wadmany (2008) found, although CBAM states that change is an individual process, teachers are influenced in their perceptions by interactions with other teachers and situations.

Using the metaphor of a bridge, Hall (2010) states that innovation implementation can be measured as a process of moving from non-use to use. Two of the CBAM measures of this implementation are Innovation Configurations and Levels of Use.

Innovation Configuration mapping. With each innovation, it is important to understand what the innovation actually is, including its various components. Early iterations of the CBAM found that although innovators believed that they were implementing an innovation, they all had different ideas about what implementing the specific innovation actually meant (Hord, Steigelbauer, Hall, & George, 2006). This gave birth to the Innovation Configuration (IC) map, including components and implementation requirements. Because individual innovators might have different operational definitions of the innovation, the IC map is used to show "how close the practices of each implementer match with the vision of the innovation's architect" (Hall, 2010, p. 239). In using the IC map, program evaluators can determine how closely innovators align with the innovation designer. As Anderson (1997) suggests:

> Within each behavioral component of an Innovation Configuration some patterns use may be regarded as more ideal than others by innovation promoters. The model allows that teachers might routinize their use of a change in patterns of implementation that do not fit the promoters' "ideal" conceptions of use. (p. 356)

Before evaluating the degree of implementation using Levels of Use, an IC map is necessary to operationalize the innovation. For this study, I developed an IC map to operationalize BYOD use by teachers, to determine the decision points within the Level of Use interview, and to create a basis for observation.

Levels of Use. Once implementation of an innovation has been operationalized in an IC map, the degree of implementation can be measured by assessing the individual Levels of Use (LoU) of the teachers. "Levels of Use is a behavioral phenomenon. It does not deal with attitudes, emotions, or feelings. It also does not deal with the quality of the innovation. Instead, LoU presents behavioral profiles of eight different approaches to using an innovation" (Hall, Dirksen, & George, p. 2006). The LoU is a structured interview that requires a certified interviewer to interpret the responses of the participant in order to place them on one of 8 levels of use: Nonuse (0), Orientation (I), Preparation (II), Mechanical Use (III), Routine (IVA), Refinement (IVB), Integration (V), and Renewal (VI) (Hall, Dirksen, & George, 2006; Hall & Hord, 2011). With this information researchers and program evaluators can target interventions to improve implementation. A Level of Use interview should only be conducted by a trained and certified LoU interviewer.

According to Hall (2010), the levels are easy to envision with regards to technology innovation. Returning to his metaphor of the implementation bridge, "Levels of Use is one way to describe and measure the extent to which each implementer has moved across the implementation bridge. With technology innovations, each of these levels is easily imagined" (p. 237). Although Newhouse (2001) found it difficult to classify LoU, this study is an example of a deviation from the set interview process, as was Newhouse, including questions in the interview that were not part of the original guide. Dirksen and Tharp (1997) believe that "data collected from LoU interviews can provide useful insights about staff development, evaluation, planning and facilitation for leaders and change facilitators" (p. 1066). They used LoU data to determine student teachers' ability to integrate technology into curriculum.

For a school whose staff is in various stages of implementation of a BYOD m-learning program, LoU interviews can be used to determine the degree of implementation across the campus, and can be broken down into other factors.

Population and Sample

The population for this study is a suburban high school located in a highly affluent neighborhood of a major city in the Southwestern United States. The school opened in 1972, and serves approximately 2,100 students in grades 9-12. Over 84% of the students are white, and less than 7% of students receive free or reduced lunch. The school prides itself as being an excelling public high school with an "A" rating from the state Department of Education; consistently performing at or near the top of the state assessment in Reading, Writing, and Mathematics, with a graduation rate of over 90%,

and annually matriculating students to Ivy League schools. Academics and college readiness are a top priority at this school, and the teachers work in Professional Learning Communities to design lessons and units to increase student learning. Although the school district as a whole serves a diverse community including all levels of socioeconomic status, the school in this study is located in a highly affluent neighborhood, and is considered to serve some of the highest SES students compared to other public high schools in the state. As such, many of the students at this school have access to computers at home, as well as mobile communication devices. This population was purposefully chosen for the characteristics of the school, as well as the program described in the following paragraphs.

Two years prior to this study, the school's administration and I encouraged teachers to begin incorporating student-owned mobile phones into their instruction. professional development was limited, and the first-year BYOD innovation was mostly an experiment, with less than a dozen teachers participating. The following year, one year prior to this study, the school district installed wireless internet (Wi-Fi) in the school's instructional rooms for teachers and students, expanding what students could do with their devices. Studies by Project Tomorrow (2010, 2011) found that parents are more willing to purchase MCDs for their students if they will be used for academic purposes, and if the school pays for the data. The inclusion of free Wi-Fi for the students meets this need. The previous two years, as well as during the current year of this study, teacher participation in the BYOD program was encouraged but not mandatory.

Table 3

Demographics of Population

Total students	2112
Hispanic	122
Asian	118
Black/African American	52
American Indian/Alaskan	17
Native Hawaiian/Other	6
White	1785
Other	12
Free & Reduced Lunch	6.7%
Matriculation to Higher Education (2012)	92%
Students in Honors Classes	42%
Students in AP Courses (seniors)	44%

Although this school was one of the first in the district to participate in BYOD m-learning, this concept is now applied at schools throughout the district. The district's Instructional Technology Teaching and Learning Coaches (ITTLCs) offered professional development throughout the year to help teachers design lessons that incorporate student-owned devices. Since the first year, all teachers at the school received introductory professional development at the start of the school year that presented BYOD as an option, but all professional development opportunities after that point were voluntary.

Initially, ITTLCs showed the teachers how to use student devices for basic tasks such as looking up information on mobile web browsers or scanning Quick Response (QR) codes, and gathering evidence using built-in digital cameras. Teachers were then encouraged to provide students with digital calendars rather than paper, to encourage students to use their devices' calendar features to increase productivity. The professional development then moved to interaction and collaboration by having students text responses to poll questions for formative assessment, and increasing communication between the school/teachers and students/parents using a web-based text messaging feature, and emailing work to teachers in lieu of paper-based assignments. To increase collaboration in support of the National Education Technology Standards (ISTE, n.d.) the school utilized a web-based and school-safe social media site called Edmodo, which allowed teachers and students to collaborate outside of the classroom online using computers or mobile devices, in an online social environment that is familiar to the students. Finally, for higher level critical thinking, teachers could learn through professional development how student-owned MCDs can be used for project-based learning, in which students use their devices to collect data, answer a question, and present the findings of their work using their device as a visual presentation, slide show, movie, or other multi-media presentation. The Level of Use of each individual teacher determined which if any of these tasks teachers incorporated into their lessons.

In this study, I selected a minimum of two to three teachers from each department to participate in an initial Level of Use interview (two teachers from departments with ten or less teachers, three teachers from departments with more than ten teachers) for a total

of 28 participants, as well as an observation of instruction for 18 of the participants. Every teacher at the school received a letter requesting their participation. From those that responded, I chose two to three from each department based on random convenience sample to eliminate unknown bias. In one case, I sought out a teacher based on the recommendation of one of the participants. Ideally there would have been an even number of novice (less than 6 years' experience) and veteran teachers (Russell et al., 2003), but this was not possible as this school only had one teacher with less than 6 years experience. This teacher did participate. Teachers were not selected based on their implementation of the BYOD program, with the exception of the teacher who was recommended; this teacher was sought out to provide an additional nonuse perspective for the study.

Instrumentation

Levels of Use interviews. The Levels of Use interview is a component of the Concerns-Based Adoption Model. This focused interview probes the participant with a series of scripted questions, beginning with whether the interviewee is currently using the innovation or not. From there, the interviewer asks a series of scripted questions to determine the Level of Use of the participant. Creative paraphrasing is not permitted in the interview to determine the Level of Use.

Scripted interview questions. See Appendix C, reproduced with permission of Dr. Gene Hall.

Pilot-test procedures. Prior to this study I received certification as a LoU interviewer, which included training by a CBAM-certified trainer in the use of the LoU

instruments and guided interviews, and establishment of inter-rater reliability. During training, we analyzed the Levels of Use and the decision points for moving between levels. We read transcripts from LoU focused interviews, listened to audio tapes, and role-played interviews. Throughout the process the trainer continually tested our rating reliability. This process concluded with submission of taped interviews and completed LoU evaluations that I completed on my own to the CBAM trainer to test reliability. In addition, I chose another school in the same district as the study school with a similar demographic of students, and tested the LoU interview on one teacher, rated him a Level IVA user, and confirmed reliability with another CBAM-certified LoU interviewer. During this practice interview I was able to tune in my probing questions to ensure that the teacher was responding accurately, as well as guide the interview questions properly. These practice interviews were important in helping me ensure that the LoU interview was reliable and viable for answering the research questions. Based on these procedures, and the work of Hall and Loucks (1977), the LoU interviews are considered to be reliable and valid to determine levels of implementation of the teachers in this study.

Observation

IC-based observation. "Observation has particular value when an innovation involves multiple user roles, or has components that call for an interactive process, such as teacher-student exchanges" (Hord et al., 2006, p. 31). Prior to the interview and observation process, I created an Innovation Configuration map for BYOD to help me operationalize use of this innovation. During the observations of participants who were assigned a User label after the first interview, I sought to observe four of the IC map

components in the classroom: BYOD lesson design, knowledge of BYOD, student MCD ownership, and student MCD use. Prior to the observations these components were loaded into the *Observe* app for iPad. See Appendix D for screen shots.

Data Collection Procedures

Access. The first step in my data collection was securing access to the teachers, permission for which had already been granted by the district's superintendent and the school's principal. I also gained formal written permission from the school district's Executive Director in charge of research.

Request for participants. Each teacher at the school received a letter asking for their voluntary participation, see Appendix B. From the positive responses, I chose two teachers from departments of up to ten members, and three teachers from departments of more than ten members using random convenience sampling.

LoU interviews. When the participants were selected, I scheduled a structured LoU interview within one month, in the first semester of the school year. After these initial interviews, I chose 15 of the teachers for another LoU interview in the 2nd semester. These 15 teachers were chosen because they indicated in their first interview a strong desire to learn more about BYOD, a desire to increase their implementation, a plan to attend professional development for BYOD, or had indicated a plan to begin using BYOD.

Observations. After the first LoU interviews were completed for all participants, I scheduled observations of the participants who were at the User level based on the first interview. The exception was one Level I teacher, who I chose to observe because he

indicated in his first interview that he was going to seek out professional development. Using the BYOD Innovation Configuration map (see Appendix A) to structure the observation, I used the *Observe* app for Apple iPad to record occurrences from the IC map. See Appendix D for a screen shot of the app. Within this app, I created 4 themes to observe: teacher knowledge of BYOD, BYOD lesson design, Student use of MCDs, and student ownership of MCDs. Each of these categories contained 4 codes based in the IC Map (Appendix A), which ranged from high to low, and were recorded in the app. Additional in vivo coding that resulted during the observation was recorded in the iPad Notes app, as well as general observation notes, and were analyzed during memo and observation summary writing.

Data Analysis Procedures

Corbin and Strauss (2008) define qualitative analysis as a "process of examining and interpreting data in order to elicit meaning, gain understanding, and develop empirical knowledge" (p. 1). I interpreted data from the LoU interviews and observations, in order to gain understanding of the implementation of BYOD at this school. Stake (2010) writes that qualitative studies rely on human perception and understanding. As such, I analyzed the LoU interviews and observations using IC map components.

During structured LoU interviews, I interpreted the responses of the participant, and probed for information when necessary and appropriate to cover all the innovation decision points and move through the interview in its entirety. "The LoU construct shifts the perspective from one of either use or nonuse to one that encompasses multiple

approaches to using the innovation" (Hall, Dirksen, & George, 2006, p. 25). By using the LoU interviews, the aforementioned research questions can be answered for individual teachers.

Prior to observations, I loaded the desired outcomes into the *Observe* iPad app, which allowed me to document teacher and student behavior based on the IC map. Innovation Configurations can tell the researcher both what the innovation is, and what it looks like in use, and "IC Maps are frequently used as a baseline from which to evaluate or conduct research on programs and outcomes" (Hord et al., 2006, p. 40). After both rounds of LoU interviews and observations were complete, I analyzed the data to answer the research questions, explained in Table 4.

Table 4

Research Questions and Analysis

Research Questions	Source(s) of Information	Data Analysis/Reporting Procedures
What is the degree of implementation of BYOD?	Levels of Use interview	Overall LoU score
What instructional decisions did BYOD user-level teachers make with regards to m-learning?	LoU interview, Observation	LoU responses for Assessing, Planning, Status Reporting, Observation data, coding, memos, summary
How did teachers collaborate on BYOD with colleagues during implementation?	LoU interview	LoU responses for Sharing, Assessing
How did teachers participate in voluntary professional development?	LoU interview	LoU responses for Acquiring Information, coding, memos, summary
Was there a difference in LoU between early career and veteran teachers?	LoU interview, Observation	Overall LoU score, Observation data, coding, memos, summary
What barriers to successful implementation did teachers at this school report?	LoU Interview, Observation	LoU interview responses for assessing knowledge, Observation data, coding, memos, summary

CHAPTER 4

FINDINGS AND RESULTS

Introduction

Chapter 4 presents the findings of this descriptive study of the implementation of mobile-learning teaching and learning strategies that utilize student-owned mobile communication devices at a high SES, high performing suburban high school in the Southwestern United States. I will present the findings that answer the research question: What are the BYOD Levels of Use of teachers at a high-performing, high SES suburban high school? In addition, in presenting the findings, this study will answer five sub questions:

1. What instructional decisions did BYOD user-level teachers make with regards to m-learning?
2. How did teachers collaborate on BYOD with colleagues during implementation?
3. How did teachers participate in voluntary professional development for BYOD and m-learning?
4. Was there a difference in Levels of Use between early career and veteran teachers? (+/– 6 years teaching)
5. What barriers to successful implementation did teachers at this school report?

The findings for these questions are presented in the following sections.

Findings and Results

What are the BYOD Levels of Use of Teachers at a High-performing, High SES Suburban High School?

To answer this question, I selected 28 teachers representing each academic department at the school. For departments with less than ten members I selected two participants, and three participants for departments with more than ten members, as described in Chapter 3. The participants by department are represented in Table 5.

Table 5

Participation by Department, % of Department

Department	Participants	% of Department
Career/Technical	2	40
eLearning	1	100
English	3	18.75
Math	4	25
Physical Education	2	50
Performing Arts	2	40
Science	3	21
Social Studies	3	25
Special Education	3	23
Visual Arts	2	50
World Language	3	25
Total	28	27.5 (of school)

In all, the 28 participating teachers represent 27.5% of the teachers at the school. There is one outlier in the group, the eLearning teacher. This teacher is assigned to work the school, but is not a member of the school's faculty; the participant is a district-wide online course teacher, and his students can be from any of the secondary schools in the district. I chose this person to include as an outlier because of years of experience (less than 6 years), and the nature of communication for his eLearning classes lends a different perspective to communication and collaboration between the student and teacher using MCDs. This perspective will be amplified later in this chapter. It is important to note that the school and district in this study refer to their program as BYOT, or "Bring Your Own Technology," and as such some teachers quoted in this section use the term BYOT instead of BYOD.

The primary method of gathering data was the Concerns Based Adoption Model Levels of Use Interview. The purpose of this interview is to assess an individual's level of implementation for a particular innovation, in this case BYOD m-learning. According to this protocol, an interviewer interprets the interview data, and assigns a level to each participant, as follows:

Level 0: Non-Use

Level I: Orientation

Level II: Preparation

Level III: Mechanical Use

Level IVA: Routine

Level IVB: Refinement

Level V: Integration

Level VI: Renewal

(Hall & Loucks, 1977)

Initially when I planned the interviews using the Innovation Configuration map (Appendix A), I planned to use "Primary and Secondary uses of MCDs" and "experimenting with BYOD lessons when convenient" as the decision points for whether the teacher was a user or nonuser. The difference between these decision points determined whether I continued with a user or nonuser interview format, see Appendix C (Hall & Loucks, 1977). However, after the first 3 interviews I changed this decision point; teachers responded that they do not design lessons that utilize MCDs, but that they are still allowing MCD use to occur. I revisited the IC map, and adjusted my interviews. For the remaining interviews, I used "BYOD lesson design" as the main decision point of whether a teacher is a user or nonuser.

After the first round of interviews, all 28 teachers allowed MCD use within the lesson, including all Level 0 Non-Use teachers. Prior to this study I considered a teacher who allows MCD use without encouraging or planning use to be a teacher who is experimenting with BYOD, or orienting oneself to the innovation. However, as a result of this study, I classified teachers that allow MCD use by students without orienting themselves to the innovation of BYOD m-learning, or planning higher levels of MCD use, as non-users. They allow voluntary use to occur, but they do not have interest or put forth effort to learn more about the innovation.

Level of Use profiles. The total of teachers by LoU for the first interview is represented in Table 6, and a further breakdown by participating teacher and department is represented in Table 7. I placed the largest group of teachers at level III: Mechanical Use after the first round of interviews. I selected 16 teachers for a second interview, based on responses in the first interview indicating that they were planning to seek out training or help with BYOD implementation, or that they were going to make an effort to increase implementation. After the second set of interviews one teacher moved from level I: Orientation to Level III: Mechanical Use, bringing the total of Level III: Mechanical users to 11, and one of the 16 teachers I selected did not participate in the second interview. In this section I will profile each of the Levels of Use for BYOD at this school.

Table 6

Levels of Use, Total Participants, First Interview

LoU	0	I	II	III	IVA	IVB	V	VI
n=	3	7	1	10	4	3	0	0

Table 7

Levels of Use, by Teacher and Department, First Interview

Teacher	Department	Level of Use	Teacher	Department	Level of Use
1	Math	III	15	Special Ed.	I
2	World Language	III	16	World Language	IVA
3	English	III	17	Social Studies	III
4	Visual Arts	IVA	18	CTE	II
5	Social Studies	IVA	19	English	III
6	Math	IVB	20	Performing Arts	III
7	PE	IVB	21	CTE	III
8	Science	IVB	22	PE	I
9	English	III	23	Math	0
10	Math	I	24	Performing Arts	0
11	Social Studies	III	25	World Language	0
12	Visual Arts	III	26	Science	I
13	Science	I	27	Special Ed.	I
14	eLearning	IVA	28	Special Ed.	I

Level 0: non-use. Level 0 teachers did not design lessons that integrate student use of MCDs, and they were not acquiring information about the innovation for future integration or lesson planning. They allowed MCD use to occur. Examples of student use in these classes included allowing students to take pictures of notes on the white board,

and allowing students to access digital calendars or other productivity applications. One of the teachers in this group also allowed students to look up information, but he was an outlier for MCD use because he taught a course that required students to use computers, and he had a lab of computers in his room; he did not see the value in student-owned devices and did not seek out information about BYOD. The other two were late-career teachers, and did not seek out information to integrate student-owned devices beyond the current level. As one teacher explained:

> I don't see them using them in mine (class), at all, except for, you know, the minor things. I just don't see it. I mean, a graphing calculator does almost all the things BYOT would do. No, I'm not going to use it. (Teacher 23)

This feedback illustrates a key decision point between levels; exploring its value and orienting oneself to using the innovation. It also indicates limited knowledge of the innovation.

Level I: orientation. Level I teachers in this study also allowed students to use MCDs on their own without designing lessons that specifically integrate student-owned MCDs. The key difference between these teachers and Level 0 teachers is that level I teachers were interested in learning more about BYOD. Although Level I teachers had a desire to learn more about BYOD, they were not active in seeking out information about how to implement BYOD; they read things that "come my way," as Teacher 28 explained. Although this could give them an individual score of Level 0 for Acquiring Knowledge in the LoU analysis, there was an expressed desire among the Level I teachers in this study to orient themselves to BYOD, and they wanted to begin

implementation. Level I teachers knew what BYOD is, and they were aware that there might be potential in harnessing these devices for learning, but their lack of knowledge about the capabilities of the devices was a barrier to implementation. A representative teacher reported:

> I would see myself behind the students in terms of their understanding. I don't text, I don't do Facebook. I would like to learn how to text, I'd like to learn how to communicate with people that way, but I feel like I'm behind. (Teacher 13)

Level I teachers' knowledge of MCD capabilities can be limited to knowledge of how the devices can be used for off-task behavior. As Teacher 26 reported, "With phones it's a catch-22. You want them to use it, but it also provides a distraction." All seven of the teachers at this level reported off-task behavior and distraction as a drawback to integration of MCDs into instruction. However, they still would like to know more about BYOD, and how they can begin integration of the devices, as they recognized that there is potential for academic uses. Other concerns of Level I teachers will be further reported later in this chapter.

Level II: preparation. Teacher 18 in this study was the only teacher at Level II. This teacher's responses were similar to the Level 0 and I teachers in that he had concerns about off-task behavior, and he passively allowed student MCD use without designing lessons specific to BYOD, but he also set a goal of creating BYOD-specific lessons during the 2nd semester. Due to this response, I interviewed him again in the second semester but he had not yet designed a BYOD lesson, although he encouraged students to use their own devices to look up information for the class. In addition to

setting a goal to begin integration, another key difference at Level II is that he had a greater knowledge of the capabilities of student-owned devices, and the potential impact on student learning that could occur with properly designed lessons. For example, he stated:

> When they (students) really need the information, and that's the biggest emphasis I have on BYOT, when they need the information for college or for work, they need to be able to figure out how to get it. And it won't be by the school providing technology for it. (Teacher 18)

One setback, he reported, is that the school's Wi-Fi signal is weak in his room, and he would be more willing to look into BYOD lessons if a stronger signal were available. Providing free access to the internet is a key component of BYOD, because students are not forced to use their own data to participate in teaching and learning activities.

In addition, although teachers at every level in this study reported equity as a concern for BYOD (not all students have access to personal technology to use in BYOD), the Level II Teacher cited equity concerns as a reason that he is motivated to incorporate BYOD. As he stated:

> They have often the latest and greatest phones...that's the strength of it, that we can learn on the cutting edge or the leading edge of technology, and they can use that as a way to adjust to the scope of the technology that's in the classroom...weakness is not all my students have technology available. It comes into the haves and have-nots. Our demographic is solidly, the socioeconomic is solidly towards the upper, upper middle class, but we have more of a student

> population coming in because of the way the economy, the way it is, we don't have as much technology coming in. But that's something I feel that allows with BYOT to have the kids maybe that might not otherwise be exposed be seeing someone else's newer item. (Teacher 18)

The finding in this case is that lower SES students in this school could gain exposure to newer technology in the classroom that they might not otherwise gain exposure to outside of school, and supports previous studies that find that the instructional decisions that teachers make are more important than the SES of their students.

Level III: mechanical. Level III users made up the largest group of teachers in this study, with 10 teachers interviewing at that level (note: at the conclusion of the study the total was 11, as one teacher moved from Level I to III between the first and second interview). These teachers directed their students during a lesson to take out their phones and use them for a specific purpose related to the lesson; specific instructional decisions that teachers at different levels make will be presented in the next section of this chapter, but the Level III teachers commonly used student-owned devices for online collaboration using edmodo.com, productivity with calendars, accessing online materials, online research, and interaction using polleverywhere.com. These activities typically did not engage the students in high level critical thinking, but they did demonstrate a level of use on the part of the teachers to incorporate student devices. As Teacher 19 described it, "I'll never be the person using the most technology, but I don't want to be in the Stone Ages not utilizing it at all." Teachers at this level wanted to incorporate all the technology that they could.

Level III teachers, however, were more concerned about logistical issues setting up these lessons, and the distractibility of the devices than making changes to their teaching that will improve student learning. They recognized however that MCDs are becoming more important; as Teacher 11 described:

> Every kid, as soon as they walk in the classroom, has got their cell phone out. We're going to have to get on board with this, sooner or later. Just because it's part of their psyche now...If you actually give them the opportunity to use their phone in the classroom for the activity, it seems like there's less (off-task) use after that. (Teacher 11)

During my observation of this teacher's class, students were engaged in looking up current events on their personal devices. Prior to the activity, I observed seven out of the 28 students with MCDs on their desks. The students were separated into groups for a competition looking up information about current events. This illustrated a shift in this teacher's part, from wanting his students to know information, to wanting them to know how to find information, but mechanical issues were still at the forefront of the lesson. Although the teacher referenced the guest Wi-Fi network, the students were teasing each other about which data service was fastest, indicating that they were not using Wi-Fi. In addition, some of the students were using their devices for off-task behavior such as text messaging and accessing Facebook. At the conclusion of the activity however, all student devices were put away and no further off-task behavior was observed, just as Teacher 11 described in his interview.

Every Level III teacher made reference to off-task behavior, which will be addressed on more detail later in this chapter. However, the connection between reporting off-task behavior and Level III use is aligned with the CBAM description of Level III: Mechanical use (Hall & Loucks, 1977). The teachers at this level attempted BYOD lessons, but not with regularity, and not with a sense of comfort; they cited difficulties in lesson planning and managing the classroom. Teacher 12, for example, wanted her students to have academic benefits from using their devices, but she believed that they do not have the discipline to do so. "I think about how it can be used as a resource," she said, "I don't think about how I can change my lesson so that a mobile device can be used necessarily, but I do think about how it can enhance my lesson." The tasks for her students, as observed during a BYOD lesson, involved students looking up examples of the day's topic on their devices and sharing the results with other students. It was an optional/supplemental resource for the lesson; students had the option to use one of her classroom computers in lieu of their own devices. All but four students, however, used their own devices, and the four students without devices paired with a partner. Throughout the lesson however, she was mostly focused on telling the students when to take out and put away the devices, and how they should be used properly. She believed that in order for students to use their devices, they need to learn self-management:

> You have got to learn to be a productive worker, and own a phone. They haven't been given the skills they need to learn self-control, and have the decision-making ability to decide when it's appropriate...and they're not there. They really need

> that training. And so that's what I kind of try to build into my room. And that's what we talk about a lot. (Teacher 12)

Her comments align with Dewitt's (2007) findings on the role of schools in teaching students technology use. At the start of the lesson, she told the students to put their phones in their bags "for now," and then directed them to take them out to look up the first image. She quickly moved from student to student and checked their examples, and then had them put the devices away. After introducing the next topic, she repeated the process by asking them to take their devices out, find an image, show her, and put the device away. She self-reported that the changes she has made to her BYOD implementation this year have been in trying out new management structures, for example telling her students when to take out and put away their devices. In this case, I did not observe any off-task behavior while students were using their devices; either they did not have time to be off-task, or the time she has spent on mechanical training of her students' behavior and managing their devices was worthwhile.

Level III teachers in this study were mostly concerned with management of student devices during a lesson, and they recognized that having the students use their MCDs has the potential for academic impact if mechanical barriers can be overcome, but were more focused on their needs as a teacher in a BYOD lesson. The Mechanical Use teachers did incorporate BYOD into their lesson planning, and that is the key decision point for this study, but they did so in order to enhance their current lesson plans rather than redesign their lessons around BYOD. MCD use was supplemental to their lessons, not the primary focus.

Level IVA: routine. Level IVA teachers in this study integrated student-owned MCDs into lessons; they were comfortable with BYOD lessons, were focused on student needs more than teacher needs, and were not making any changes to their lessons to improve or decrease use of MCDs. Although teachers at this level still reported some mechanical concerns such as off-task behavior or logistical problems with Wi-Fi, they were much more concerned with student success than how these difficulties affected them as a teacher. Teacher 4, in whose room Wi-Fi is not available, still made use of student-owned devices for productivity and submitting work, and saw great potential for students; she did not let mechanical issues become a hindrance to implementation for student success. While observing her class, students had the option to use their MCDs to find images online to help in their projects, although it was not required to do so. Less than half of the students used a device, which might be in part because of a lack of Wi-Fi. Teacher 5, who cited immediate access to information as a strength of BYOD, reported that "They are able to access info as we speak, which is beautiful," and that "the successes far outweigh the negatives." In observation of his class, I noticed that students had the choice of whether they used their devices or not to suit their own learning. Like Teacher 4's students, less than half of the students chose to use their device, but they were not specifically directed to do so.

Another Level IVA, Teacher 16, demonstrated another key descriptor of this level, which is keeping a status quo for current level of implementation; "Anything that would make it easier and more effective, I would make any changes. But I'm not sure what that is...I'll definitely keep using it the way I have been." Level IVA teachers gained

comfort with their current level of use for student success, and they were not looking to make any changes in the future. A key decision point between Routine and Mechanical Use is this comfort of the teacher with the innovation. As Teacher 5 reported, "I love it. I continue to integrate it as much as possible, and embrace their (student) efforts...the more I'm comfortable, the more I've embraced students using it."

An outlier in this study was the previously mentioned eLearning teacher, identified here as Teacher 14. He did not teach a traditional class; his curriculum was delivered in an online format and he never met his students face to face. For this type of course format, communication between the teacher and student is critical because of the lack of face to face daily meetings. The course format also lends itself well to m-learning, as Peng et al. (2009) describe m-learning as mobile eLearning. Teacher 14's students had access to their course in a true anytime, anywhere format because the content could be accessed on most tablets and smart phones, but there was still a communication requirement for the teacher. In each course, the student had to participate in a minimum number of discussion-based assessments, which required direct communication with the teacher. For this purpose, Teacher 14 was issued an MCD from the school district, and each student received a district email address to facilitate communication. Email was not the preferred method of communication for students, however. He reported:

> I would say that text message is actually the most communication I get with the kids...Since I don't see the kids at all, this is pretty much the main way we communicate with them. Like I said, they are the most comfortable texting

> people, so they're really the ones who want to initiate the conversation because it's the easiest way for them to communicate with us. (Teacher 14)

I included this teacher when scheduling my observations, and although there were no students in the room, I observed him in conversations with students via text message to schedule the discussion-based assessments, and observed him in a phone conversation discussing the current reading assignment. Text messaging seemed to be an effective means of making initial contact with the student to ascertain whether he was ready for the assessment, and the student was able to call the teacher back and discuss a reading passage from the currently assigned coursework. The discussion, which the teacher conducted over speakerphone on his device, was as rich of a literature discussion that I have seen in traditional classrooms, and was facilitated through both the student and teacher having access to MCDs for anytime communication, and the student having access to the content of the course online. Teacher 14 reported that although students can use their devices to access content online, the most common use for students is communicating with him. He had no plans for changing his use of student devices for the remainder of the year, and he was comfortable with current use; he therefore is included with the other Level IVA teachers as being routine in use.

Level IVB: refinement. Although there are eight Levels of Use in the CBAM structure, the highest level of teacher in this study was Level IVB: Refinement; none of the teachers in the study were Level V or VI. A Level IVB teacher was similar to Level IVA, in that they were not as concerned with mechanical or logistical issues as they were with student use, but the decision point difference was that they were focused on refining

how they designed their lessons to incorporate BYOD for more student success. As Teacher 8 described:

> I'm comfortable with it. You know, not afraid of it. I'm open to suggestions from the kids, from other colleagues, you know it's exciting stuff. Any time that you can change your routine in the classroom, add new ideas, it's exciting. (Teacher 8)

In addition, Level IVB teachers did not report off-task behavior as a weakness of the BYOD strategy. When asked about weaknesses of BYOD, Level IVB teachers commonly reported access/equity as the main weakness. However, unlike the lower level users and nonusers, teachers at this level did not cite this as a reason to avoid BYOD lessons, but instead stated that they employed a variety of instructional strategies to give all students access to devices, such as pairing. Teacher 6 was able to acquire a number of iPads through department funding to supplement his lessons and combat equity issues. He described:

> Their stuff is usually better than the district stuff. Because by the time we buy it, and get it catalogued, and get it distributed, and get it installed, and teach the teachers how to use them, then all of a sudden it's obsolete. When the kids, they have a cell phone on them...ok, so now I don't have to provide 36 (iPads), if, you know, half of you could bring your own, then I could just provide ones to the kids who don't have it. Or, I could do pairing, and that usually helps. (Teacher 6)

Although access/equity was a challenge, it was not a hindrance to the Level IVB teachers. In addition, when asked about weaknesses, Level IVB teachers cited a lack of

resources or applications specific to their content area; a weakness that affects student performance, not the successful execution of a lesson. Teacher 6 further explained the difficulty in finding applications specific to Algebra 2; most applications, he said, are geared to lower level math courses, and he instead utilized the devices for online communication with and between students using remind101.com and edmodo.com. But, as he described, "I'm up for anything, as long as it can help me with the lesson." A Level IVB Science teacher, Teacher 8, explained a difficulty with finding resources specific to Science, until she sought out a blog online for teachers to discuss technology integration. During my observation of her class, students were using their personal MCDs to take pictures of their experiments at various stages through a microscope, and while the students clearly showed enthusiasm for being able to document their projects in this manner, they also demonstrated difficulty in holding the device steady enough for a clear picture. As a follow up, in the second interview after this observation, she reported that she sought out a solution on the blog by another Science teacher employing BYOD. The simple solution was to modify a film canister to fit over the eyepiece of the microscope to allow the MCD to rest against it while taking pictures. This process modification would allow students in future lessons to better use their devices to document their experiments. This illustrates Level IVB: a teacher seeking out new information to refine her implementation in the classroom. Whereas Level IVA teachers were comfortable where they were with BYOD implementation, and were not interested in making any changes, this IVB teacher reported "if it [making a change] benefits the kids, I'm absolutely open to it."

Among the Level IVB teachers, the teacher who utilized student-owned devices the most, on a daily basis, is Teacher 7, a Physical Education teacher. The students in his resistance training course used their devices every day for tracking their progress and fitness, using fitness, calorie, and photography applications. Use of student devices in his class was completely focused on improving student performance, and the use evolved frequently as he and his students discovered new applications. Like the other teachers at this level, off-task behavior was not a concern for him, and he handled access/equity issues by pairing; during the observation, 20 out of 37 students were using MCDs and sharing with their workout partners. While he was comfortable with his current program, he was looking for new applications that allow online backup of data, to give his students anytime, anywhere access to their information. The refinements that he was looking to make were to improve student performance; this is what a Level IVB BYOD teacher looked like in this population.

Although these profiles provide a brief overview of the various Levels of Use of the teachers in this BYOD population, the findings do not tell the complete story of BYOD implementation at this school. The findings for the sub questions in the following sections seek to provide a more in-depth understanding of the implementation of this teaching and learning strategy.

Instructional Decisions Related to M-Learning

To answer this question, I analyzed the interview data and observation notes for the 17 teachers who were Level III through IVB. Since Levels of Use interviews have been tested to have a correlation coefficient of .98 to observation (Hall, Dirksen, &

George, 2006), I expected to observe the same instructional decisions that teachers described in their interviews. For example, Level III Teacher 9 said that a successful BYOD lesson takes a great deal of time for preparation by saying that "if the teacher isn't prepared, there's no reason to bring it in just to bring it in," reported that her main uses of BYOD include having the students use their devices for research, productivity, and communication. During the observation, her students had the option of using their mobile devices or traditional print media to look up information, and encouraged them to pair and share MCDs. The activity was secondary and optional use of the devices for collaboration and research, in line with her self-reporting of BYOD use. Although use of the device was optional, 25 of 29 students used a personal device. Teacher 20, another Level III teacher who reported that "if you give them the chance to use it for school, they will use it for academic purposes," said that her students engage in regular use of MCDs for research, and also had her students looking up examples of the lesson's topic on personal devices during my observation of her class; a secondary/optional use of the device with pairing and sharing. For the Level III teachers, observations confirmed the same instructional decisions that teachers reported in interviews. This trend continued for all user-level teachers, with the exception of one Level III teacher who did not demonstrate a BYOD lesson during the observation.

Benefit of technology for instruction. User-level teachers are dedicated to implementing BYOD; "I'm open for teaching my students in any way possible, and if that means through mobile devices, then I'm perfectly happy with doing it that way," described Teacher 6. Overall, the instructional decisions that teachers made ranged from

low to high level use, from allowing MCD use an option, such as the two teachers referenced in the previous paragraph, and primary use activities, where students needed to use an MCD to complete the activity. Teacher 8, a Level IVB teacher, described how she evolved in her instructional decisions and lesson planning, and how her initial use was just for the sake of trying out the innovation:

> I used those [Quick Response, or QR Codes] last year, and the year before. And I realized that, I felt that I was only using them to use them, and they weren't really benefitting the students. So where I am right now, with technology for kids, is really searching for that higher level, where the kids really benefit from learning, not just use technology for technology's sake. (Teacher 8)

User-level teachers in this BYOD program, regardless of their actual level, without fail self-reported that they could be doing more to integrate BYOD, and that they were not where they should be. As one Level III user reported:

> I am committed to try and do some of these things differently...I do try to think of ways that I can incorporate it within the lesson. And it's not just logistics, but it helps me out because it cleans things up so it fits into my lesson plans, and it does help to assess where the kids are at. (Teacher 1)

BYOD user-level teachers, even Level III: Mechanical Use teachers who worried more about how BYOD affects them personally, are focused on the students to some degree.

Instruction and motivation: teachers and students. Students can be the driving factor as to how teachers make decisions about integration of BYOD. As Danzig and Aljarrah (1999) found, student perceptions and concerns can be used as a basis for

curriculum decisions. "They like using these tools, it keeps them engaged," Teacher 8 reported. "While they are doing it, I hear 'Oh wow, this is really cool.' If it's a positive impact on them, and if they're enjoying it, and if I see that it affects their progress in the class, their understanding, their comprehension, their confidence, I'll definitely use it again" (Teacher 8). The student reaction described here was also clearly observed in the teacher's classroom, where the addition of MCDs into the lesson improved what they could do over the previous lesson. The nature of this reporting is inline with this teacher's Level IVB status, but the sentiment was present with other teachers as well. Teacher 10, who moved from Level I to III, reported in his second interview that 90% of his students prefer to access their textbook via an MCD in lieu of bringing their book to class. Since the students want to use their devices, he embraces it:

> I think I just need to do more, explore more, use it more...I need to incorporate it more into my lessons instead of just letting the students do their own thing. So I need to use BYOT more than them. Because I don't use it at all, the students use it. (Teacher 10)

And for some teachers this can be a shift away from the teacher being the main source of information in the room. As one Level III teacher reported that he tells his students, "Why are you asking me? Let's take the phones out and find the answer, and then let's go from there. See what you come up with and we'll go from there. And I do that more often (with the students)" (Teacher 2). During my observation of Teacher 2, he was implementing a new lesson using polleverywhere.com for student feedback and engagement for the first time, and he explained to his class why he was trying this tool,

and that he wanted to determine if it was useful for future lessons. It was clear that this was his first attempt at using this tool, as he struggled with mechanical issues of making it work. This free online service allows students respond to prompts from the teacher using their MCDs, either as multiple choice or open response. For this lesson, he provided four open response questions for his students. Twenty-seven of 29 students used personal devices to respond to the prompts. During responses, some students replied with off-topic responses in an attempt at humor and disruption, and some students were off-task with their devices. He reminded them that this was an academic discussion, not a forum for jokes.

At the conclusion, Teacher 2 asked his students how they liked using this service to respond to prompts and have discussions, and whether they found it to be useful. Their responses varied. One student responded that if they used it more often they would take it more seriously. Another response was that since it is anonymous, more people will respond. Another mentioned a lack of access to devices by all students as a weakness. Another said it should not replace classroom discussion because there are aspects that are lost. Another liked the tool, but said that it takes too long to respond to other comments. Another responded that the activity is not as valuable as traditional discussion, but worth doing again to get more people to respond. Another said that it is not the most effective, but a nice change. Overall, the teacher reported that although not all students found the tool to be useful, he was going to try and use it again more effectively in the future, but in different ways. Student enthusiasm or lack thereof for MCD use can affect teacher

decisions when lesson planning. As Norris and Soloway (2011) write, BYOD is the first instructional technology that is driven by the students.

Still other teachers made instructional decisions based on what they, as lesson planners, need to do, as reported by one teacher who said "If I am planning a technology-driven lesson that is going to take an entire class period, I essentially feel like I don't think I can rely on just that lesson, I feel like I have to plan two lessons" (Teacher 4). Planning technology-rich lessons such as BYOD lessons require the teacher to have vision, not just for mechanical issues such as preparing for technical difficulties, but vision for the future of teaching and learning, and why it is important therefore to make instructional decisions that integrate student devices. In reference to his vision that more students will be using personal devices to access online textbooks and materials in the near future, as well as the need to learn new skills as a teacher, a Level IVB teacher said:

> I know that that's coming; I know that's what's down the road. I know that this is going to happen, and when it does I want to be ready for it and so I'm, again my goal right now is just to implement and try to work things out so right now it's my choice, and I can see how things work instead of waiting, you know, until the last minute and then go 'OK, now I don't have a choice, now I have to figure everything out.' (Teacher 6)

This vision to anticipate future trends and district mandates allowed the teacher to refine his use of BYOD to anticipate future trends in m-learning. This anticipation can be difficult however, as a Level III teacher described:

> If anything I'm just frustrated that I haven't got a surfboard to ride this wave yet. I know the potential is out there, and I think there's a handful of the population that have the glasses on that can see all the potential, and must look at a traditional classroom and cringe to think of what could be. And I'm one of those people who are like 'yeah, I wish I had those glasses.' Because I think I would be amenable to making the change, I just haven't had the time to invest in knowing what I need to know to create the change. (Teacher 3)

This teacher, in an attempt to have vision for the future of teaching and learning with technology, had a management technique for MCDs that was unique in this study. Many of the teachers practiced a "take out, put away" policy of device management in class, whereby students were directed when to use their devices and told to put them away when the activity was completed. Teacher 3, however, required all devices to be on the desk and turned on at all times. Just as a teacher referenced in the previous section feels that students do not have the skills to decide when to use their devices appropriately, this teacher believed that the way to teach this skill is to force the students to make the decision. As she explained the policy to parents, how many meetings do adults attend where devices are out on the table, and adults must decide if a text message or email is worthy of disengaging to read? Level III teachers, although focused on mechanical issues such as device management and off-task behavior, can also have vision of BYOD potential, and the potential impact on students' lives in the 21st century, and this vision affects the instructional decisions that they make.

Teacher Collaboration

As Looi et al. (2010) found, initiatives such as this need to be supported by professional development and opportunities for collaboration. All teachers at this school participated in ongoing collaboration through Professional Learning Communities to analyze student performance data, create goals, design assessments, and plan lessons. As one of the teachers explained, "As a department, a majority of the people here seem pretty willing to actually collaborate and work with each other help each other out" (Teacher 6). However, in the CBAM Levels of Use (Hall & Loucks, 1977), teachers who are at Level V: Integration participate in collaboration about the innovation to increase student performance. As there were no Level V teachers participating in this study, none of the teachers reported ongoing collaboration specific to BYOD. Although there was no reported collaboration on BYOD that was ongoing and sustained, teachers in this study did report sharing information about their BYOD practices with other teachers. A Level IVA teacher for example explained "My working with others is more along the lines of teaching them how to do it, rather than collaborating" (Teacher 4).

When asked about what they share about BYOD with others, user-level teacher responses were in line with their LoU. For example, Level III: Mechanical teachers often shared with other teachers their successes and failures in executing a successful BYOD lesson. As one teacher explained:

> I tell them how to organize it, I try to get some of the other teachers that are hesitant to allow it to happen in their class; how I control my class while students

have their phones out. Because some of the teachers are so scared of having the kids' phones out. (Teacher 10)

Another teacher reported that he simply tries to "tell them things that I believe are working, something that I'm not too sure if it's working or not, if it's a waste of time" (Teacher 11). Teacher 17 shared an example of a recent conversation that he had with a colleague:

> Well I'll give you an example, today I was having lunch with (name omitted), and he was talking about how in his class, he was asking students about if their parents are authoritarian. And the response, he said, was minimal, mixed. And I said, well, there's this program polleverywhere, and I explained it to him. He seemed to be kind of enthused about using that. Whether he'll follow through I don't know, but I'll probably ask him. (Teacher 17)

In these cases Level III teachers were having conversations with other Mechanical Use teachers, or nonusers. In one case, a teacher explained that she tries to tell teachers that "it's so much easier, and that there's nothing wrong with the kids using the technology. And you just have to find a way of making it comfortable for you" (Teacher 9). However, another Level III teacher reported frustration at trying to collaborate with other teachers in his department who are at a higher personal level of technology use; "My level and their level, there's not a patience among them, any teachers that are farther ahead" (Teacher 2). Level III: Mechanical Use teachers had conversations with other teachers around mechanical issues.

Level IVA teachers reported sharing their use of BYOD in an attempt to share their current implementation successes with colleagues. "I tell them what I use, I tell them how I incorporate it," Teacher 16 explained. "You should really use remind101.com, because it really helps the kids" (Teacher 16). This is the difference in level of use; at the IVA Routine level, teachers reported sharing specific techniques that are beneficial to the students, instead of convincing teachers to implement BYOD or explaining how to successfully integrate a BYOD lesson. Another Level IVA teacher who used BYOD to have students present project findings explained:

> What I'm doing in the classroom, how it works for me, my successes...I would invite them to come to any of the presentations. I'm very proud of the students' achievements as it relates to using technology as a resource and support to build upon their Independent Study projects. (Teacher 5)

Level IVA: Routine teachers in this study shared what they were doing with other teachers to improve student outcomes.

The Level IVB teachers in this study reported their efforts to continually modify their lessons to improve student outcomes; all 3 teachers reported that they share their successes and efforts with educators outside of their school. As mentioned in the previous section, one of the teachers was active in an online blog community where the participants shared lesson ideas and tips specific to instructional technology. Another shared his ongoing use of BYOD and modifications he makes with a teacher at another school within the district:

> I tell him which apps I use, why I use them, all the little tricks...I actually send him lesson plans. He was very interested, so instead of reinventing the boat I send it over to him. (Teacher 7)

This is a teacher who was making changes to his use of BYOD frequently, and sharing his use with another school helped disseminate best practices for their academic discipline. The third Level IVB teacher, in addition to sharing his successful implementation strategies within his department, reported that he shares information about student-owned technology with the community outside of education, as well as at professional conferences and national organization meetings:

> It's one of the things I usually end up bringing up and talking about because I think our district is doing a better job than some districts are. So I talk about it and try to share our successes. (Teacher 6)

Level IVB teachers in this study shared their work with BYOD in a more broad scope than within their school.

Collaboration matches Level of Use. While the teachers in this study did not participate in ongoing collaboration with colleagues specific to BYOD, they participated in conversations about this innovation. The conversations that teachers had about their BYOD use varied depending on what their Level of Use was; Mechanical teachers had conversations about overcoming apprehension of use and dealing with mechanical issues such as student behavior, Routine teachers discussed the success they have with BYOD and how their lessons impact students, and Refinement teachers shared their implementation of BYOD with a wider community than their own school.

Student collaboration. Although collaboration within the CBAM framework refers to ongoing collaboration among teachers specific to the innovation, collaboration among students is inherent in using BYOD; one of the benefits of anytime, anywhere student access to information is that they can collaborate in new, interesting ways. While many teachers in this study utilized student MCDs with tools such as edmodo.com to foster collaboration, Teacher 3 (Level III) had unexpected student collaboration occur as a result of her lesson. During my observation of her class, she was discussing the concept of a hero with her students. As part of this lesson, she was attempting to access CNN.com, where the site had profiles listed for people around the world who could be considered heroes, and visitors to the site could vote up to ten times for the best example of a hero. However, when she tried to access the site it was not working. Almost as an afterthought, she asked her class to see if any of them could access the mobile version of the site and vote there. This was not a planned BYOD activity; it was unplanned optional use of student-owned devices. At the conclusion of this class period I recorded that only four out of 22 students used an MCD to participate in this unplanned lesson. However, the unexpected collaboration occurred throughout the day after I left her room. As she later explained to me:

> After you left, the kids in first hour all decided to wage a last minute campaign for a hero and had everyone start voting for the same person. They then posted on their Facebook pages the link to vote on the CNN website, and asked all their Facebook "friends" to cast votes for the hero. By the time third hour came, two kids stood in front of the doorway and asked kids if they voted and if the link was

> on their Facebook page. Those who hadn't were stopped and brought to my computer to vote. In two class periods, a campaign for their hero was launched using their phones. Yet...there is more. During 4th hour lunch, I had 4 kids who I had never seen before come in my room and ask to use my computer to vote for the CNN hero. By fifth hour, kids were texting everyone they knew to verify they voted. By 7th hour, one student counted that over 3,500 votes were cast (keep in mind you can vote 10 times per day) from 9:00 until 2:00. I have 130 students, that means an additional 200 plus students who I don't have and who had no clue about this lesson voted. (Teacher 3, personal communication, 2013)

So although this teacher did not plan this collaboration using BYOD, this example demonstrates that students, as well as teachers, can collaborate using BYOD.

Participation in Voluntary Professional Development

Teachers at every Level of Use in this study reported that they were not where they want to be in terms of BYOD implementation, or that they simply need help or do not know enough. One of the Level 0 teachers explained, "I'm not opposed to doing more things with it if someone came in and just sat down and trained me individually on what to do with it" (Teacher 25). Level I teachers also reported a lack of knowledge, with comments ranging from not knowing what they are doing to not being where they want to be to get the most out of student use. These feelings were reported at every level, including level IVA teachers who were comfortable with their BYOD lessons and were not making any changes: teachers felt that they are not where they would like to be or should be.

The school district in this study offered professional development both in BYOD and m-learning, as formal training sessions that teachers chose to attend as well as one on one training from Instructional Technology Teaching and Learning Coaches (ITTLC). The district-wide BYOD professional development courses were often taught by the ITTLC assigned to this school, providing an opportunity for the teachers in this study to avail themselves of training in BYOD.

Although professional development was available within the school district, few of the teachers sought out any training opportunities for BYOD. One of the Level III teachers did work with the ITTLC in creating BYOD lessons, and encouraged other teachers "to take the workshops...and that they really should let her (ITTLC) come in and do a lesson for them" (Teacher 9). However, despite the presence of the ITTLC on campus and the recommendation of this teacher, only one other teacher in the study contacted the ITTLC for professional development, after reporting that "I would like to do a lot more. Eventually, I'd like to get there" (Teacher 13). However, after meeting with the coach, he had yet to implement a designed BYOD lesson at the conclusion of this study. Only 2 of the teachers in this study participated in voluntary, district-sponsored professional development for BYOD.

For professional development offered outside of the school district, four of the teachers in this study attended a seminar that was not specific to BYOD, but on teaching and learning in the technical age. Three of the teachers, Level III, Level IVA, and Level IVB, did not report any significant changes in teaching or lesson design as a result of attending this session. The third teacher, however, is the only teacher in this study who

changed LoU between the first and second interview, moving from Level I to III. Prior to the seminar, he admitted "I would like to be using BYOT way more than I am...if I start trying to do BYOT right now then I just don't think it would work" (Teacher 10). During the second interview however, which followed his participation in the seminar, he reported that 90% of his students were using a mobile device instead of the textbook on a daily basis, and that he has been seeking out additional online materials for his students to access on their devices, such as channels on YouTube that reinforce his daily lessons. He also reported that the more his students use their MCDs in class, the more their parents were relieved that students were using MCDs for school work rather than entertainment, supporting the findings of the Project Tomorrow surveys (2010, 2011). Another result of increased encouragement of student MCD use in his class was an increase in students using their devices for productivity and organization; the only students who still use a paper organizer, he said, were students whose parents require them to. For example, many parents require their students to keep a paper agenda daily, to be signed by the teacher at the end of the class period to monitor their student's work. The other students are organizing themselves using digital resources, according to Teacher 10. In the example of Teacher 10, voluntary professional development for m-learning can therefore have an effect on teacher implementation of BYOD and student MCD use, if the teacher participates.

Difference in Level of Use Between Early Career and Veteran Teachers

As stated in Chapter 2, there is disagreement in research literature as to the effect of teacher experience and technology integration. While some studies find that

experienced, veteran teachers are more likely to adopt technology because it will make their jobs easier, other studies find that novice teachers are more likely to adopt technology. Russell et al. (2003) found that novice teachers (less than 6 years experience) are not necessarily going to use more technology than veterans. Oncu et al. (2008) found that experienced teachers are more likely to accept new technology, and Metzler et al. (2008) found that novice teachers are more willing to accept technology but will not do so if the experienced teachers are resistant.

The findings presented here are not able to answer whether there is a difference in Level of Use between early career and veteran teachers; only one participant, Level IVA Teacher 14, had less than 6 years experience. Of the remaining participants, three had over 40 years of teaching experience, and were all at different Levels of Use (Level 0, Level III, Level IVA). However, one participant did describe a difference in teaching experience:

> There's a discussion (about BYOD), especially with younger teachers. Older teachers kind of frown upon the technology; they're kind set in their ways, you know, they don't really want to dive into that. (Teacher 11)

One of the veteran teachers agreed, stating:

> Since I'm at the end of my career, I do not see it as something that I'm going to put major emphasis on. If I were younger I would see it as something that has to be addressed and included, but it has to come across that there is substance to it. Something beyond just a superficial rendering of information. (Teacher 2)

This teacher, a Level III, also reported that he does not use mobile technology in his personal life beyond making phone calls, and that this might influence his decisions in class. Another veteran (Level 0) teacher reported similar lack of use, in that she did not have any devices at all at her home on which to practice, not a mobile phone or computer. "With me being so old, I don't know what half the stuff is" (Teacher 25). However, the age of this teacher was not the deciding factor in her knowledge of mobile technology, her lack of exposure to technology was.

> MCD technology is relatively new in the school setting. As one teacher stated:
>
> It's still pretty new. You know, teaching 15 years, it's been something now that only within the last two years, really, because the smart phones have been around before then, but the kids didn't really have access to them as much before two years ago. (Teacher 8)

The veteran teachers who had not been exposed to technology in their personal or professional lives were less likely in this study to be encouraged to implement new instructional technology. A Level III teacher described the influence that her current student teacher had on technology use in her classroom:

> The fact that he's grown up with it. I mean, he's obviously younger, and he's used it at ASU, he's used it in his classes, he's been exposed to it. And it's just like second nature, it's easier for him. (Teacher 9)

However, is this student teacher's technology comfort due to his age or exposure to technology? A level IVA veteran teacher, for example, took the interview as an opportunity:

> To reflect on technology after 40 years. I've reflected on all the various devices that I've tried to integrate into the classroom. And we've come a long way, specifically in the last 20 years...I used to be evaluated on whether or not I used an overhead projector, (laughs), Hello! So where we are today is like, wow. (Teacher 5)

Based on the responses of the teachers in this study, the experience that teachers had using instructional technology in their teaching careers and personal lives was more of a determinant of BYOD Level of Use than their age or years of teaching experience. This is in line with the findings of Project Tomorrow (2010), who found that most teachers and administrators who implement BYOD programs are MCD users themselves.

Barriers to Successful Implementation

Barriers to successful implementation are inevitable for any innovation. In this study the main barriers reported by teachers include time, equity/access, and off-task student behavior.

Time. Teachers from Level 0 through Level III reported time as a barrier to successful implementation of BYOD. The non-use teachers reported time as a barrier when I asked them questions about their knowledge of the innovation, assessing the innovation, planning to implement the innovation, sharing resources, for acquiring more information about the innovation; they could not orient themselves to begin implementation because they did not have the time to talk to others about it, attend professional development, or read about it. As a Level I teacher explained, "I think if I had more time I'd be actively looking, but I haven't had time to go out and look for them

myself" (Teacher 26). It is possible that teachers at these levels used a lack of time as a reason for not acquiring more information about BYOD, but whether their lack of time was a perception or a reality, it was a barrier for them. For non-use teachers, moving to a user level will not be possible if they cannot devote time to orienting themselves to an innovation.

Level III teachers also reported time as a barrier to doing more with BYOD. As one explained, "There's simply finding time. Which is an excuse, but it does play into it" (Teacher 2). Mechanical Use teachers found more difficulty than higher level teachers in finding the time to attend professional development, or even set aside time for lesson planning for BYOD or other new innovations. They most commonly discussed time when I asked them about acquiring new information about BYOD. As one Level III teacher reported:

> I think we're so inundated with everything that's changed in this state and in education that teachers don't have the, I don't know if it's the desire, the time, or what it is, to try something new. (Teacher 9)

This statement might account for non-user resistance to acquiring information about new innovations such as BYOD, but these Level III teachers had already made a commitment to investing time in this innovation, they had the desire. However, as another teacher explained, it is not easy to make time for lesson planning in new ways: "Once the school year begins, you're a step and a half ahead of the kids; it's really tough to find the time to find those golden nuggets that you can use technology for" (Teacher 3).

So although the Level III mechanical users were implementing BYOD lessons, a result of the lack of time to devote to acquiring more information about BYOD to create more BYOD lessons was that many of the activities occurred spontaneously in class; for example, Teacher 3 is the same teacher who experience the unplanned collaboration about heroes on CNN.com. She felt that she didn't have time to devote to planning BYOD lessons once the year starts, but her spontaneous lessons demonstrate strong student use of their devices. At some point in the past, a student in a classroom somewhere asked the teacher if he or she could look up the answer to a discussion question in class, and the concept of BYOD was spontaneously born. But, without devoting time to acquiring more knowledge about BYOD or planning BYOD lessons, Level III teachers will only sporadically plan BYOD lessons; the majority of BYOD activities will be supplemental and spontaneous. Therefore, without regularity in lesson planning, Level III teachers cannot become Level IVA: Routine teachers.

None of the Level IVA or B teachers reported time as a major barrier to successful implementation, nor did they talk about time in response to any of the interview questions. These higher level teachers seemed accept the time for planning as a necessary part of successful implementation.

Equity and access. Oncu, Delialioglu, and Brown (2008) found that availability and access are some of the most important factors that affect teachers' decisions to incorporate technology into instruction. In addition, both Dewitt (2007) and Norris & Soloway (2011) found that teacher perception of SES and home computer use affect their decisions related to lesson planning. The nature of a BYOD instructional strategy is that

the instructional activities are dependent on students having a device to use. Non-use teachers reported that not all students had devices to participate in activities, and did not report any attempt to fix that barrier; they only identified access as a weakness of BYOD. Teachers at every level in this study reported that not all students own devices, but they also deal with that barrier in different ways.

Student pairing and BYOD. During my observations of teachers, I observed 417 students engaged in learning. Of these students, I witnessed 212 of them using MCDs. When taken alone these figures suggest that access is a true barrier to successful implementation, but the numbers alone do not tell the story. For two of the observations, totaling 58 students, there were no BYOD activities directed by the teacher in the lesson plan, and thus the 58 students had no reason to use their devices; they were neither encouraged nor discouraged from using devices, so I could not determine device ownership by those students. On the other hand, for three of the observations, only four students or less did not have a device. All three of these teachers were Level III, and all three lessons were structured activities where students were directed to use their MCDs for a specific purpose as a primary or secondary resource, based on the IC Map (Appendix A). In other observations where the teacher gave students the option to pair and share for a BYOD activity, I observed that some students possessed their own devices, but chose to pair with another student in lieu of using their own device.

The most common method that the participants used to avoid the equity/access barrier was pairing and sharing of devices. In this method, the teacher created activities where the students were encouraged to work with a partner or in a small group instead of

individually to use a device. As a Level IVB teacher explained, "If there's a student who doesn't have that technology, there's always a student at that table with that technology, so they can share" (Teacher 8). As previously mentioned, Teacher 11 had his students engaged in a current events competition in small groups, so that only a fraction of his class needed to have a device, and Teacher 12 had students paired during the activity to look up images on their devices. Teacher 4 also had her students using devices to assist in their work, and groups of four students at the table were equally sharing their devices. Teacher 20 had her students in small groups looking up examples of the day's topic, and then posting their results to a class web page displayed on a media projector. In the physical education class, Teacher 7's students were sharing devices with their exercise partners to record progress, and Teacher 9 had her students working in groups of 4 or 5 using their devices to look up information to complete an activity. All of these observed activities illustrate how teachers employ pairing and sharing to overcome access issues. In these classrooms, not every student needed a device, as long as they were participating in a group activity with another student who was willing to share his or her device.

However, Teacher 3 described how her students voted on a topic of equity. In her English class, some students used iPads to annotate literature during class. Collectively, the class decided that on a literature exam where it is not possible to pair and share a device, having an annotated iPad gave those students an unfair advantage at being able to find annotated text more quickly. A teacher then, needs to determine when pairing and sharing is appropriate, and when it is not appropriate to use a device at all, as well as

determine if the students who own the devices in the room are in agreement to share their devices without being stigmatized.

While it is inevitable that access to MCDs will be an issue at every school, including a high SES school such as this, user-level teachers make adjustments to their lessons to accommodate the students. As Anderson (2005) found, low SES students might have only one shot at using new technologies; in school.

Off-task behavior. For years before teachers started to embrace the concept of BYOD, students were bringing their devices to school. MCDs were seen by teachers as a tool for misuse: distraction, cheating, and off-task behavior, and were generally viewed as something that should not be allowed in the classroom. The school in this study in fact, prior to implementing the BYOD program, had a policy of confiscation any time a teacher saw a mobile device, and a parent was required to come in and pick up the device from the front office. Because students were not prompted by teachers to use their devices for academic reasons, they misused their devices for off-task behavior. It is understandable, then, that teachers would cite off-task behavior as a barrier to successful implementation. As one teacher described, "Part of it may just be because of the psychological connection that I associate the phones, with doing everything they're not supposed to." Later in the interview, he added that "I'm not opposed to the technology, your phones, and the use of them. I'm opposed to the misuse of them" (Teacher 2).

For non-use teachers, off-task behavior can seem like an insurmountable barrier to BYOD implementation; text messaging in particular was cited by many teachers as a weakness of allowing students to use their devices, and was also the most commonly

observed off-task behavior when I was in classrooms. Level IVB Teacher 7 argued that in his class the students are so engaged in the lesson and primary use of their MCD, that they do not have time to be off task sending text messages. While this might have been true in his class, other teachers echoed concerns about students being off task, especially with text messages. As reported by one teacher:

> The biggest disadvantage that I see is definitely that they are not seeing where the social aspect of having that device in their hand 24 hours a day interferes with the education process. So if they're looking up images and they receive a text message they're not going to ignore the text message, they're going to respond to it. (Teacher 4)

She explained that discussing responsible use with her classes is a hurdle to BYOD implementation, but that she continues to work with her students on appropriate use:

> We came up with a student-written electronic device use policy...so we as a group, as a class came up with appropriate and inappropriate uses could be...I try to make sure that I've got this up in all my classrooms, and I've got the dialogue going with my students on a regular basis, but I don't feel like it's a solid thing yet. (Teacher 4)

Another teacher had a different opinion about text messages, and what it means to be off-task or engaged:

> They're still learning, they're still on task, you've just got to trust them. If you have kids that are getting off task you can deal with it accordingly. But, it kind of goes with the territory. If kids have their phones out, they're all going to be able

> to read a text when it comes. Or they might even send a text while you're teaching. And you kind of just have to get over that...if you have a kid that's just staring at their phone, texting, that's another thing. (Teacher 10)

This is akin to the teacher who required all students to have their devices on their desks and turned on, so that students learn when it is appropriate to text or not. However, not all teachers in this study agreed with that idea, and concern over misuse and off-task behavior was a frequent topic in interviews.

Robinson et al. (2010) declared that increased use of MCDs will also increase incidents of MCD misuse, but this does that mean that the MCDs lead to student misuse. While students can clearly use their MCDs to engage in off-task behavior, the attitude of the teacher toward what off-task behavior looks like in a 21st century classroom, as well as the conversations that the teacher has with students about behavior and digital citizenship are factors that determine whether off-task behavior is a barrier to successful BYOD implementation.

Summary

This chapter has summarized the findings of this descriptive study of the Levels of Use of teachers at an affluent, high-performing high school that has adopted a voluntary BYOD program. In addition to presenting profiles of the Levels of Use for 28 teachers at this school, I presented the findings for six sub questions related to this BYOD program.

In Chapter 5, I will discuss conclusions, recommendations, and implications of this study so that others may decide learning results and what further research is needed.

CHAPTER 5

SUMMARY, CONCLUSIONS, RECOMMENDATIONS, AND IMPLICATIONS

Introduction

This final chapter will summarize the study and its findings, and provide recommendations for practitioners and researchers who are looking at BYOD programs as a means of leveraging student-owned mobile communication devices for teaching and learning. I will end the chapter with implications for this study in the field of education and instructional technology.

Summary of the Study

In Chapter 1, I presented the purpose of this study, which was to examine the degree of implementation of mobile-learning teaching and learning strategies that utilize student-owned mobile communication devices at a high SES, high performing suburban high school in the Southwestern United States, and describe the BYOD Levels of Use of the teachers. This is an innovation in which teachers design lessons that utilize student-owned mobile communication devices (MCDs) for the purpose of improving teaching and learning using 21st century digital skills. The degree of implementation for this study included Levels of Use, instructional decisions, collaboration, professional development, ubiquity of devices, frequency of student use, and teacher experience.

Schools across the country have begun to implement BYOD programs in an attempt to keep up with the rising, consumer-driven presence of MCDs, as more and more students begin using these devices and bringing them to school. Although there is no paucity of research into technology in schools and m-learning, there is a lack of

empirical research about BYOD programs, and how teachers implement this new innovation.

In Chapter 2, I presented the literature related to this study, and the four major themes that are present therein: (1) The role of schools in the 21st century, (2) Funding and Access to technology at home and in school, (3) Technology implementation and m-learning, and (4) Adoption of new technology by teachers. The role of schools has changed over time, with a move from teacher-centered to student-centered learning. As new technologies have been introduced, schools have changed how they teach to accommodate new tools and new methods of learning. This is seen in the rise of smart phones and anytime access to information. While students today have greater access to information and productivity tools than ever before, not all schools have equal access to technology. And within a school, not all of its students have equal access to technology. New learning strategies such as m-learning with student-owned devices have potential to change the role of schools in the 21st century, as well as help to mitigate the effects of SES on student access to technology for learning, but they are dependent on visionary leadership for school leaders, and independent implementation by teachers (Hall & Hord, 2011). The process of change and adopting new technology is not easy; teachers react to change in different ways and implement new innovations at different levels. These themes are present within research literature, as well as a strong recommendation from BYOD advocates and the United States Department of Education that schools leverage student-owned devices for teaching and learning, but there are few studies that look directly at the teachers; the instructional decisions they make with BYOD, how they

collaborate on this new innovation, seek training, overcome barriers, and implement this new innovation.

In Chapter 3, I restated the problem and the research question: What are the BYOD Levels of Use of teachers at a high-performing, high SES suburban high school? In addition, I restated the five sub questions, as well as presented the methods by which I answered these questions. This study was framed by Hall and Hord's (2011) *Implementing Change: Patterns, Principles, and Potholes.* Volunteer participants in this study represented 27.5% of the teachers at the school, from every academic department. The main method of data gathering was the Concerns Based Adoption Model Levels of Use interview (Hall & Loucks, 1977). This structured interview (see Appendix C) allowed me to rate each of the participants' Level of Use. I then observed the user-level teachers, and one non-user to triangulate the data I recorded during the interview. The observations were based on an Innovation Configuration map that I created at the beginning of this study to operationalize BYOD implementation (see Appendix A). After the observations, I interviewed 15 of the teachers a second time, based on their responses in the first interview. At the conclusion of data gathering, I analyzed and coded the interview and observation data in order to answer the research question and five sub questions (see Table 2) and presented the findings and results of the interviews and observations in Chapter 4.

In Chapter 5, I present a summary of the findings, as well as discuss their meaning and importance.

Discussion and Interpretation of the Findings

What are the Bring Your Own Device (BYOD) Levels of Use of Teachers at a High-performing, High SES Suburban High School?

One of the most interesting findings of this study is that teachers at every Level of Use all allowed students to use their own devices to some degree in the classroom. This was an especially surprising finding for the Level 0 teachers. Hall, Dirksen, and George (2006) describe Level 0 teachers as not orienting themselves to an innovation and one would expect Level 0 teachers to not allow student-owned devices into their classrooms at all. Due to this interesting finding, I sought out a teacher who was reported to me by other teachers in the study to be particularly opposed to student-owned devices. When I saw this teacher in the hallway, I briefly asked her what her opinion was about student MCDs, and her first response was to tell me how much she hates them. I asked her if she would participate in the interview, and when we began I was surprised to hear her say that, like the other Level 0 teachers, she allows students to use their devices in class to access online materials, applications, and to take pictures of notes on the board. Level 0 teachers in this study may therefore allow student MCD use without orienting themselves to what the innovation is and what it is not; they were passively allowing it to happen.

Level I teacher responses were not surprising within the framework of CBAM Levels of Use. The most telling finding for Level I teachers is that they lacked knowledge about the innovation, and had trouble seeing beyond off-task behavior as a barrier to implementation. They would like to orient themselves to BYOD, and were interested, but had no plans to begin implementation.

The Level II teacher demonstrated a greater knowledge of BYOD potential, and had a goal to begin implementation. In particular, it was interesting to find that he considered the SES of students, and issues of access and equity as both strength and a weakness of BYOD.

Level III teachers, the largest group in this study, created specific tasks for their students to complete using their devices, but they were concerned with logistical issues in implementing a successful BYOD lesson, were not completely comfortable with daily use, and reported off-task behavior as a major barrier. They used BYOD to enhance their current lessons, rather than redesigning their lessons to teach in new ways. Like the Level I and II teachers, findings for Level III teachers are consistent with what one would expect to find using the LoU interview as a means of determining the degree of implementation.

The Level IVA teachers were comfortable with students using their devices in class for academic purposes, and unlike the lower levels did not report off-task behavior as a significant barrier. Instead, the teachers at this level cited individual student access to MCDs as a barrier to successful implementation; this is also in line with descriptors of a Level IVA teacher in that their concerns were more about student success than their own difficulties successfully teaching a BYOD lesson.

Level IVB teachers were refining their lessons in an attempt to increase student success. They did not report off-task behavior as a major weakness, and although they also cited access as a hindrance, it was not a significant barrier for them. The more interesting finding for Level IVB teachers is that, when they shared information about

their use of this innovation, it was on a greater scope than the lower level teachers, for example sharing with colleagues at other schools or at conferences.

Hall (2010) described Levels of Use as an effective means of envisioning how an innovation is being implemented. Although there were unexpected findings for Level 0 and Level IVB teachers, the findings generally matched the descriptions of Levels of Use as presented in the Concerns Based Adoption Model. And although the model has been criticized by Levin and Wadmany (2008) as being too formulaic, for this study it did provide profiles for the teachers with supporting descriptive details. Although I was not able to profile Level V or Level VI teachers, this study does provide descriptions of teachers at the first six levels that might be applied to other populations of teachers who are implementing BYOD.

What Instructional Decisions Did BYOD User-level Teachers Make With Regards to M-Learning?

The biggest distinction for user-level teachers is that they included student-owned MCDs when they planned their lessons. Overall, instructional decisions for User-level teachers in this study were similar to those outlined in Engel and Green's (2011) work. Students used their devices for a variety of tasks, from looking up information and productivity, to collaboration and synthesizing their work into projects. In general though, the instructional decisions that teachers made were aligned with their Level of Use. Lower-level user teachers made instructional decisions that used student-owned MCDs to enhance their current lessons, rather than reinventing new lesson plans around the device. These mechanical lessons often used the device as an optional or secondary

device, rather than primary. The barriers cited in Chapter 4 play into these decisions; time, equity, and student behavior. Level III teachers made their decisions based around these perceived barriers. Level IV teachers integrated the devices in such a way that they were more important to the lesson. Students who had a Level IVA or Level IVB teacher seemed to feel a greater need to have an MCD to use that class than students who had a Level III teacher, whose lessons might still be low-level use, and possibly still novelty.

Teachers at all three user levels reported that student enthusiasm was a driving factor that affected their integration of BYOD. If the students were more engaged during a BYOD activity, and the teacher could see that the students were excited about using the devices, the teacher was more inspired to create new BYOD lessons. However, the opposite could also occur; if students did not see the value in taking their devices out and using them for a purpose that would help them succeed in the class, there was a higher likelihood that engagement would not increase due to the BYOD activity, and off-task behavior with the device was likely. This was the pitfall for Level III teachers; if they were regularly creating BYOD lessons that were not engaging for the students, a lack of enthusiasm on the part of the students could influence the teacher to return to traditional teaching methods.

Level IV teachers saw beyond traditional teaching methods however, and had vision for what the future of teaching and learning might look like. Their instructional decisions therefore attempted to capture this vision to stay ahead of the curve, for example seeking out open source online material to help students with concept

reinforcement. However, instructional decisions were linked with the teacher's Level of Use.

How Did Teachers Collaborate on BYOD with Colleagues During Implementation?

The highest level of teacher in this study was Level IVB, and as such teachers at this school were not participating in ongoing collaboration regarding BYOD; a key decision point between Level IVB and Level V is ongoing collaboration with others to improve implementation. This was an interesting finding, given that the school and district placed a strong emphasis on Professional Learning Communities. Although some of the teachers referenced their collaboration with the Professional Learning Community when I asked if they ever worked with others in their use of BYOD, they reported that the topic of BYOD sometimes comes up in these meetings, but it is not a regular topic. I conclude, however, that the lack of ongoing collaboration about BYOD in these meetings was not due to a lack of interest, but because of the various Levels of Use that are likely within a Professional Learning Community.

The Level III teachers, when sharing their use of student-owned devices, shared mechanical issues, such as how they dealt with off task behavior. They often tried to convince non-user teachers to "give it a try." Level IVA teachers shared lessons with other BYOD teachers that were successful in terms of student learning, and Level IVB teachers, in addition to sharing with colleagues, shared their successes with groups outside of the school. Because the ongoing collaboration within their departments focused on myriad topics, and because there were various Levels of Use and non-use within each department, collaboration at Level V: Integration might not be possible

without interventions, administrative leadership, and mandates from administration (Hall & Hord, 2011) to create a collaboration group specific to BYOD.

How Did Teachers Participate in Voluntary Professional Development for BYOD and M-Learning?

Every LoU interview concludes with the teacher reporting their own status with regards to implementing an innovation. For this study, the question I asked was "Can you summarize for me where you see yourself right now in relation to the use of BYOD m-learning?" The overwhelming response was for teachers to report that they are not where they should be, including the highest level teachers. Many of the teachers also reported that although they are not implementing BYOD as much as they would like to, they could do more if someone could show them, or if they could attend professional development for BYOD. In addition, many of the teachers expressed an interest in more training, either from the ITTLC or from any other workshops that are available to them. These were the teachers I selected for a second interview, to determine if they sought out professional development, and if so, if the training increased Level of Use. Because this study did not test whether a particular treatment was effective for BYOD teachers, I waited to see if they would seek out professional development on their own.

The second interview for the 15 teachers was 2 months after the first interview. In that span of time, only two of the teachers sought training from a school district Instructional Technology Teaching and Learning Coach. One of these teachers encouraged others in her department to also work with this coach, but the other

department members in this study did not. The other teacher who sought training from the coach did not implement a BYOD lesson by the second interview.

Four of the teachers attended a seminar outside of the school district that focused on digital-age learning, but was not specific to BYOD. Of these, one teacher moved from Level I to Level III. He was the only non-user teacher I observed, because in the first interview he was so adamant about his desire to do more with student-owned devices.

Given the emphasis that the school district placed on BYOD, and the responses of the 15 teachers I chose for a second interview expressing a desire to learn more about BYOD implementation, I expected more of the teachers to take advantage of the professional development opportunities. An explanation for why the majority of teachers did not participate in voluntary professional development is that there was not enough time between the first and second interview; the two months might not have contained enough opportunities for professional development. In addition, the school's winter recess fell during the span between the interviews; the teachers might have felt too busy with their other teacher duties at the end of one semester and the beginning of another to attend a voluntary training, and might simply have felt the need for respite from work-related activities. Although they might have been well-intentioned in stating that they want more training, the reality of their responsibilities at this time of year might have prevented them from attending trainings. If the second interview were later in the school year, more teachers might have attended voluntary professional development. For the teacher who did move to a user-level, the professional development might have had an effect on his implementation. It is possible then that voluntary training can therefore

have an effect on BYOD implementation, but only to the degree that teachers opt to attend this training.

Was There a Difference in Levels of Use Between Early Career and Veteran Teachers? (+/– 6 Years Teaching)

In designing this study, it was my hope to have both early career and veteran teachers represented in the population, however only one early career teacher participated. One of the other (Level III) teachers also reported that BYOD implementation increased when she began working with a younger student teacher, but these two examples alone were not enough to determine how early career teachers implemented BYOD at this school.

Likewise, the veteran teachers at this school provided mixed results. Other studies into instructional technology implementation and age are likewise in disagreement. Oncu et al. (2008) reported that experienced teachers are more likely to adopt new technologies to make their jobs easier, while Metzler et al. (2008) found that novice teachers are more willing to incorporate new technology, but bow to veteran teachers who resist it. The findings of this study are more in line with those of Russell et al. (2003), who found that early career teachers do not necessarily use more technology than veterans, and that barriers to implementation decrease as technology use increases. Of the three veteran teachers, one was a Level 0, and admitted that she did not have a good deal of knowledge of what mobile devices can do, and although she said it is because she is so old, she also admitted that she does not own a computer or mobile device on which she can practice. Another (Level III) veteran teacher also admitted a

lack of knowledge due to a lack of exposure and experience to technology in his personal life, and although he was making the attempt at integration, he stated that he is close to retirement and might try to incorporate it more if he were younger in his career. Like the other two veteran teachers, the Level IVA veteran had over 40 years teaching experience, but he had integrated new technology the whole time. His comfort level with BYOD was not related to his age, but his exposure to and experience with technology. In addition, this teacher continually through his career had a focus on student-centered learning rather than teacher-centered; his comfort was not because of his age, but rather his commitment to learner-centered instruction. BYOD lessons are better suited for a student-centered classroom.

Although this study is lacking in a large number of early career and veteran teachers, from the data I collected I can conclude that experience with technology in a teacher's personal and professional lives is a stronger indicator of technology integration that their age or teaching experience. It is not accurate to conclude that a veteran or late-career teacher cannot be successful with BYOD, and likewise for an early career teacher. Age and teaching experience are not the key concepts for understanding BYOD usage for this population; commitment and type of pedagogy embraced by the teachers are more important variables to consider than age or experience.

What Barriers to Successful Implementation Did Teachers At This School Report?

Teachers reported three main barriers to successful implementation: time, access/equity, and student behavior. Although the teachers were clear about these barriers, it is unclear whether these are actual barriers, or perceived barriers.

Time. Teachers at every level reported time as a barrier to implementation. Non-user teachers reported that they do not have time for innovation orientation. Level III teachers did not have enough time to acquire more knowledge about BYOD or redesign their lessons so that devices are for primary use instead of enhancing current lessons, and Level IVA and Level IVB teachers reported that they did not have time for training, although this was not a main (reported) barrier to implementation. This is not a surprising finding, as time is often cited as a culprit for one's actions or lack thereof. Educators often report that they are increasingly asked to do more with fewer resources, and although technology is intended to make lives easier, teachers reported that they do not have time to learn how to integrate it. One of the Level III teachers admitted that this is an excuse, but whether this is real or perceived, teachers used it as a reason to remain at their current Level of Use. However, teachers also allocate time where they find value; the more value they find in an innovation, the more time they will devote to learning more about it. This would account for Level IV teachers not reporting time as main barrier to implementation, while non-use teachers dismissed the innovation because they do not have time to learn about it; the more accurate statement is that they did not see enough value in the innovation of BYOD to allocate the resource of time to learning more about it.

Access and equity. Although equity and student access to MCDs is certainly an important issue tied to BYOD, it was only a barrier based on the decisions that teachers made and their knowledge of m-learning; it is a barrier that can be overcome in a BYOD classroom. The most common method to overcome this barrier was using a pair-share

method of MCD use in which students were not required to have a device of their own, but instead they needed one for the group. While this method does not fix the overlying equity issue, or the SES status of the students, it does provide students who do not own personal devices exposure to new technologies. It is critical that the teacher handle this pairing in a manner that does not demean students without devices, but instead takes it as an opportunity for students to collaborate on a common task. In addition, this technique could place a strain on the students who do own their own devices, by frequently asking them to share their devices with others, as well as privilege them by allowing them to use their devices when others cannot. Sharing their device could expose their device to damage by another student, and just as not having a device can stigmatize a student, being one of the only students with a device could likewise label a student.

It was commonly reported by these participants that not all of their students own personal devices. While this is most certainly true, observation data revealed that more students were using devices in classes where teachers designed lessons with specific BYOD activities; there were more devices in use by students in rooms where the students were required to use them. In other words, teachers who did not advocate that their students use mobile technology on a daily basis were not likely to see the full spectrum of device ownership, and as a result misconstrued the usage of MCDs in the classroom. For example, in classes where the teacher was frequently asking students to take out their devices for a specific engaging task, I witnessed high student ownership and use. In classes where the teacher never made reference to the devices at all, I observed very little student use. This does not mean that the students in one room own more devices than the

students in the other room. If students do not have a reason to bring their device to class, they might not bring it, and the teacher can perceive this as a lack of student ownership. In addition, a teacher's knowledge of MCD capabilities is relevant to this discussion. Teachers often reported that not all of their students have smart phones, to which I asked how many students have another wireless device, such as an iPod. That number of students is higher, but teachers did not always see these devices as having the same capabilities as other devices.

Without a survey of actual MCD ownership by students at this school, I cannot determine to what degree access to mobile devices or issues of equity affected the degree of implementation of the BYOD program. However, based on responses to interview questions and observed classroom activities, student MCD use was higher in classes where teachers direct students to complete a specific task with an MCD as a secondary or primary resource. As Rogers (2000) found in his study, barriers decrease as technology use increases. Teachers who reported MCD access as a weakness without providing the students opportunities to use their devices cannot know the reality of MCD ownership; their students might possess devices that they do not bring to school because they do not have an academic reason to bring the device. In addition, as other studies have shown, if teachers believe that equity is an issue for their students, they might be less likely to plan BYOD activities. Access and equity of device ownership is a barrier based on the degree to which a teacher challenges students to learn using devices, and provides them with methods to work around lack of ownership, such as pairing and sharing. This is a barrier that can therefore be overcome based on decisions that teachers make.

To tie in with the role of schools in the 21st century, if schools believe that it is their responsibility to prepare their students to live, work, and study in the 21st century, they must prepare their students to use mobile technology. Schools have their own equity issues that prevent them from purchasing the newest equipment, but allowing students to bring their own devices ensures that new equipment will be available. In addition, the students who would not otherwise receive training and practice at home with mobile devices will learn these valuable skills. So while issues of SES and access to technology cannot be ignored, a BYOD program can actually help students with equity issues have exposure to new technology. This is dependent, however, on the teacher using BYOD as a solution to equity issues, and not viewing equity as a barrier.

Student behavior. Perhaps the most common concern about students using mobile devices in the classroom was off-task behavior. Like other findings in this study, reports of off-task behavior as a major barrier decreased with higher teacher Level of Use. A teacher's opinion and attitude toward appropriate behavior determined how much it was a barrier. In the often reported example of texting during class, teachers had different opinions. Before MCDs were allowed in classrooms, students passed notes to each other; texting did not invent off-task behavior. While some teachers believed that a student looking at their device in class, whether the reason is to read a text message or to check the time, is an example of the off-task behavior that BYOD allows, other teachers felt that looking at a text message is a part of life in the 21st century. A student who is engaged in an activity and disengages to read and reply to a text message, and then reengages in the class was viewed differently by teachers. Is this off-task behavior or

indicative of life in the 21st century? Several teachers in this study said that students can and should learn how to manage their device, and remain engaged in the lesson.

Teachers who see potential off-task behavior as an insurmountable barrier to taking advantage of student-owned devices will have a difficult time implementing a successful BYOD program. There will be initial discomfort for many teachers at seeing students using devices that were previously banned from classrooms. If they cannot get past the idea of students using their devices in class because of the potential for off-task behavior, it will be very difficult for teaches to embrace BYOD. For this study, a teacher's opinion and attitude about appropriate behavior with MCDs determined the degree to which off-task behavior was a barrier to successful BYOD implementation. These opinions were aligned to Level of Use, in that Mechanical teachers saw potential, but were still concerned about behavior. Teacher concern about student behavior decreased as Level of Use increased; non-user teachers often cited misuse as the first weakness of the BYOD innovation. Off-task behavior was a barrier to successful implementation therefore only to the extent that teachers allowed it to be a barrier.

Principles of Change: An Extension of Levels of Use

Although the Level of Use interview was an accurate tool for determining the levels of teachers in this study, it is not a tool that anyone can use. Hall and Hord's (2011) principles of change, on the other hand, are present in various forms throughout this population, and can be used to design BYOD programs. The 10 principles of change are:

1. Change is Learning
2. Change is a Process, Not and Event
3. The School is the Primary Unit for Change
4. Organizations Adopt Change – Individuals Implement Change
5. Interventions are Key to the Success of the Change Process
6. Appropriate Interventions Reduce Resistance to Change
7. Administrator Leadership is Essential to Long-term Change Success
8. Facilitating Change is a Team Effort
9. Mandates Can Work
10. The Context Influences the Process of Learning and Change

    (pp. 6-15).

As Anderson (1997) found, one of the strongest of the ten principles is "Change is a process, not an event." The other principles all tie into this one. While this school was labeled as a school that has implemented a BYOD program, that is by no means an indication that BYOD lessons were occurring with fidelity. Teachers at this school were in the process of change, and as individuals they were all at different stages. This aligns well with Rogers (2003) Innovation Diffusion Theory, and the s-curve of change adoption; these teachers were all at different points on the curve. Understanding that change has not occurred because an event such as adopting BYOD occurred is what allows the other principles, such as interventions, mandates, and administrator leadership, to ensure that the change process is ongoing. Ceasing effort to continue the change process is what stifles innovation.

Another of the principles that is of importance to this study is that, although the school and district adopted this change, it was the individual teachers who implemented it. This also ties in to the other principles, because the other principles are focused on helping the teachers implement the change. Administrator leadership, interventions, team collaboration, and mandates all aim at facilitating change by individuals. Without a culture and context of ongoing attention to change by administrators and teachers, what will drive change? Kitchenham (2009) found that culture affects the readiness for technology adoption, and this is evident both in these ten principles and this population. As stated earlier, one of the most interesting findings of this study is that every teacher, regardless of Level of Use, was allowing students to use their devices in class. This is evidence of a culture of change and commitment to teaching and learning at this school, and this frames the context for this population. For any new innovation program, a school leader could use the ten principles of change to analyze the adoption and implementation of change. In the following paragraphs, I will discuss some of the principles in relation to this study.

Change is Learning

Teachers in this study are learning; what they are learning is dependent on their Level of Use. Non-Use teachers, for example, were still learning what the BYOD innovation is, and what it is not. They displayed a lack of knowledge of BYOD potential; what academic uses are possible by students; for example, Teacher 23 responded that calculators can do just as much in her class as MCDs. This is a lack of knowledge about MCD potential. User-level teachers were also learning. Mechanical Use teachers were

learning how to manage student devices in their classrooms, for example Teacher 12's commitment to creating new management strategies such as "take out, put away" showed that she is learning new ways to get around mechanical issues in her lessons. Routine and Refinement teachers were learning how students can be successful using mobile devices, and how they can improves student success, for example Teacher 14 learning how to leverage student-owned devices for discussion-based assessments, and Teacher 7 always looking for new apps to enhance student performance in resistance training. Students are learning in this process as well; they are learning to harness the device that they might already have in their backpacks, and how to use them for more than texting and off-task behavior. Teacher 3's students demonstrated the power of their devices in their hero campaign, by harnessing the social media aspect of their MCDs to raise thousands of votes for a worthy cause. In the process of implementing BYOD for this population, the teachers and students were discovering how to teach and learn in new ways.

Change is a Process, Not an Event

When this school began encouraging teachers to incorporate student-owned MCDs into instruction two years prior to this study, there was not an event that resulted in automatic implementation. The process of changing teaching and learning with student-owned devices was different for each of the teachers in this study; otherwise they might all be at the same Level of Use. Each of the teachers dealt with the change in his or her own way, depending on the barriers they reported, and the value they placed on m-learning. For example, Teacher 4 reported that she was constantly trying to deal with this change with her students to overcome barriers, by involving the students in creating

policies and discussing appropriate use frequently with them, as did Teacher 18. One of the strengths, he saw, was in getting students exposure to technology that they might not otherwise get to use. Teachers who placed more value on m-learning, and teachers who had more experience with technology in and out of the classroom, advanced through the levels of use more quickly than others, for example Teachers 5 and 6, who both had experience with technology in their personal or professional lives, both advanced quickly and comfortably to Levels IVA and IVB, respectively. On the other hand, Teacher 25 had very little exposure to technology outside of her classroom, and therefore found it more difficult to begin the change process. When a school decides to implement a new program such as BYOD, they are beginning a process of change, but it is not an event that solidifies the innovation. Change is a process that occurs over time.

The School is the Primary Unit for Change

Students are the driving factor in a BYOD program (Norris & Soloway, 2011); teachers in this study reported that student enthusiasm for using their devices affeceds their decisions in BYOD implementation. Teacher 11, for example, discussed how mobile phones are embedded in the psyche of the students, that they walked into his room ready to use them for learning. Teacher 8 likewise expressed that her students are noticeably more engaged and enthused when they are participating in a BYOD lesson, and this encouraged her to do more. However, without teachers and school leaders designing and implementing lessons that empower students to use their devices for specific academic purposes, some students use their devices for off-task behavior. Teacher 13 admitted that his students are much farther ahead than he is with using

MCDs, but it inspires him to try and catch up to them. Teachers such as Teacher 12 reported that students are very skilled at using their devices, but not necessarily for academic uses, which was one of her main motivations in implementing BYOD; to give her students the necessary tools to use their devices productively in the 21st century. Finally, Teacher 10 stated that students will ultimately use their devices for academic purposes, if teachers give them the power to do so. Without the school driving the change, students will continue to use their phones as social and gaming tools.

Organizations Adopt Change – Individuals Implement Change

For this population, both the school and district adopted the change to BYOD teaching and learning. However, it was the individual teachers who implemented BYOD in their classrooms, and that implementation looked different in every room. Teachers shared similar characteristics based on their Level of Use, but they were still individuals working at implementation. For example, Teachers 6 and 7 were both Level IVB teachers, and thus shared many similar characteristics in their implementation, but their classrooms were very dissimilar; Teacher 6's honors-level math courses did not look the same as Teacher 7's resistance training courses. They are individual teachers, and they both implemented BYOD in different ways to suite their students' needs. Although the teachers in this population shared information about BYOD with other teachers, they did not work collaboratively at this school to implement BYOD; it was an individual effort for them.

Facilitating Change is a Team Effort

As mentioned earlier in this chapter, there were no teachers in this study participating in ongoing collaboration specific to BYOD. The result is that there are no teachers in the study above Level IVB: Refinement. However, teachers and students did work in collaboration, if not ongoing and sustained. Teachers 1 and 6, for example, were in the same department, and discussed BYOD among other topics regularly. While this did not fit the CBAM definition of collaboration, they did put forth a team effort in BYOD implementation, as did Teachers 4 and 12, also departmental colleagues. Teachers 9 and 13, while not in the same department, both sought out coaching from the ITTLC. Teachers 15 and 28 both teamed with other teachers at the school to provide special education services to students, and while they were not user-level teachers themselves, some of the teachers with whom they teamed for instruction were. None of these teachers worked in isolation on BYOD implementation. Although they did not participate in regular collaboration specific to BYOD, the teachers in this study did put forth a team effort to share BYOD ideas and strategies.

The Context Influences the Process of Learning and Change

The context of this study is a high-performing school in a high SES neighborhood with a strong focus on academics. Although teachers at every Level of Use reported that not all of their students had their own MCDs to use in class, the SES of the student body as a whole suggested that device ownership was high. I observed this in classes where students were empowered to use their devices; all but a few students produced their own devices to use. Although access to devices is a barrier that can be overcome by teachers,

the process of implementing BYOD for this population is different than for populations whose context is different. In addition to the school, the context for this study is also teaching and learning in the 21st century. As Cuban (1993, 2001) illustrated, the context of the classroom has changed over time from teacher-centered to student-centered, and schools have sought to integrate technology into instruction. And while many technology initiatives over time have not been successful, in the 21st century learning context where students walk through the door every day with their own devices, as Teacher 11 described, the presence and ubiquity of the devices at this school influenced the change process.

Recommendations

Recommendations for Practice

Professional and trade journals present best practices for BYOD programs frequently, and research literature presents findings on numerous studies about m-learning and technology integration. However, the results of this study provide several specific recommendations that school and district leaders should follow to create a successful BYOD program in their learning environments.

First, administrative leadership and vision are key to implementing this type of innovation. Teachers, students, and parents on their own may not initially see value in m-learning with student-owned devices, and strong administrative leadership in establishing the teaching and learning vision and setting policies and practices will lay the groundwork for successful implementation. School leadership, as part of creating a shared vision, should provide up-front and ongoing professional development

opportunities, on site, for teachers that provide best practices for all levels of teacher, that address the barriers that the teachers in this study reported, as well as in helping them to create subject-specific lesson plans that engage the students in meaningful ways with their devices; the goal is to help the teachers create lessons that are designed around mobile devices for high level critical thinking, not supplementing or enhancing existing lessons. These professional development opportunities need to be ongoing, and not a single event at the beginning of program implementation. In addition, this ongoing professional development should include sponsoring teachers to attend seminars and training outside of the district, to allow teachers to collaborate with educators on a larger scale. In placing emphasis on professional development and training for teachers, school and district leaders should also allow teachers to prioritize their time to attend these trainings.

Ancillary to professional development, school leaders should provide teachers with exposure to MCDs for their own personal practice and professional use. The teachers in this study who used mobile devices in their personal and professional lives had more perceived ease of use of MCDs, were more comfortable with using the devices in class, and had better knowledge of the capabilities of the devices. A greater exposure to mobile technologies will help build teacher knowledge, comfort, and willingness to incorporate them for teaching and learning.

In addition to ongoing training, school leaders should facilitate collaboration among teachers. This collaboration should involve teachers at different Levels of Use, and could be accomplished as a professional learning community that is specific to

BYOD. Within this collaboration, administration should encourage the sharing of lessons and best practices between teachers. The teachers in this study often did not seek out collaboration, and for some this meant that their progress was stifled. By providing teachers the time and wherewithal to collaborate, administrators can help ensure that this innovation keeps momentum, and that the BYOD strategy becomes a part of the school culture instead of a novelty program that scattered teachers on the campus are implementing. When students and parents see that the school is collectively and actively participating in implementing this new strategy, they will place more value on using student-owned devices for learning. In turn, teachers should feed off of the enthusiasm of students; as students become engaged in their own learning with MCDs, teachers should take advantage of this enthusiasm and create new, dynamic lessons that keep the enthusiasm among the students. This enthusiasm can be shared between teachers as they discuss best practices and success stories when they create lesson plans in their BYOD professional learning communities.

Finally, issues of equity and access to MCDs should not be ignored by school leaders. This population was able to overcome issues of equity and access because many of the students did possess their own device to bring. In addition, in classes where students saw value in using their devices, observed device ownership and use was higher than in rooms where emphasis on m-learning was not strong. Some of the teachers at this school were able to use BYOD to help students who do not have access to their own device by having them pair and share with other students, and give them access to mobile technology to which they might not otherwise be exposed. However, before school

leaders can try to replicate this result, they should take a survey of their student and parent population to determine what the reality of MCD ownership is, to determine if enough students possess devices to make a pair and share model viable. They should also be cautious not to marginalize a group of students because they do or do not possess an MCD, or strain those who do own devices by forcing them to share with other students every day, or in turn privileging these students by giving them access that other students do not. In addition, leaders should look at their funding sources and, if possible, purchase mobile devices to be used in class to fill in the gaps for students without access.

Beyond the school level, district leadership needs to review their technology policies for students and teachers, and update them to ensure that they include policies for mobile devices. An infrastructure needs to be in place to support use of student devices, including a high speed Wi-Fi network for student use that can not only support the number of devices, but can also support them within federal guidelines for student safety. The professional development for teachers should be provided and supported at the district level, to ensure that the culture of m-learning is shared at the different campuses. A successful BYOD program might be a systemic change for many schools and districts, and school or district administrators should not enter this program without the necessary preparations recommended in this section.

Recommendations for Future Research

BYOD is still a new topic, both in practice and research literature. While this study provided valuable data and findings about BYOD implementation at this particular school, it also provides a starting point for future research studies. The CBAM Levels of

Use interview proved to be a successful research framework for studying this population. Future BYOD researchers should consider framing their studies with this tool, as well as the full complement of CBAM tools including Innovation Configuration Mapping as well as the Stages of Concern Questionnaire. The questionnaire was not included in this study because I wanted to focus on the implementation instead of concerns. However, the barriers to success were a strong theme within the interviews, and future studies should include the Stages of Concern Questionnaire as a quantitative tool. In conducting the Levels of Use interview, researchers should provide more time in between the first and second interview. While the second interviews in this study provided a great deal of valuable information, the short interval between interviews did not allow enough time for the teachers to attend professional development or make changes to their implementation. As a longer, longitudinal study, researchers could look at factors such as professional development at a greater depth than this study. Finally with regards to framing research with the Concerns Based Adoption Model, researchers should use the Innovation Configuration Map prior to interviews operationalize BYOD prior to interviews.

In order to gain a wider view of BYOD implementation, researchers could expand the study to include more teachers in a population to include teachers at all levels, including Level V and Level VI, which were missing from this study, as well as seeking input from students and parents to create a case study. While teachers in this study reported student and parent feedback, and student response to BYOD could be observed, interviewing students could provide a different perspective on this issue, which could help contextualize the teacher responses. As a part of the inclusion of students and

parents, researchers should survey the student population to determine device ownership. An interesting result of this study was observing a difference in the presence or absence of devices in rooms where teachers did or did not have a strong emphasis on m-learning. In addition, given that many of the teachers in this study reported access and equity as a barrier to implementation, the data of actual student ownership in a population will serve useful to future studies.

Looking beyond studies about BYOD implementation, new research questions arise from this study. Future researchers into BYOD m-learning might seek to answer these questions. First, as so many teachers described time as a barrier to successful implementation, future researchers could question how teachers devote and allocate time to professional development for technology integration. This study can be integrated with a CBAM study or completed independently; how teachers responded about time in this study matched their Level of Use, but researchers can go beyond the LoU interview to determine how and why teachers allocate their time for their own learning, to discover if they really do not have time for technology professional development, or if they do not value it enough to make time for it.

Many teachers in this study reported on student behaviors, attitudes, and skills with mobile technology. However, input from actual students was lacking, unless students discussed BYOD with their teacher during an observation. As a result, this study was very useful in providing the teacher perspective on BYOD m-learning, but future research studies could instead focus on the student perspective. How do students feel about m-learning, and is this affected by the emphasis that their teachers place upon

it? Including input from students will provide another chapter to the discussion and research into BYOD programs.

Implications for Practice

Ownership of mobile communication devices continues to rise. As more and more students begin using devices for aspects of their personal lives, their importance at school will grow. Teaching and learning in the 21st century cannot look the same as it did in the 20th century; rows of students facing forward for teacher-centered instruction do not take advantage of the anytime, anywhere access to information and collaboration that is available to students and teachers, nor does it teach students in the way that they want to learn. BYOD m-learning is a step in the transition to student-centered learning, and as such is one of the most important implications of this study: a shift in teaching and learning.

Teachers and schools who hold on to traditional instruction, where m-learning is not allowed, could soon find themselves as an anachronism in the world of education. Despite how the role of schools has changed over time, one responsibility of schools is to prepare students through student-centered teaching and learning to live and work in society, and in the 21st century this includes mobile devices. While m-learning should not replace other skills, traditional lesson plans should be redesigned to integrate all of the new tools that m-learning affords. However, this is not financially possible for all schools; school equipment is often outdated compared to the devices that students already possess. This is the reason behind BYOD m-learning; taking advantage of the devices that students already own. In addition, redesigning lesson plans is a time commitment for

the teachers, because they need to acquire new skills themselves before they can apply them to new lessons. Because this is such a new strategy however, many schools and teachers struggle with how to best implement this major change to teaching and learning, and how to find the time and energy for professional development and training to implement new strategies. The findings and results of this study can help practitioners throughout the process of making this change.

Implications for Leadership

As school and district leaders make decisions about teaching and learning, they should be looking for information about new teaching and learning strategies. The school in this study has been at the forefront of BYOD. The fact that, three years after initial implementation, not every teacher at this school is even at the user-level, illustrates that change is a process, and one that cannot be left to occur on its own. Within the microcosm of this school, the individual teachers at the various Levels of Use provide insight into the idiosyncrasies of BYOD implementation. Their successes, struggles, and reports provide researchers with the necessary tools to scribe a roadmap for BYOD implementation.

The BYOD program at this school is encouraged but voluntary; therefore no mandates regarding the change to BYOD were in place. However, some teachers, such as Teachers 6 and 11, could foresee that BYOD might be in the future of education for all students, and expressed a desire to stay ahead of mandates; to learn this teaching and learning strategy now and become comfortable with it before it becomes a mandate. And while implementation of BYOD was not mandated at this school, during their change

process the mandate of phone confiscation did change. By the school district mandating that phones were not to be confiscated, teachers were then empowered to begin the integration process. In addition, mandating that teachers and students read, sign, and follow acceptable use policies for BYOD use in the classroom can help teachers get beyond the barrier of off-task behavior.

Although every teacher and every school is unique, the Levels of Use profiles described in this study provide accurate representations and predictions how others teachers might be categorized when implementing a BYOD program. This study, therefore, is important to the field of education because it provides a unique look into a school that has implemented a BYOD program. As long as personally-owned mobile communication devices are affordable and available to students for learning and collaborating, schools will need to embrace the BYOD concept. The findings contained herein will help schools implement this innovation.

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APPENDIX A

INNOVATION CONFIGURATION MAP

Innovation Configuration Map: M-Learning with BYOD			
A	B	C	D
BYOD lesson design			
Designs lessons in which MCDs are a primary/critical component	Designs lessons in which MCDs are secondary and supplemental to other class materials	Designs lessons in which MCDs are optional but not required	Designs lessons which do not utilize MCDs
BYOD lesson frequency			
Teacher implements BYOD lessons on a daily basis	Teacher implements BYOD lessons more than once per week	Teacher implements BYOD lessons more than once per unit	Teacher experiments with BYOD lessons when convenient
Collaboration			
Collaborates with other teachers to create BYOD lessons that improve student learning	Collaborates with other teachers to create BYOD lessons that incorporate MCDs	Collaborates with other teachers about management and logistical issues with MCDs	Discusses resources needed to implement BYOD lessons
Knowledge of BYOD			
Knows how student-owned MCDs can improve student outcomes	Knows short and long-term requirements for a BYOD program	Understands day-to-day requirements for a BYOD program	Understands general information about BYOD programs
Student MCD ownership			
Student owns an MCD and uses it in school daily to improve learning	Student owns an MCD and uses it occasionally in school to improve learning	Student owns an MCD but brings it to school only when directed by a teacher, or is prohibited by parents from bringing it to school	Student does not own an MCD, but shares MCD use with another student at school
Student MCD use			
Students use their MCDs for project-based learning/share results of work	Students use their MCDs for collaboration with peers and teacher(s)	Students use their MCDs for research or gathering evidence	Students use their MCDs for productivity or low-level critical thinking

APPENDIX B

INFORMATION LETTER — INTERVIEWS

BYOD Implementation

September 23, 2012

Dear Teacher:

I am a graduate student under the direction of Professor Arnold Danzig in the Mary Lou Fulton Teachers College at Arizona State University. I am conducting a research study to analyze the degree of implementation of a mobile-learning program that utilizes student-owned mobile communication devices.

I am inviting your participation, which will involve two interviews and one observation. The interviews are scripted, and will last between five and 60 minutes. The first interview will take place in September, the second in January. The observation will be for one class period in the first semester. You do not need to currently be implementing mobile-learning in your classes in order to participate in this study. You have the right not to answer any question, and to stop the interview at any time.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty; your participation will not have any bearing on your evaluation, and your evaluator will not see the results of interviews or observation.

There is a lack of empirical research in the area of mobile-learning using student-owned devices. Your participation in this study will benefit not only your school and school district, but also the field of education by providing school and district leaders with new knowledge about the implementation of m-learning BYOT programs. There are no foreseeable risks or discomforts to your participation.

Your responses will be anonymous; you will never be identified by name to anyone. The results of this study may be used in reports, presentations, or publications but your name will not ever be used. Interview and observation data will be coded to protect your identity.

I would like to audiotape this interview. The interview will not be recorded without your permission. Please let me know if you do <u>not</u> want the interview to be taped; you also can change your mind after the interview starts, just let me know. The interviews will be recorded digitally, and stored on my iPad, and my iCloud account until the conclusion of this study.

If you have any questions concerning the research study, please contact me by email at kross1975@gmail.com. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU

Office of Research Integrity and Assurance, at (480) 965-6788. Please let me know if you wish to be part of the study.

Thank you for your consideration,

Kyle Ross

APPENDIX C

LEVEL OF USE INTERVIEW

Are you currently using BYOD m-learning?

If Yes:

Please describe for me how you use student-owned MCDs for BYOD m-learning

What do you see as the strengths and weaknesses of BYOD in your situation?

Have you made any attempt to do anything about these weaknesses?

Are you currently looking for any information about BYOD m-learning?

What kind, for what purpose?

Do you ever talk with others about your use of BYOD? What do you tell them? If I were to eavesdrop, what would I hear you say?

Have you considered alternatives or different ways of doing things with student-owned MCDs?

Are you doing any evaluating, either formally or informally, that would affect your use of BYOD?

Have you ever received any feedback from your students or parents that would affect the way you're using BYOD? What have you done with the information you got?

Have you made any changes recently in how you use BYOD m-learning? What? Why? How recently? Are you considering making any changes?

As you look ahead to later this year, what plans do you have in relation to your use of BYOD?

Are you considering or planning to make major modifications or replace BYOD m-learning at this time?

Can you summarize where you see yourself right now in relation to the use of student-owned MCDs and BYOD m-learning?

If No

Can you describe BYOD m-learning as you understand it?

Are you currently looking for any information about BYOD or m-learning? What kinds? For what purpose?

What do you see as the strengths and weaknesses of BYOD in your situation?

At this point in time what kinds of questions are you asking about BYOD or m-learning?

Do you ever talk with others and share information about BYOD m-learning? What do you share?

What are you planning with respect to BYOD m-learning? Can you tell me about any preparation or plans you have been making for the use of BYOD m-learning?

Can you summarize where you see yourself right now in relation to the use of student-owned MCDs and BYOD m-learning?

LoU V Probes

Do you work with others in your use of BYOD? Do you meet on a regular basis? Have you made any changes in your use of BYOD based on this coordination?

Please describe for me how you work with together. What things do you share with each other?

What do you see as the effects of this collaboration?

Are you looking for any particular kind of information in relation to this collaboration?

Do you talk with others about this collaboration? If so, what do you share with them?

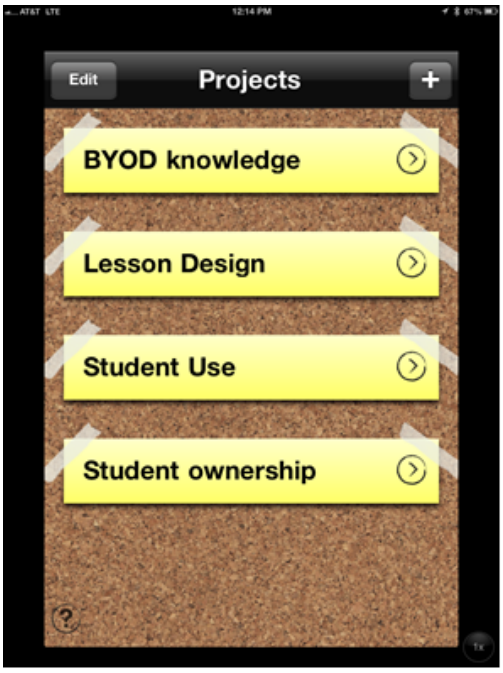
Have you done any formal or informal evaluation of how your collaboration is working?

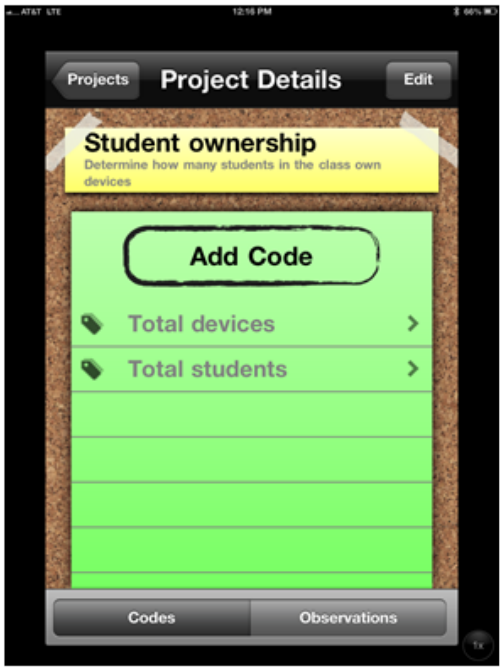
What plans do you have for this effort in the future?

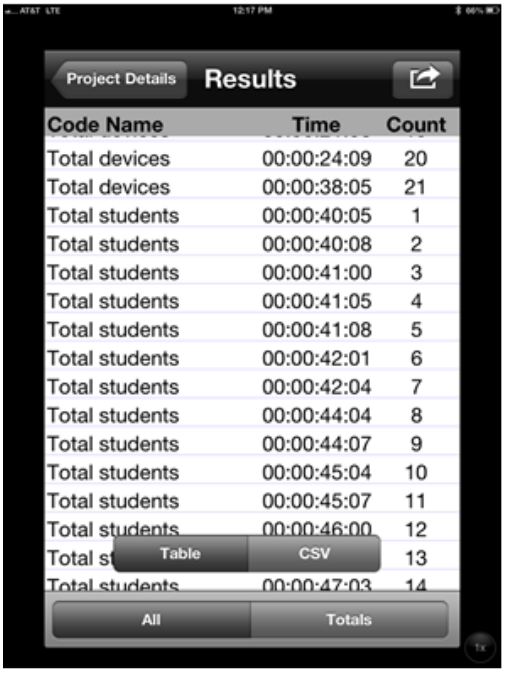
Can you summarize where you see yourself right now in relation to the use of student-owned MCDs and BYOD m-learning?

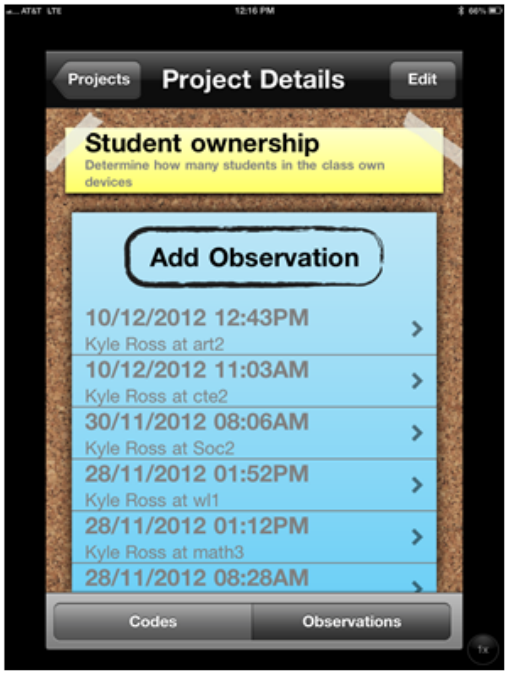
APPENDIX D

OBSERVE iPAD APP


Edit
Projects
+
BYOD knowledge
Lesson Design
Student Use
Student ownership


Projects
Project Details
Edit
Student ownership
Determine how many students in the class own devices
Add Code
Total devices
Total students
Codes
Observations


Project Details
Results
Code Name
Time
Count
Total devices 00:00:24:09 20
Total devices 00:00:38:05 21
Total students 00:00:40:05 1
Total students 00:00:40:08 2
Total students 00:00:41:00 3
Total students 00:00:41:05 4
Total students 00:00:41:08 5
Total students 00:00:42:01 6
Total students 00:00:42:04 7
Total students 00:00:44:04 8
Total students 00:00:44:07 9
Total students 00:00:45:04 10
Total students 00:00:45:07 11
Total students 00:00:46:00 12
Table
CSV
13
14
All
Totals


Projects
Project Details
Edit
Student ownership
Determine how many students in the class own devices
Add Observation
10/12/2012 12:43PM
Kyle Ross at art2
10/12/2012 11:03AM
Kyle Ross at cte2
30/11/2012 08:06AM
Kyle Ross at Soc2
28/11/2012 01:52PM
Kyle Ross at wl1
28/11/2012 01:12PM
Kyle Ross at math3
28/11/2012 08:28AM
Codes
Observations

APPENDIX E

IRB EXEMPTION LETTER

ASU Knowledge Enterprise Development

Office of Research Integrity and Assurance

To:	Arnold Danzig College of
From:	Mark Roosa, Chair Soc Beh IRB
Date:	09/26/2012
Committee Action:	**Exemption Granted**
IRB Action Date:	09/26/2012
IRB Protocol #:	1209008300
Study Title:	BYOD m-learning implementation at a secondary school

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(1) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.