Summer 2015

An Examination of Factors That Influence Teacher Adoption of Bring Your Own Device in the Classroom

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AN EXAMINATION OF FACTORS THAT INFLUENCE TEACHER ADOPTION OF BRING YOUR OWN DEVICE IN THE CLASSROOM

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A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

PUBLIC ADMINISTRATION AND URBAN POLICY

OLD DOMINION UNIVERSITY
August 2015

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ABSTRACT

AN EXAMINATION OF FACTORS THAT INFLUENCE TEACHER ADOPTION OF BRING YOUR OWN DEVICE IN THE CLASSROOM

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The purpose of this research is to examine if and how Bring Your Own Device (BYOD) is implemented in secondary public schools by focusing on teacher adoption of BYOD in the classroom. Given the newness of BYOD, there is little research on how school districts have implemented this policy or why and how teachers have adopted the practice in their classroom. Using both Innovation Diffusion Theory (IDT) and the Technology Acceptance Model (TAM), this research investigated several key elements that could influence teacher adoption of BYOD: teacher characteristics, school culture, and professional development. The population for this mixed method study was teachers in three middle schools and three high schools located in a large suburban school district in Virginia. The mixed method study was divided into two parts: focus groups and web survey. Selecting schools for both parts of the study was based on three variables: student ethnicity, percentage of the student body considered economically disadvantaged, and teacher experience. Data collected from the focus groups was used to create the web survey.

The results from this study revealed that five predictor variables were statistically significant concerning teacher adoption of BYOD in middle and high schools: perceived usefulness of BYOD, school culture, professional development,

the secondary school level middle or high school, and the type of school program whether a traditional program at a zoned school or a specialized program such as an academy. The strongest predictor of the five variables was perceived usefulness. Findings from this study will contribute to policy makers understanding of which factors influence a teacher's decision to adopt or reject an innovation (such as BYOD) and may influence development and implementation of policies regarding such innovations.

This dissertation is dedicated to my parents, Elaine and Harvey Lloyd, who instilled in me at a very early age the importance of both a good education and a strong work ethic. Everything I have achieved has been a direct result of their sacrifice, encouragement, and support.

ACKNOWLEDGEMENTS

Completing this Ph.D. program and earning a postgraduate degree has been both challenging and rewarding. Looking back, I realize how my success from working through the coursework to completing my dissertation was truly a collective effort. In the following paragraphs, I would like to thank just a few of the many people who were instrumental in helping me achieve success in this program.

I would first like to thank the members of my dissertation committee, Dr. Wie Yusuf, Dr. William Leavitt, and Dr. Jennifer Kidd, for giving their time, support, and confidence in helping me complete this dissertation. I want to especially thank Dr. Wie Yusuf, who worked tirelessly reading and critiquing countless drafts. Your attention to detail, your confidence in me, and your ability to point me in the right direction was crucial in the completion of this work. I also want to thank Dr. William Leavitt and Dr. Jennifer Kidd for being part of my dissertation team and always giving me great feedback and support.

I would like to thank the many professors in the department, both in the past and present, from whom I have learned a great deal over the past eight years: Dr. John Morris, Dr. John Lombard, Dr. Berhanu Mengistu, and Dr. Mohamad Alkadry.

I would like to thank two of my classmates and really good friends in this program: Dr. Getachew Melkie and Dr. Sawsan Abutabenjeh. Dr. Melkie, I really value the many discussions that we had through the years concerning the readings and topics in public administration and policy. Working together helped me gain a deeper understanding of the material, challenged me to think more critically, and gave me the confidence to move forward. Dr. Abutabenjeh, I also appreciate your

encouragement and support as we prepared for class discussions, the comprehensive exams, and prospectus and dissertation defenses.

I would like to also thank a few of the people I have worked with over the years. Mr. Joe Burnsworth, thank you for your help and guidance at each stage of my research, especially during data collection. Dr. Violet Hoyle, Mr. Fred Rebmann, Ms. Toni Case, and Ms. Beth Wydra, thank you for helping me prepare for my oral defenses, for helping me stay focused, and for always cheering me on.

Finally, I would like to thank Ms. Suzanne Forehand. Over the years you have always been patient, supportive, and encouraging of me from my first graduate class to the completed dissertation. I cannot thank you enough for taking the time to proofread and provide feedback on my papers and for the kindness that you have always shown me.

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CHAPTER 1

INTRODUCTION

Introduction and Background

This dissertation is a case study involving middle schools and high schools located in a single school district located in Virginia. The school district has a diverse population with a student enrollment of more than 60,000. Thirty-six percent of the student population is identified as economically disadvantaged. The average years of teaching experience is 14.7 years and 53.3 percent of the teachers hold a graduate degree. Students in this district have the option of attending a high school with a traditional curriculum or applying to an academy and advanced academic program. The school district serves a population with a median household income of $65,219, and 7.9 percent of the population are living below the poverty level (U.S. Census Bureau, 2013). This school district was one of the first districts to implement Bring Your Own Device (BYOD) in the region (Hajasz, 2012). The purpose of the dissertation will investigate how teachers are using BYOD and why teachers have adopted the practice in their classroom.

In an age where the public demands more accountability from every level of government and the public sector is experiencing shrinking budgets, school districts must find cost-effective ways to raise student performance by using fewer dollars. The focus of education also has shifted towards providing students with 21st century knowledge and skills such as problem solving, critical thinking, communication, collaboration, and decision-making. Information technology is one area school

districts have invested in to target these skills and transform the way that the material is delivered. Bring Your Own Device (BYOD) is a school district policy that allows students to use their own mobile devices in the classroom for educational purposes. With the increased access to mobile technology, students using their own device on a school network may be an effective and cost-saving way of integrating technology into the classroom without the school having to purchase any additional hardware and software. Mobile technology, such as laptops, phones, and tablets, offers a way to make learning more interactive. One of the challenges for policymakers and school administrators is to encourage teachers to utilize BYOD in their classrooms.

For this study, Bring Your Own Device policy is defined as a school district policy that allows students to use their own mobile devices in the classroom for educational purposes. A mobile device is defined as any student-owned device that can be used to access the Internet. This includes, but is not limited to, laptop computers, tablets, smart phones, and MP3 devices such as an iPod.

Technology is currently transforming the traditional classroom setting to one where the teacher is the facilitator and the students complete more problem-based activities, an approach known as constructivism. Using the technology helps motivate students by keeping them engaged in the learning process (Enriquez, 2010; Morrison & Lowther, 2010; Roschelle, Pea, Hoadley, Gordin, & Means, 2000). This is especially important when teaching a "...generation [who] are defined by its use of technology" (Walling, 2012, p. 42). If a teacher teaches from a constructivist

perspective, then "...computers become one of many tools students can use to concretize concepts" (Wenglinsky, 2005, p. 8).

One-to-one computing is one initiative to engage and motivate students where every student receives a computer and Internet access to use in school (Penuel, 2006). One-to-one computing is when a school provides every student "...with a computer to use in the classroom or the school" (Hew & Brush, 2007, p. 245). One-to-one computing allows for greater incorporation of technology as a tool for student learning. However, when schools provide the devices, this is an expensive option that many school districts have not been able to implement (Raths, 2012). Since schools have limited resources to provide information technology, student-owned devices can become a valuable resource. BYOD policies may help schools achieve this one-to-one computing ratio since the students can use the devices that they own.

One concern with BYOD programs is that not all students possess a personal device, and the policy may contribute to the digital divide. The digital divide "...refers to inequalities in children's access to computers because of factors such as income, race, and parent education," and is increased if the teachers are not ready to use computers for educational purposes (Chen & Price, 2006, p. 398). If teachers are unwilling to use technology, then students do not gain the benefits from using the technology. The digital divide has been shrinking as a result of cheaper hardware and access plans (Peng, Su, Chou, & Tsai, 2009). Even though earlier studies did not always examine socioeconomic backgrounds, one concern is that students from lower socioeconomic backgrounds may not own a personal device.

Although research shows that the higher the family income, the more likely the child is to own a device, the disparity between the income levels is shrinking. Students from lower socioeconomic backgrounds are more likely to access the Internet on phones than computers (Kent & Facer, 2004; Thomas, S., Heinrich, Kuhnlein, & Radon, 2010). They are also using mobile phones more and use them more than students from a higher socioeconomic background, probably because they do not have computers at home (Thomas, S. et al., 2010).

Project Tomorrow, a nonprofit education organization that conducts research on technology in K-12 schools, is one group that has been researching trends and issues involving technology for the past ten years. In Fall 2012, the organization surveyed 364,240 students from 2,400 urban, suburban, and rural school districts located across the country. Their findings support the argument that the majority of students surveyed had a personal smartphone, tablet, or laptop. Students also had greater access to personal devices than devices provided to them by schools (Table 1.1).

Table 1.1: *Students' Access to Personal and School Provided Mobile Devices*

	Grade 3	**Grade 6**	**Grade 9**	**Grade 12**
Personal smartphone	41%	59%	75%	82%
Personal tablet	44%	53%	48%	40%
Personal laptop	61%	68%	69%	73%
School provided smartphone	8%	6%	5%	3%
School provided tablet	16%	18%	14%	17%
School provided laptop	27%	30%	27%	29%

Source: (Project Tomorrow, 2013, p. 4)

Another finding from this study is that students use technology to work on their school assignments (Table 1.2).

Table 1.2: *Students' Use of Emerging Technologies to Self-Direct and Support Schoolwork*

	Grade 6	**Grade 9**	**Grade 12**
Texting with classmates about assignments	39%	65%	67%
Using Facebook to collaborate with classmates on a school project	19%	35%	40%
Taking photos of school assignments of materials using my mobile device	11%	28%	35%
Watch a video I find online to help with homework	29%	30%	33%
Using Twitter to communicate or to follow others	7%	29%	25%
Communicate with classmates using a webcam, Skype or online chat	20%	29%	26%
Using a mobile app to keep schoolwork organized	15%	24%	25%
Texting with my teacher	7%	11%	20%

Source: (Project Tomorrow, 2013, p. 8)

More than 90% of the high school and middle school students surveyed were aware of their school's policies on using personal devices. These students envision using these devices in school to "...lookup information on the Internet whenever they need to (73 percent), record lectures of labs so that they can review them later (69 percent), receive alerts about school assignments (63 percent), and collaborate with peers (61 percent)" (Project Tomorrow, 2013, p. 10).

The Pew Research Center, a nonpartisan think tank that conducts research on public issues, found similar results in a study that they conducted on digital

technologies in the classroom. In 2013, the Pew Research Center surveyed 2,462 Advanced Placement and National Writing Project teachers from urban, suburban and rural schools. Seventy-three percent of these teachers responded that "....they and/or their students use their mobile phones as a learning device in the classroom or to complete assignments" (Purcell, Heaps, Buchanan, & Friedrich, 2013, p. 34). The also use these devices to communicate with other students and look up grades. This survey also discovered that rural students were less likely than urban students to use cell phones in school because of the school policy.

In another survey conducted in 2012 by the Pew Research Center, reported that 78% of middle and high school students ages 12-17 had a cell phone (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013). Seventy-four percent of these students access the Internet on a cell phone or tablet. Older students, ages 14-17, were more likely to own a cell phone (83%) than younger students ages 12-13 (68%). Even though household income does make a difference in whether or not a child owns a cell phone, 69% of students who come from households with incomes less than $30,000 a year own a cell phone compared to 86% of students living in households earning more than $75,000 a year (Madden et al., 2013).

With the increase in the number of students who own their own device, and the ways students use their devices for academic purposes, school districts are now considering how to use BYOD within their schools and classrooms. Most school districts already have some of the infrastructure necessary to support BYOD as a result of funding from the federal, state, and local governments. The federal government has subsidized information technology in K-12 education since the mid-

1990s through a number of grant programs. These programs have helped build wired and wireless computer networks, made the Internet accessible to all schools, and provided teachers with professional development in information technology.

In addition to federal funding, many state and local governments also have contributed a percentage of their annual budgets to information technology. In 2012, Virginia spent 36.4% of its annual budget on public education and 41.5% of the educational budget went towards K-12 public education (Virginia Department of Planning and Budget, 2012). Part of this budget goes towards technology which includes both information technology (hardware and software) and professional development in the use of the technology.

Local school boards are the main source of information technology funding, and the percentage of the budget that they devote varies widely. Like many state governments, when school boards spend money on technology, they spend it in two areas: information technology (hardware and software) and professional development. The professional development can include mandatory or voluntary training. While school districts can offer this training to everyone in the district, schools can offer additional training to their teachers, so training in technology can vary between schools as well as between school districts.

To fully implement BYOD, school districts need to upgrade their wireless technology within each school building and provide more money towards professional development (Raths, 2012). School districts are at different stages of implementation of BYOD. Some school districts are investing in mobile technologies to distribute to students through a one-to-one program. Fewer school districts are

banning the use of personal devices within their school buildings and many are now implementing the use of devices in a voluntary way (Schaffhauser, 2014). The problem with voluntary policies is they are inconsistently implemented and are "...not easily tracked or measured" (Francis, Abramsohn, & Park, 2010, p. i16).

The school districts that have implemented BYOD have different policies in place giving students different levels of permissions (Foulger et al., 2013). The school district being researched for this study is in the early stages of implementation of BYOD. When the school board in school district X adopted the BYOD policy in the summer of 2012, they left the implementation to the discretion of each classroom teacher. The only requirement for teachers is that the devices are used "...to enhance the students' educational experience and outcomes" (School district X). School district X's policy consists of 14 guidelines covering appropriate student use, prohibited use of personal devices within the school, consequences of violating the BYOD policy, and disclaimers which are displayed on the school district's website (Appendix B).

Appropriate use of a student-owned personal device includes connecting to the school district's Wi-Fi network and using the devices for educational purposes and with the approval of the classroom teacher. Prohibited use of personal devices specify that students are not permitted to do the following: load school-owned software to their devices; record video, voice or images without permission from the teacher; use the device in an illegal collection of data or to disrupt the network.

Also included in these guidelines are two disclaimers. The first disclaimer is that the school district is not responsible for devices that are lost, stolen or

damaged. School district employees are not allowed to troubleshoot student-owned devices. The second disclaimer is that the school district reserves the right to examine devices "...if there is reason to believe that school districts policies or local, state, and/or federal laws have been violated" (school district X).

Statement of the Problem

Since the availability of personal mobile devices has changed the way that the public accesses information, organizations are now creating policies addressing this new reality. Until recently, research in education that has concentrated on the adoption of technology in schools has focused on one-to-one computers (Donovan & Green, 2010; Lei & Zhao, 2007; Penuel, 2006), mobile phones (Campbell, 2006; Thomas, K. & O'Bannon, 2013) and the role of self-efficacy (Buchanan, Sainter, & Saunders, 2013; Kale & Goh, 2014; Salajan, Schönwetter, & Cleghorn, 2010).

Previous studies focusing on the barriers to personal device adoption have concentrated on the infrastructure of the organization and the compatibility of different device platforms. Now that stronger cellular networks and cloud-based systems are available, schools today must now decide the role that these devices will take place within their system (Patten & Harris, 2013). School officials, like leaders in the private sector, must balance the potential cost savings with challenges such as privacy and security. Understanding how teachers implement BYOD in the classroom along with understanding why they have adopted this policy may help school officials evaluate if this is a viable direction for the future.

Purpose of the Study

The purpose of this research is to examine if and how Bring Your Own Device (BYOD) is implemented in a school system by focusing on teacher adoption of BYOD in the classroom. Given the newness of BYOD, there is little research on this policy and the management issues involved. This study will add to the limited literature and will have practical implications for teacher practices, school management, and school district policy and management. The results of the study will help school districts understand the factors that explain or influence teacher adoption of BYOD and could have implications for addressing barriers and challenges to BYOD implementation.

Research Questions

This study investigates two research questions: (1) How are teachers currently implementing BYOD in middle and high school classrooms? (2) What factors influence teacher adoption of BYOD in middle and high school classrooms? In answering these research questions, the analysis will focus on several key factors identified by the Innovation Diffusion Theory and the Technology Acceptance Model, including professional development, school culture, perceived usefulness, teacher characteristics, and student access to portable devices.

Significance, Relevance, and Impact of the Study

Bring Your Own Device (BYOD) is a relatively new policy being implemented in many public school districts. There is currently very little research on how

school districts have implemented the policy or why teachers have adopted the policy in their classroom. Previous research on technology adoption has either investigated just one device such as cell phones or has investigated how technology has affected student performance on standardized assessments. This study should help policy makers understand the importance of professional development and collaboration when trying to implement a new policy direction. Contributions from this research could provide public administrators, school officials, and teachers with an understanding necessary to manage adoption of an innovation within a school setting.

This study could assist federal, state, and local governments to determine whether the BYOD policy is a useful alternative to the current way that technology is implemented in public schools. Since a portion of each level of governments' budget is designated towards K-12 education, effective implementation of BYOD policy could change how technology in schools is financed.

Organization of the Study

This dissertation is organized into five chapters. Chapter One includes an introduction and background of the study, statement of the problem, purpose of the study, research questions, and the significance of the study. Chapter Two provides a review of the literature relevant to Bring Your Own Device. Chapter Three discusses the qualitative and quantitative methodologies used in investigating the research questions. Chapter Four discusses the study's findings including the results from both the qualitative and quantitative portion of the study. Chapter Five

contains a discussion of the findings, and provides implications and recommendations for future research.

CHAPTER 2

LITERATURE REVIEW

Introduction

This chapter provides a review of the literature and gives a rationale for the study. The first section will discuss the two models that will be used for the theoretical framework: Innovation Diffusion Theory and Technology Acceptance Model. The chapter is then organized by the six key variables of the study: (a) faculty age and experience, (b) teacher beliefs about ease of use and usefulness, (c) teacher beliefs about privacy and security, (d) school culture, (e) professional development, and (f) school characteristics. My research questions will explore the factors that predict the use of Bring Your Own Devices in the classroom.

The integration of technology in the classroom has been researched through the years, but allowing students to use their own technology is a relatively new topic of research. Portable devices that can access the Internet are now ubiquitous in society and those devices have become part of everyones' daily lives. More mobile devices than personal computers were purchased in 2013 and it has become the number one way people access the Internet (Patten & Harris, 2013). Since technology is no longer restricted to a computer in the classroom, teachers must now decide if and how to incorporate this new technology into their classroom in a way that will have a positive effect on student learning.

The role of technology in the classroom has been studied in the United States since the 1980s. Studies such as the Apple Classroom of Tomorrow (ACOT)

discovered that as teachers began integrating computers into the classroom, their teaching styles eventually evolved into more collaborative, student-centered classroom environments (Dwyer, Ringstaff, & Sandholtz, 1990). Studies since the 1980s have primarily focused on the impact of technology on student performance. Most studies found that the use of technology either made a minimal difference or no difference at all on student performance (Bennett, F., 2002; Higgins, Beauchamp, & Miller, 2007; Kulik & Kulik, 1991).

One of the challenges that teachers face with "...21st century learners is not only what they learn, but also how and when they learn" (Looi et al., 2010, p. 155). Students use technology outside of the classroom in an informal way. They use mobile devices to play games, communicate with friends through text messages, and complete their homework assignments. Educators are now tasked with trying to find a way to bring the informal manner that students use technology at home to the formal learning environment at school (Kent & Facer, 2004). Teachers must plan lessons to incorporate these devices into their classrooms and change their teaching practice from one that is "...didactic teacher-centered to participatory student centered leaning" (Looi et al., 2010, p. 156).

Much of the funding from the 1990s and early 2000s created the infrastructure that supports the technology used today. School districts are trying to facilitate the move toward one-to-one computing and can do this by "...taking advantage of the technologies that students already [have] allowing schools to focus on instructional strategies and professional development" (UNESCO, 2012, p. 22). While few school districts are now completely restricting the use of BYOD, "Legal

liability and concern for student safety have led to extremely restrictive polices prohibiting mobile devices in many US and Canadian school districts" (UNESCO, 2012, p. 27).

Teachers Use of Technology in the Classroom

Availability of school technology resources is one of the challenges faced by teachers. Despite the decreasing cost of technology, school districts vary in the amount of technology available to them.

In many classrooms, the technology available to teachers has profoundly changed since the first ACOT studies in the early 1980s. Teachers are no longer restricted to having students use a few desktop computers in the classroom or taking their students to a computer lab. Today, in addition to desktop computers, teachers now have laptop computers, tablets, e-readers, document cameras, and interactive boards among other technologies. Teachers use these devices not only to cover new material but also to use these resources to remediate students.

The most recent study known as "Teachers' Use of Educational Technology in U.S. Public Schools" conducted by the National Center of Education Statistics found that teachers use technology in their classroom for presentations, desktop publishing, and spreadsheets. Those teachers allow their students to use technology mainly for multimedia presentations, research, and creating visual displays (Gray, Thomas, & Lewis, 2010).

BYOD Policy

BYOD policy in K-12 public schools varies between school districts and between schools. For the past few years, BYOD adoption has increased across the country with fewer school districts banning the student use of personal devices. In 2014, implementation of BYOD in school districts expanded from 22 percent the year before to 56 percent and occurs mainly in high schools and middle schools. (Schaffhauser, 2014).

Once school districts decide to allow BYOD in schools, the focus is on two items: instruction and infrastructure (Raths, 2012). Instruction targets the appropriate use policy for staff and students and the need to be trained (Gatewood, 2012). Through professional development programs, schools train their teachers on how to use mobile devices as well as on applications to use for instruction. Infrastructure focuses on what is needed to ensure that the school's network can handle all the devices.

Theoretical Frameworks and Models of Technology Adoption

There are a number of models that investigate technology adoption. The common elements in most models are individual characteristics (personal traits), innovation characteristics concerning the compatibility of the innovation, and contextual characteristics such as the environment (Straub, 2009).

One of the more popular theories that explains technology implementation in education is the Concerns Based Adoption Model (CBAM). Recently, CBAM has been applied to one-to-one computing (Donovan & Green, 2010; Donovan, Hartley, &

Strudler, 2007; Towndrow & Wan, 2012), using laptops in the classroom (Hosman & Cvetanoska, 2013; Newhouse, 2001), interactive whiteboards (Hall, J. S., Chamblee, & Slough, 2013), and web-based instruction (Hae-Deok, Wei-Tsong, & Chao-Yueh, 2011).

The Concerns Based Adoption Model (CBAM) is a conceptual framework that equips change facilitators, such as a school leader or policy maker, with the tools necessary to "...monitor the change process, [provide] diagnostic data to facilitate implementation, and [give] planning concepts to show where and how activities should advance" (Hall, J. S. & Hord, 1987). CBAM is made up of three parts or dimensions: Stages of Concern, Levels of Use, and Innovation Configuration. The focus of this framework is on the individual teacher, because understanding how change affects the individual will translate into successful or unsuccessful implementation. This theory is useful in giving administrators the tools to help facilitate change but not useful at explaining why adoption has occurred (Slough & Chamblee, 2007; Straub, 2009).

There are two other theoretical models that have been used in education that can be useful for explaining teacher adoption of technology such as BYOD: Innovation Diffusion Theory (IDT) and Technology Acceptance Model (TAM). IDT is a useful framework because it has been used to address why the adoption occurs (Hazen, Wu, Sankar, & Jones-Farmer, 2011; Vanderlinde & van Braak, 2011). Technology Acceptance Model (TAM) is a useful framework because has been helpful to identify factors that contribute to technology acceptance (Holden & Rada, 2011; Huntington & Worrell, 2013; Ma, Anderson, & Streith, 2005; Venkatesh,

Morris, Davis, & Davis, 2003). Even though each of these models address different areas of adoption, there are similarities between two of the factors in each of these models (Lee, Hsieh, & Hsu, 2011; Moore & Benbasat, 1991; Stols & Kriek, 2011). These two models will be combined into a comprehensive model to explain teacher adoption of BYOD. Key elements of both will be incorporated into the theoretical framework underpinning this research.

Innovation Diffusion Theory

Diffusion of Innovations is a theory that explains how "...an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p. 11). This concept has been applied in a number of disciplines and has provided the basis for several models since Everett Rogers published the first edition of his book titled *Diffusion of Innovations* in 1962 (Agarwal & Prasad, 1998). Innovation Diffusion Theory (IDT) is a useful framework for explaining why teachers adopt or do not adopt BYOD.

Rogers discusses four main elements by which an innovation is diffused over time: the innovation, communication channels, time, and the social system (Rogers, 2003).

The Innovation

Innovation Diffusion Theory describes five characteristics of the innovation that influence adoption: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). All five characteristics are based on each

individual's perception of the innovation. Relative advantage is the belief that the innovation is better than previous innovations. If the person believes the innovation is better, then adoption of the innovation will be faster. This is important in education because teachers have to be convinced that an innovation is better than what has traditionally been done in the past. Compatibility is the belief that the innovation is "...consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 2003, p. 15). An innovation that goes against these beliefs will not be adopted as quickly. Complexity is the "...degree to which an innovation is perceived as difficult to understand and use" (Rogers, 2003, p. 16). The more complicated the innovation, the slower the adoption rate. Trialability refers to the availability of an innovation to test. If the innovation is not available to be tested, then adoption rate will be slower. Teachers are more likely to adopt an innovation if they are able to try out and practice with it first (Abbott & Faris, 2000; Ertmer & Ottenbreit-Leftwich, 2010). Professional development sessions would provide an opportunity for teachers to try a new innovation or see it modeled. Observability refers to the innovation being used by others. Teachers are influenced by their peers, so if a teacher can see others implementing innovation, there is a greater chance that they will also adopt it. Teachers need to see that an innovation is successful (Mueller, Wood, Willoughby, Ross, & Specht, 2008).

Communication channels

Rogers argues that "...most individuals evaluate an innovation not on the basis of scientific research by experts but through the subjective evaluations of near

peers who have adopted the innovation" (Rogers, 2003, p. 36). When individuals listen to their peers, the innovation will increase in popularity. Professional development is a way for teachers to share information with other teachers and to plan together. These sessions are typically taught by other teachers and are attended by teachers with similar content areas. If trainers are favorably inclined towards an innovation, then teachers will be more likely to adopt the policy for their classroom.

Time

Time is needed to allow progression from when the innovation is proposed to the adoption or rejection of the innovation. The more teachers use an innovation, the more likely they are to adopt the innovation and use it on a regular basis. According to Rogers there are five adopter categories or "...classifications of members of a social system: 1. innovators, 2 early adopters, 3 early majority, 4 late majority, and 5 laggards" (Rogers, 2003, p. 37). Rogers groups these different types of individuals based on their willingness to adopt an innovation. Innovators are individuals who bring ideas from outside the organization and are not as concerned with uncertainty and setbacks as are individuals in other adopter categories. Early adopters are considered role models within the system. When they adopt an innovation, they share their experiences with others. To implement a policy successfully, it would be important for veteran teachers, curriculum leaders and department chairs to be the early adopters since they influence people around them. Early majority are individuals who take longer to adopt an innovation. Late

majority are individuals who adopt an innovation as a result of peer pressure. They are typically skeptical and cautious and do not adopt an innovation until it is adopted by almost everyone. Laggards are individuals who are slow to adopt because their decisions are based on what they have done in the past. Rogers (2003) also mentions that laggards are usually individuals who have previously tried the innovation once, but rejected the idea because they were dissatisfied with it. Since teachers have a tendency to resist change or are slow to adopt new strategies (Ertmer, 2005; Eteokleous, 2008), many teachers could be categorized as late majority or laggards.

Social system

As teachers start to plan with each other, support groups can develop. The "...social and communication structure of a system facilitates or impedes the diffusion of innovations in the system" (Rogers, 2003, p. 37). Within this social system are three roles: opinion leadership, change agent, and aide. Since teachers are part of a social system, how an innovation is adopted is based on the opinions of those within the group. A social system or culture of a school can sometimes be more influential than training (Roschelle et al., 2000). For successful implementation of an innovation it may be more important to encourage the group rather than the individual to adopt it.

Prior research using IDT

Previous studies that have used IDT as their framework have employed it in combination with other models to explain technology adoption. IDT provides a general foundation of understanding and has influenced many other theories (Straub, 2009). Lai (2011) used IDT to look at teacher adoption of teaching blogs. Considering the five characteristics along with nine other variables, the authors discovered that compatibility and perceived usefulness were two variables that were significant. In their study, unlike other studies, peer influence, self-efficacy, and reputation were not significant (Lai & Chen, 2011).

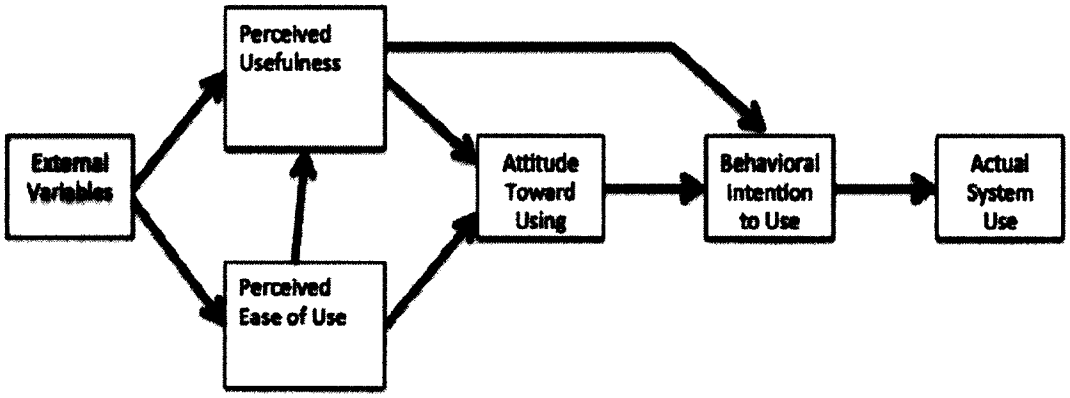
Foulger (2013) used IDT to find out if colleges were preparing teacher candidates to use mobile technologies in classrooms. They discovered that time was the biggest factor that was needed for the innovation to be accepted and spread to different schools. Other findings from the study were that many of the individuals who responded to the survey had not implemented or defined how they were going to incorporate mobile devices into their teacher programs (Foulger et al., 2013). Until teaching programs include how teachers can incorporate mobile devices in the classroom, adoption rates of personal devices in schools will be affected.

Technology Acceptance Model

Davis, Baggozi, and Warshaw (1989) developed a model known as the Technology Acceptance Model (TAM) to explain when a person would use technology (Figure 2.1). Two factors are at the core of their model: (1) perceived ease of use and (2) perceived usefulness. These two variables when combined help

explain user behavior.

Figure 2.1: Technology Acceptance Model



Source: Davis, Fred D., Bagozzi, Richard P., & Warshaw, Paul R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 985.

Davis, Baggozi, and Warshaw (1989) concluded that perceived usefulness and perceived ease of use are indicators of whether or not a person will use information technology, and that perceived usefulness directly predicted intention to use. Teachers must see the innovation as a way that will make it easier to do their jobs, increase their effectiveness, and improve their overall performance (Davis, Bagozzi, & Warshaw, 1989; Oncu, Delialioglu, & Brown, 2008; Venkatesh et al., 2003). Venkatesh, Morris, Davis, & Davis (2003) discovered that perceived usefulness is "...the strongest predictor of intention and remains significant at all points of measurement in both voluntary and mandatory settings" (p. 447). Both perceived usefulness and perceived ease of use may explain how and why some teachers adopt innovations such as BYOD.

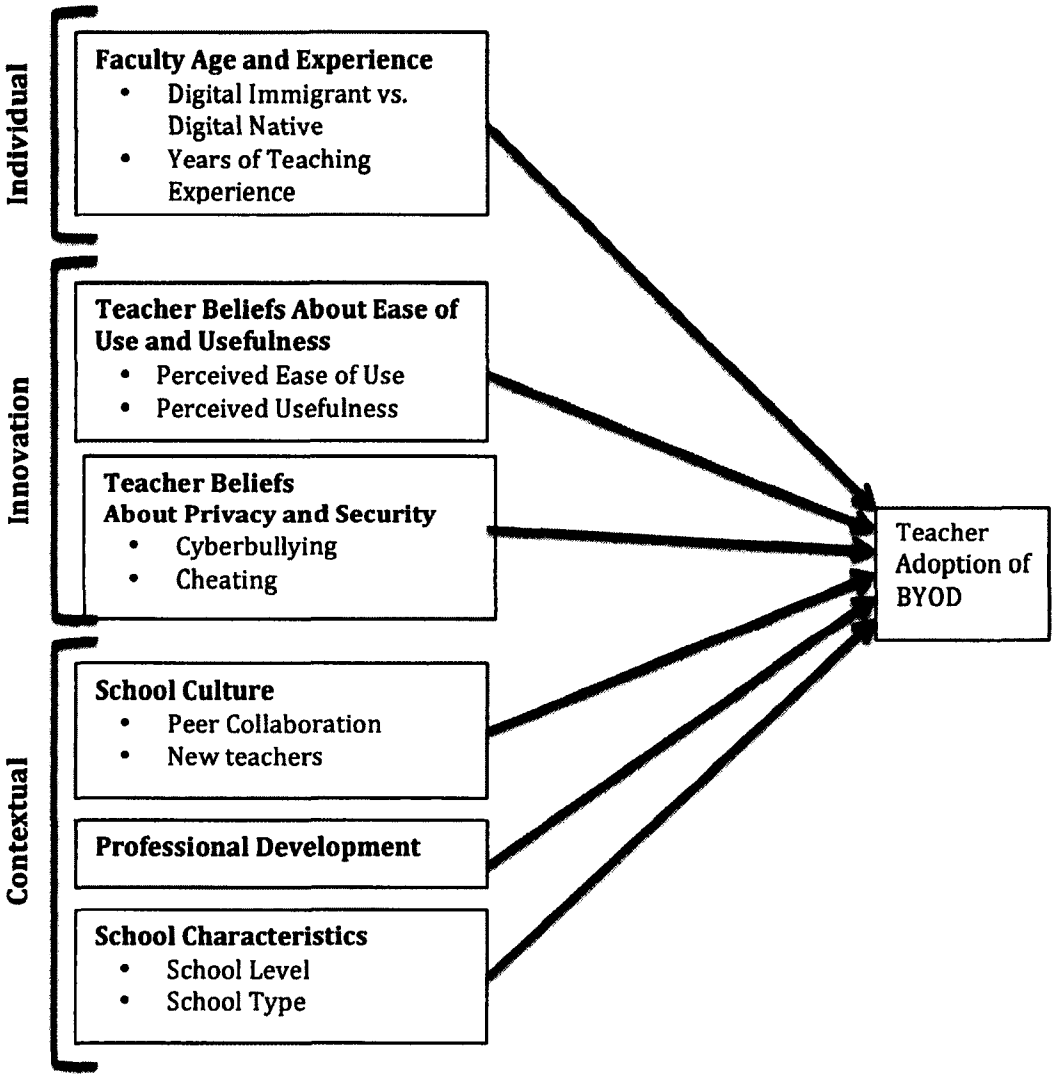
A Comprehensive Theoretical Framework: Key Elements of Teacher Adoption of BYOD

Straub (2009) argued that most adoption and diffusion theories share three categories: individual characteristics; innovation characteristics; and contextual characteristics. Individual characteristics are personal traits that influence a person to accept or reject an innovation (Straub, 2009). This could include a teacher's belief about how many of their students have access to a personal device or beliefs about integrating technology into their lessons. Innovation characteristics are "...specific to that innovation—how easy an innovation is to use, how the use of an innovation is compatible with the lifestyle of an individual" (Straub, 2009, p. 628). Teachers are more likely to adopt an innovation that they perceive would be useful in their classroom. Teachers must be convinced that an innovation will be a useful tool that can improve students' performance (Wozney, Venkatesh, & Abrami, 2006). Contextual characteristics are influences on an individual, such as the environment (Straub, 2009). Peer collaboration, school culture, the school subculture, and professional development would all be considered examples of contextual characteristics.

The Diffusion of Innovations Theory and the Technology Acceptance Model highlight several key elements that could influence teacher adoption of BYOD. These key elements form the conceptual framework for this study and include the following: faculty age and experience; teacher beliefs about ease of use and usefulness; teacher beliefs about privacy and security; school culture; professional development for teachers; and school characteristics. These six elements are

organized into three categories, as Straub described when comparing the similarities between diffusion and adoption theories, and are displayed in Figure 2.2.

Figure 2.2 Conceptual Framework



Faculty Age and Experience

Some literature identifies how different generations of teachers integrate technology differently in the classroom. Those born before 1980 are known as

digital immigrants while those born after 1980 are known as digital natives (Bennett, S., Maton, & Kervin, 2008; Prensky, 2001). Digital immigrants did not grow up with computers and had to adapt to them over the years. Digital natives always have lived in a world with computers and see the benefit of using them. Digital immigrants may be more reluctant to incorporate technology into the classroom because digital immigrants may not always see the value or treat technology with the same level of importance as digital natives (Prensky, 2001). This differing view about the role of technology in education may affect the how much technology is incorporated in the classroom. If technology is not used in schools, it may limit the opportunities of the learners who are accustomed to using computers to get information (Warschauer, 2007). Other research has found that "...less experienced technology users believe that technology is not convenient as it requires more preparation time" (Oncu et al., 2008, p. 38).

Other literature disputes these claims and argues that there are no differences in how different generations use and integrate technology in the classroom (Guo, Dobson, & Petrina, 2008; Mueller et al., 2008; Salajan et al., 2010; Tondeur, Valcke, & van Braak, 2008). Mueller (2008) hypothesized that younger teachers are more focused on classroom management and learning the curriculum and less on technology.

Teacher Beliefs About Ease of Use and Usefulness

Teachers tend to be slow to adopt new technologies (Ertmer, 2005; Hennessy, Ruthven, & Brindley, 2005; Herro, Kiger, & Owens, 2013). Teachers' use

of technology is influenced by their beliefs about their students and they will only implement policies they believe are useful (Windschitl & Sahl, 2002). If they do not perceive their students as having access to a BYOD device then they may not adopt it for their classroom (Hadjithoma-Garstka, 2011).

Teachers' perception about ease of use of an innovation is also important for adoption. Pew Internet (2013) found that 71% of teachers thought that managing mobile devices in their classrooms was an issue. The teachers defined an issue as a mobile device being a distraction for students in their classrooms. Another finding from this study was that teachers who taught students from low socioeconomic backgrounds were more likely than other teachers to say that managing these devices was an issue.

Self-efficacy also is important in forming a teacher's perception about an innovation. Self-efficacy is defined in social psychology and "...one's belief in his or her ability to execute a particular task" (Holden & Rada, 2011, p. 345). This belief "...plays an important role in shaping an individual's feelings and behaviors" (Compeau & Higgins, 1995, p. 203). Previous studies have discovered that self-efficacy was a significant predictor of whether or not an individual used a computer (Bao, Xiong, Hu, & Kibelloh, 2013; Gong, Xu, & Vu, 2004; Zayim, Yildirim, & Saka, 2006).

Changing teachers' views on whether they can successfully use an innovation can be influenced through positive experiences or from teachers within their department or school (Compeau & Higgins, 1995; Mueller et al., 2008). The more positive experiences they have, the more likely they are to implement a new

strategy or innovation in their classroom. If a person has a negative experience or is surrounded by individuals who hold negative views towards an idea or innovation, then the teacher's expectations will change (Sahin, 2008). The teacher must believe that he or she is capable of successfully implementing the technology.

In addition, the level of usage of technology in a teacher's classroom is important. The more teachers use technology, the more they see the benefit and the more they will incorporate technology into their classrooms (Miranda & Russell, 2012).

Teacher Beliefs About Privacy and Security

Since people are using mobile devices more than computers as a way to access the Internet, "...security of these mobile devices is a major concern for organizations" (Patten & Harris, 2013, p. 41). Securing computer networks from malware and hackers trying to access confidential information is a major concern for both businesses and schools.

BYOD is a new policy that goes against the traditional teaching practices in that students may have greater expertise using their educational tools than their teachers. According to Rogers, this is an issue of compatibility. Up to this point in time, students have typically used school-owned devices that are equipped with the same software. There is a degree of uncertainty with a BYOD policy. Students have different devices that are running different programs and teachers are not likely to be familiar with every software application. Concerns about academic honesty and

cyberbullying can also emerge. This uncertainty may lead teachers either not to adopt the policy or adopt it more slowly.

The literature on privacy and security when referring to Bring Your Own Device is very limited. Previous literature reflects the concerns of businesses that are now experimenting with BYOD in the work place. The largest concern for businesses is the issue of security if the device is lost or stolen. Businesses want the ability to remotely wipe the device (Drew, 2012; Gatewood, 2012; Semer, 2013).

Literature in education has primarily examined the educational impact of BYOD. Issues such as cheating have not been fully discussed in K-12 education literature. A few studies at the college level focus on cheating (Tindell & Bohlander, 2012). There has also been some discussion about students bypassing security in order to cheat in school (Sharples, Graber, Harrison, & Logan, 2009). Concerns about privacy and security may reduce the compatibility factor of BYOD referred to in the Innovation Diffusion Theory.

Cyberbullying has recently become more of a issue for students in K-12 education both in and out of school (Eden, Heiman, & Olenik-Shemesh, 2013). Some teachers and schools may avoid implementing BYOD in the classroom to avoid issues regarding cyberbullying. Teachers are more likely to deal with bullying if he or she believes that they can deal with the bullying (Boulton, Hardcastle, Down, Fowles, & Simmonds, 2014). One problem teachers and administrators face is determining where cyberbullying takes place, in school or out of school, since Internet access is mobile (Slonje & Smith, 2008).

A second problem is that research is limited on "...the relationship between age and involvement in cyberbullying, either as a bully or a victim" (Stauffer, Heath, Coyne, & Ferrin, 2012, p. 354). Some studies suggest that older students are more likely to be bullied online because they have more access to the Internet (Kowalski & Limber, 2007; Stauffer et al., 2012). This may deter middle and high school teachers from using BYOD in the classroom.

There is, however, a connection between the student's age and the teacher's attitudes towards a child involved in a cyberbullying incident. The older the child, the more the teacher may believe that the student can handle the situation (Eden et al., 2013). Teachers may also "... not see it as their responsibility to intervene in response to cyberbullying other than to report the incident to administrators" (Stauffer et al., 2012, p. 364).

School Culture

According to some of the literature, one of the strongest predictors of technology adoption is the school culture. Rogers (2003) found that "...most individuals evaluate an innovation not on the basis of scientific research by experts but through the subjective evaluations of near peers who have adopted the innovation" (p. 36). The culture of the school must be supportive of new technologies which are less likely to be adopted if they are too far from "...existing values, beliefs, and practices of the teachers and administration in the building" (Ertmer & Ottenbreit-Leftwich, 2010, p. 264). If teachers and administrators do not see the benefit of information technology, teachers will not use it. Three elements

that are influenced by school culture can predict technology adoption: leadership, peer collaboration, and new teachers.

When considering policy initiatives, "top-down initiatives that mandate [information technology] use have not succeeded in increasing IT use" (Miranda & Russell, 2012, p. 653). Leadership styles, however, do influence both organizational culture and implementation of policies (Hadjithoma-Garstka, 2011; Herro et al., 2013). In order for implementation to work, the leaders must be supportive (Hall, G. E., 2010).

Peer collaboration and mentoring can help teachers overcome barriers in using information technology in the classroom (Kanaya, Light, & Culp, 2005). Collaboration provides a support system so teachers can help each other during implementation. This formation of support groups can also help reduce resistance from teachers who do not see the benefit in using technology in the classroom. Teachers are more likely to adopt innovations because of social pressure rather than seeing the usefulness of the innovation (Frank, Zhao, & Borman, 2004; Zhao & Frank, 2003). This relationship among peers can either make the implementation of the innovation successful or unsuccessful (Frank et al., 2004; Li, 2010; Penuel, 2006; Rogers, 2003; Venkatesh et al., 2003).

In addition to the culture of the school, middle schools and high schools also have subcultures within each building. These subcultures are the departments that are grouped by subject areas. Teachers are greatly influenced by other teachers within their department and know more about their department than what is happening in the school as a whole (Firestone & Louis, 1999). Teachers within each

department are less likely to adopt an innovation that goes against the existing norms and beliefs of the department (Hennessy et al., 2005; Selwyn, 1999; Zhao & Frank, 2003).

Research indicates that teachers are especially influenced by their peers and school culture in their first few years (Ertmer & Ottenbreit-Leftwich, 2010; Griffin, 1985; Hazzan, 2002; Kelley, 2004; Wong, 2004). In addition to being heavily influenced by their peers, new teachers may be less likely to use technology than veteran teachers for other reasons. New teachers "...typically work in the least desirable schools, with the least desirable students, in the least desirable rooms, and in the least desirable teaching assignments" (Brown & Schainker, 2008, p. 14). They may not have access to resources in information technology and their students may not have access to personal devices. New teachers are often assigned to schools located in more urban and poverty stricken areas (Borman & Dowling, 2008). Schools in low socio-economic areas have high teacher turnover rates because teachers either quit or they are likely to "...use their seniority to transfer out of a challenging school" (Raudenbush, 2009, p. 175). As a result, new teachers in these schools have a lesser sense of community and are more dissatisfied. New teachers who work in these schools will probably be unlikely to adopt BYOD if others do not support it or they may believe that the students do not have access to the technology. Teachers who are new to the profession may be more vulnerable to the culture and subculture of the school. This might have an effect on whether or not they adopt BYOD.

Professional Development

Professional development is necessary to help teachers to understand the value of technology (Hew & Brush, 2007). Although providing both hardware and software is important, providing teachers with the software and hardware does not mean they will use it (Cuban, Kirkpatrick, & Peck, 2001; Glover, Miller, Averis, & Door, 2005). Information technology must also "...include improvements in teacher training, curriculum, student assessment, and a school's capacity to change" (Roschelle et al., 2000, p. 76). Policy makers and school officials dedicate resources toward ways in which teachers can learn how to use the equipment and how to implement the technology in the classroom. Rogers also found that "...most individuals evaluate an innovation not on the basis of scientific research by experts but through the subjective evaluations of near peers who have adopted the innovation" (Rogers, 2003, p. 36). Through use and individuals listening to their peers, the integration of technology will increase.

Like the federal government, many state governments provide funding for information technology and professional development without specifying areas. Since there are few technology requirements that come from the federal and state governments, local school districts must decide how much professional development is offered and required of teachers. Since few guidelines are in place, information technology training can vary, not only between school districts, but also between schools within those districts. As a consequence, training can affect how information technology is implemented in the classroom. According to research, if teachers do not receive adequate training in information technology, they will not

use it (Eteokleous, 2008; Vrasidas & McIsaac, 2001), and accordingly, students will not benefit.

Professional development can help teachers with both perceived usefulness and perceived ease of use. This will increase the likelihood that technology will be integrated into the curriculum. Teachers must have both the knowledge of the technology available to them and an understanding of the usefulness of how it can help in the classroom (Becker, 1994; Mueller et al., 2008; Wozney et al., 2006).

Professional development has been defined by policies such as No Child Left Behind as training that advances "...teacher understanding of effective instructional strategies" and is ongoing and not just a one-time effort (U.S. Department of Education, 2002). School districts often do not have trainers qualified in the integration of information technology (Burns, 2005). Additionally, many trainers are not qualified to teach teachers how to effectively implement technology in the classroom. If teachers do not see the value of information technology, they will not implement it (Wozney et al., 2006).

Professional development can be more successful when teachers are from the same department or school because the teachers can rely on one another. Peer collaboration and mentoring can help teachers overcome barriers in using information technology in the classroom (Kanaya et al., 2005; Levin & Wadmany, 2008). This type of collaboration provides a support system when teachers return to their schools and help each other during implementation. This support group can also help reduce any resistance from teachers who do not see the benefit in using technology in the classroom.

School Characteristics

The characteristics of a school are an important consideration when investigating technology use or adoption of technology. The first consideration is the level of the school. Secondary schools are typically divided into two levels, middle school covering grades 6-8 and high schools including grades 9-12. Older students ages 14-17 are more likely to own a cell phone, tablet or other mobile devices than students between the ages of 12-13 (Madden et al., 2013). Since older students may have access to a student-owned device, the teachers in the high schools may implement BYOD more than middle school teachers.

The second consideration is the socioeconomic status (SES) of the school. Socioeconomic status affects students' access to technology (Sun & Metros, 2011). This access includes the number of devices within the school, the way teachers use technology in their classroom, and the technology available to the student outside of school. Although problems with the availability of technology, both hardware and software, within schools has declined through a series of federal and state grants (Wenglinsky, 1998), the ways teachers use technology varies between high and low SES schools (Warschauer, Knobel, & Stone, 2004; Wenglinsky, 1998). One of the reasons for this difference is the teaching philosophy between high SES schools and low SES may differ. Teachers experience more professional development in higher SES schools (Song & Owens, 2011), and teachers in lower socioeconomic schools have more "...pressure to teach to assessments, a lack of resources among students, and a lack of technical support [to] incorporate more digital tools into their teaching" (Purcell et al., 2013).

Conclusions

Bring your Own Device (BYOD) is a new policy in education that can provide a number of benefits to both students and school districts. Discovering the factors that influence teachers to implement this policy in their classroom is the focus of this dissertation. Specifically it asks two questions: (1) How are teachers currently implementing BYOD in middle and high school classrooms? (2) What factors influence teacher adoption of BYOD in middle and high school classrooms? Faculty age and experience, teacher beliefs about ease of use and usefulness, privacy and security, school culture, and professional development are all important variables in answering these research questions.

CHAPTER 3

METHODOLOGY

Introduction

Chapter One of this dissertation provided an introduction and background related to the growing use of personal devices in schools and how access to such devices has affected school policy, specifically Bring Your Own Device (BYOD) policies. Chapter Two provided a literature review of two theoretical frameworks, Innovation Diffusion Theory (IDT) and the Technology Acceptance Model (TAM) that are used to guide this research. Chapter Two also identified and discussed six variables linked to the adoption of BYOD: teacher beliefs about ease of use and usefulness of an innovation, faculty age and experience, teacher beliefs about privacy and security, school culture, professional development, and school characteristics. This chapter is divided into six main sections: research design, population, instrumentation, potential errors and bias, data collection and analysis, and summary.

This chapter begins with a discussion of the research design and a description of the population being used for the study. The qualitative stage and quantitative stage of the study are discussed followed by the potential errors and biases. The chapter finishes with a discussion of the data collection.

Research Design

This study uses a mixed method research design to answer the two research questions: (1) How are teachers currently implementing BYOD in middle and high

school classrooms? (2) What factors influence teacher adoption of BYOD in middle and high school classrooms? Questions in social sciences are sometimes not adequately answered by using either the qualitative or quantitative approaches alone (Creswell, J. W., 2009, p. 203). This study uses the sequential exploratory strategy, which collects qualitative data in the first phase "...followed by a second phase of quantitative data collection and analysis that builds on the results of the first qualitative phase" (Creswell, J. W., 2009, p. 211). The first phase, the exploratory phase of the research, used focus groups to understand how BYOD is currently being implemented by teachers and why teachers chose to use or not use BYOD in their classroom. Issues that emerged from the focus group discussion that were not included in the literature were included in the survey instrument in the second phase. The second phase of the research examined these issues in more breadth using a web survey to identify how teachers used BYOD and what factors influenced adoption (Research Question Two).

The unit of analysis for this study was teachers and the research participants for the study were teachers. The research design for this study was approved by the participating school district's Department of Planning, Innovation, and Accountability, and by the Human Subjects Review Committee of the Darden College of Education at Old Dominion University (Approved Application Number 201401092). Participant responses remain completely anonymous and in reporting the research results schools are not identified. Complete IRB information can be obtained by contacting the author.

Population

The study was conducted at three high schools and three middle schools located in a large suburban school district in Virginia. The school district under study henceforth will be referred to as school district X. School district X has a diverse population with a student enrollment of more than 60,000.

This school district originally piloted the BYOD policy at six schools during the 2011-2012 school year. The school board officially approved the policy district-wide in June 2012 allowing students across the school district the option of using their personal devices during the school day. This school district was one of the first districts to implement this policy in the region (Hajasz, 2012). Implementation of BYOD in individual classrooms is optional and is left to the teacher's discretion.

For the first phase, one middle school and one high school were selected for the focus group because they were representative of the district across the three variables: student ethnicity, percentage of the student body considered economically disadvantaged, and average teacher experience. Both schools also contained an academy and an advanced academic program. The sampling frame for the focus groups was instructional personnel who work in the two schools selected for the focus groups. There were 87 instructional personnel at the selected middle school and 132 instructional personnel at the selected high school.

One middle and one high school, that are average in all three variables for the district and have academy programs, were selected. Selecting schools that are average in all three variables helped identify the practices and concerns for teachers at any school within the district. School B and School F are schools that are close to

average in all three variables for the district (Table 3.1). Both schools have an academy program.

Table 3.1
School Characteristics 2013-2014 School Year

	Teacher Information	Student Information				
School	Average Years of Teaching	Economically Disadvantaged	Identified as Gifted	African American	Caucasian	Hispanic
Middle School B	12.7	42.7	26.4	27.7	49.9	8.9
Middle School Average	14.9	36	19.3	24.1	52.5	8.9
High School F	12.7	33.2	12.3	32.7	39.6	9.6
High School Average	15.4	30.0	15.6	23.9	52.0	9.6

Source: school district X Report

School district X offers academic and career based specialized programs to middle and high school students. Each program is located within a middle or high school and has a different curriculum focus and educational philosophy. Any student from the district can apply for admission. Students are selected based on their academic performance, community service, and extra-curricular activities. Admission into these programs is selective; therefore, students chosen are more likely from higher socioeconomic backgrounds. There is a possibility that these students may have more access to technology or their teachers may use technology more in their classroom. The academy program has a different teaching method which includes a technology component, so it was necessary to include those teachers' views in order to create a more accurate measurement tool.

Three middle schools and three high schools were selected for second phase, the survey, based on the same three criteria as the focus groups: student ethnicity, percentage of the student body considered economically disadvantaged, and average teacher experience. One middle school and one high school with a high percentage of economically disadvantaged students and with teachers with the least amount teaching experience were selected. The second selection was a middle school and high school with the smallest number of economically disadvantaged students and teachers with the most experience. Selecting schools with the highest and smallest percentage of economically disadvantaged students would show if there was a difference in the teachers' perception of student ownership of devices and a difference in teacher implementation of BYOD. The third selection would be the middle and high school that participated in the focus groups to see if the faculty who completed the survey mirrored and validated the faculty responses from the focus groups. The data from the six schools was used to identify which factors influence teacher adoption and implementation of BYOD.

Table 3.2
Middle School Characteristics 2013-2014 School Year

	Teacher Information	**Student Information**				
Middle School	Average Years of Teaching	Economically Disadvantaged	Identified as Gifted	African American	Caucasian	Hispanic
Middle School A	12.7	70.7	7.4	59.8	20.9	9.4
Middle School B	12.7	42.7	26.4	27.7	49.9	8.9
Middle School C	14.7	11.7	15.9	4.8	79.2	6.8
Middle School Average	14.9	36.0	19.2	24.1	52.5	8.9

Source: school district X

Table 3.3
High School Characteristics 2013-2014 School Year

	Teacher Information	Student Information				
High School	Average Years of Teaching	Economically Disadvantaged	Identified as Gifted	African American	Caucasian	Hispanic
High School D	14.1	51.1	6.9	41.0	31.0	13.8
High School E	18.4	8.9	18.1	6.0	79.1	6.4
High School F	12.7	33.2	12.3	32.7	39.6	9.6
High School Average	15.4	30.0	15.6	23.9	52.0	9.6

Source: school district X

The sampling frame for the survey is instructional personnel who work in the six schools. There were a total of 250 instructional personnel at the three selected middle schools and a total of 357 instructional personnel at the three selected high schools. The total number of instructional personnel is 607. The survey was conducted using SurveyMonkey, an online web survey.

Research participants for this study were all teachers. Participants for the first part of the study, the focus groups, were recruited through a principal's newsletter that was distributed to the faculty weekly in their individual schools. Once the survey instrument was created using information from the focus groups, participants for the second part of the study, the survey, were recruited through a weekly principal's newsletter distributed in their schools.

Instrumentation

The first instrument used in this study was a semi-structured focus group. Focus group sessions were conducted at two different public schools, one middle school and one high school. The semi-structured approach allowed the researcher

the flexibility to investigate how teachers were using BYOD in their classroom. Eleven open-ended questions were created based on the literature review and were designed to allow all participants a chance to reflect on their views concerning BYOD. The questions that were asked during each focus group are as follows:

- To the best of your knowledge, what type of access do your students have to personal devices they could use under a BYOD policy? How do you determine your students' access?
- Describe how you are using BYOD in your classroom. How often do you use it?
- For those of you who have adopted the BYOD policy into your classroom, can you share why you decided to implement it? What, if any, benefits have you found?
- What are some obstacles to you using BYOD in your classroom?
- What are some of your concerns with using BYOD in the classroom?
- Has your view of BYOD changed since the policy was first implemented last year? If so, how? Why do you think that has occurred?
- Are there any other comments that you would like to add?

The second instrument used in this study was a 58 questions online survey consisting of two open-ended questions and 56 closed-ended questions. Given the newness of BYOD policy in public K-12 education, the researcher designed a survey (Appendix H) based on previous studies on technology, a review of the literature, and feedback from the focus groups. The researcher consulted members who worked in educational technology, both in education and in academia. Each group reviewed the survey instrument on the clarity of questions and relevance to the topic.

The survey consisted of three parts. The first part contained seven questions and collected demographic data on the teachers. The second part contained nine questions and collected information about the teacher's student

population. The third part consisted of 50 questions regarding professional development, collaboration, privacy and security, and how the teachers currently use BYOD in their classroom. A table explaining how each survey item relates to the topics is listed in Appendix I.

Once the survey was completed, the survey was pilot tested with doctoral students in public administration to check for questions that were unclear or ambiguous. Based on feedback from the pilot test, modifications were made to the survey instrument before sending it out. Members from the Department of Planning, Innovation and Accountability at school district X reviewed and approved the survey prior to contacting the individual schools.

A number of precautions were taken to ensure reliability and validity. For reliability, all respondents received the same questions, and the wording of each question was made clear (Fowler, 2009). After questions were created precautions were taken which included discussing the questions with the teachers, pilot testing the survey with teachers and doctoral students, and having the questions reviewed by the dissertation committee. Increasing the validity of the responses was done through ensuring that the respondents knew that their answers would remain anonymous, that the questions were those that questions that teachers would have the knowledge with which to answer them, and making sure the questions were worded so that the teachers could understand what was asked of them.

Potential Errors and Bias

During the qualitative portion of the study (Stage 1), one of the concerns was the researcher's relationship with the participants. Creswell (2007) warns about researchers who "...share personal experiences with participants in an interview setting [because it] minimizes the 'bracketing' that is essential to construct the meaning of the participants [and] reduces information shared by participants" (p. 142). To reduce this possibility, the researcher used bracketing in which he set aside his bias, personal views, and prejudgments. He also stressed to the participants the need to answer the questions to the best of their ability. An outside observer, a doctoral student, attended both focus groups to ensure that the same format was followed. The researcher and doctoral student met and coded each of the focus group sessions.

During the quantitative portion of the study, there are four types of errors that could occur with survey research: coverage error, sampling error, non-response error, and measurement error (Dillman, Smythe, & Christian, 2009). Although these errors cannot be eliminated completely, the research design attempted to minimize these errors.

Coverage Error

Coverage error is a type of bias that does not give all members of a population an equal chance of being selected for the survey. Coverage bias should be minimal in this study as all eligible teachers were notified about the focus groups and survey via a principal's newsletter that is sent electronically through email.

Email is the primary form of communication between the principal and the faculty. All faculty have access to email accounts and check their email frequently.

Sampling Error

Sampling error occurs when only part of the population is surveyed rather than using the entire population. In this study, a nonrandom or nonprobability sample is used, as specific schools were selected for inclusion in the sample to "...ensure that different subgroups of the population are included" (Johnson, 2010, p. 129). Although surveying more schools would decrease the sampling error and make the results more generalizable, one of the purposes of this research is to see if socioeconomic status is a main factor of teacher adoption. Using a purposive sample to select those schools should highlight the main trends for most schools.

Nonresponse Error

Nonresponse error occurs when potential participants do not respond to a survey. Response rate is always a concern in research. Several ways to increase the response rate is to contact the individuals a couple of times and offer a financial incentive (Fowler, 2009). To increase the response rate, the faculty were contacted a few times during the survey window. The first contact was through the principal's newsletter. A reminder was sent a week later and the final contact was right before the survey window closes. Participants were offered a financial incentive if they complete the survey. Individuals had a chance to enter a drawing where they will have a chance to win one of four gift cards.

Measurement Error

Measurement error can occur when the survey questions are poorly worded and do not measure what is intended. Measurement error was reduced by developing a survey questionnaire based on the results of the focus groups and by piloting the question on other doctoral students.

Researcher Bias

The researcher for this study has been an employee of the school district under study for 18 years. The researcher works at one of the schools that was solicited to participate in both the focus group and survey. As mentioned earlier, this school was selected because it had an average socioeconomic status (SES) in the school district and contains one of the two middle school academy programs in the district. As mentioned earlier in the chapter, the school district offers academic and career based specialized programs to middle and high school students. Each program is located within a middle or high school and has a different curriculum focus and educational philosophy.

The researcher's current position is a technology specialist, and one of the researcher's responsibilities is to provide professional development to school employees including training related to Bring Your Own Device. The researcher does not supervise any teachers and took measures to ensure that teachers answered the questions appropriately and honestly. The researcher also has a professional relationship with many teachers and school administrators as well as teachers throughout the district. Care was taken to ensure that participating

teachers were forthcoming and honest in their responses. However, because the researcher does not have supervisory influence over the teachers, it was not expected that teachers would feel pressured to participate or to respond in any specific way.

Anonymity

This study involved teachers participating in either a focus group or completing a survey based on their current classroom practices. As part of the conditions for receiving approval to conduct the research, the names of the participants, school, and school district participating in the study will not be published. The researcher will also strip any identifying information and if the source could still be identified, the content will not be used.

Data Collection and Analysis

Stage One: Qualitative

In Stage One of the study, two focus groups of teachers were conducted to explore how Bring Your Own Device (BYOD) is being implemented in their classrooms. Conducting a focus group helps refine questions, discover areas previously not considered and clarifies key terms for a survey (Fowler, 2009). This stage is important to develop the instrumentation for Stage Two.

First, school principals for the selected focus group sites were contacted. They were given an overview of the study and the rationale for the site being selected. A flyer was given to the principal to be included in their weekly

newsletter. A follow up email was also provided to the principals for dissemination. A sample solicitation e-mail is provided as Appendix D.

Participation in the focus group was completely voluntary. Focus group participants only needed to be teachers in the school. Teachers could choose either not to answer questions or withdraw from the focus group at any time. Responses of teachers were kept confidential and anonymous. Characteristics of participants were collected through a pre-focus group questionnaire (Appendix E).

The focus groups, conducted in May 2014, lasted approximately 45 minutes. The participating teachers were asked questions concerning how they have implemented the Bring Your Own Device policy in their classroom. The questions for the focus groups are included in Appendix F. A focus group facilitator and a note taker were present during both focus groups. Themes identified from focus group data helped develop the survey instrument that was used in stage two of the research.

In order to ensure that findings from the data collection were credible, several precautions were taken by the researcher. To reduce the possibility that participants may not answer questions because they know the researcher, participants were told at the start of each focus group about the importance of the study and to answer the questions to the best of their ability. Along with the researcher, another doctoral student was present during the focus group to take notes and to ensure that the procedures were followed at both locations.

The first focus group was conducted on May 14, 2014, at high school F and the second one took place on May 16, 2014, at middle school B. The researcher met

with the doctoral student who was taking notes 15 minutes prior to each focus group to discuss format and rules. The researcher followed the same format and asked the same 11 open ended questions for both focus groups. Once each group was formed the following was explained: a background to the study; the purpose of the focus group; and how the results from the focus group would be used to develop a survey instrument to be given to several schools across the school district. Teachers were then given some basic rules and guidelines that included how long the focus group would take, the possibility of a question or follow-up questions, the option to leave the focus group at any time, and how the information would remain anonymous.

Both focus group sessions were recorded using a digital recorder. After each session the file was immediately downloaded to the researcher's computer, and the researcher transcribed the session verbatim. Once the session was transcribed, the file was deleted from the digital recorder. All transcriptions were reviewed and coded by themes by the researcher. The researcher looked over the transcriptions and searched for dominant items or factors and added notes to the margins.

Once the focus groups were completed and the recordings were transcribed, the researcher met with the doctoral student who attended and took notes during both sessions. Both the researcher and the doctoral student discussed and analyzed the transcripts and notes to gain a better understanding of how teachers were using BYOD and their overall view of the policy. After reviewing the transcripts and notes, both the researcher and the doctoral student looked for the patterns and overarching themes that emerged from each session. Any items that were different

were discussed in detail and only themes that both the researcher and doctoral student agreed on were entered into the final codebook. Once the final codebook was created, the survey instrument (Stage 2) was adjusted to incorporate issues that had not previously been considered.

Stage Two: Quantitative

In Stage Two of the study, school principals for the selected survey sites were contacted. They were given an overview of the study and the rationale for why the sites were selected. When the principal approved participation in the survey, an announcement for the survey was advertised through the weekly principal's newsletter. The announcement included the rationale for the study and a link to the online survey. The researcher also asked the principal to include a reminder announcement in their principal's newsletter one week after the first announcement.

The survey was administered online through SurveyMonkey.com and was completed by the teachers at their convenience during a ten day period in June 2014. The survey did not include any identifying information and responses were anonymous.

For the survey portion of the study, SurveyMonkey was used to collect responses. The use of this online survey site allowed responses to remain anonymous. Once the survey window had closed, the raw data was downloaded and imported into Microsoft Excel so that it could be coded. Once the data was coded it was then imported into SPSS 21 for Mac for analysis.

Exploratory factor analysis was used to examine all the variables that may predict BYOD and then collapse them into overarching themes. Individual variables were then grouped to create composite explanatory variables to represent those factors. Items were dropped that either had low loadings or were cross loading with other variables. Seven factors were identified: perceived usefulness, professional development, privacy and security, perceived ease of use, policy awareness, collaboration, and school culture. Reliability for the factors was determined using Cronbach's Alpha. Kaiser-Meyer-Olkin, Bartlett's Test of Sphericity, communalities, variance explained, and the factors loadings were closely analyzed. Once the seven factors were identified, composite variables were created for analysis.

Logistic regression was used to examine the relationship between the predictor variable and the dependent variable teacher adoption of BYOD. The results of the analysis are presented in Chapter 4.

Limitations

There are some limitations to this study. First, since the study only considered teachers from one school district, the results cannot be generalized to other school districts in Virginia or beyond. School district X has always invested a portion of the annual technology budget, as well as received both federal and state grants, to improve its infrastructure. This improvement to the infrastructure allowed the district to implement the BYOD policy at all of its schools. Without high speed Internet access, wireless access points throughout the school building, as well

as supporting information technology personnel, BYOD would not be possible to implement.

The second limitation is that the study was limited to the individuals who participated in the focus groups and the survey. The conclusion may not reflect all the reasons why teachers adopt the BYOD policy and how they use BYOD in the classroom.

The third limitation is that this study only investigates BYOD at one point in time. Technology is constantly changing and improving at a dramatic rate. The prices for personal technology devices have become cheaper and more powerful and are available to a greater number of people. In addition to the improvement of devices, school division policies and teachers' view concerning BYOD are also changing. As a result, BYOD is being implemented in more classrooms.

Summary

This chapter explained the mixed method methodology used for this study. In the first stage a focus group was used to qualitatively explore how teachers implement BYOD and why they chose to adopt or not adopt the policy in their classrooms. The second stage used a quantitative approach to expand the research. It consisted of a 55 question survey of teachers in six schools within school district X. The purpose of the research was to examine if and how Bring Your Own Device (BYOD) is implemented in a school system by focusing on teacher adoption of BYOD in the classroom. Chapter Four discusses the study's findings including the results from both the qualitative and quantitative portion of the study.

CHAPTER 4

RESULTS OF THE STUDY

Introduction

Chapter Three explained how the data was collected for the study, described the population, discussed the survey instruments, and discussed the analytical tools. This chapter presents the results from the mixed methods study, presenting the results and findings of qualitative stage first and the quantitative stage second.

Stage One Qualitative

During the qualitative portion of the study, two 45 minute focus groups were conducted to discover if any themes emerged that were not included in the literature review. Focus groups were held at two different school locations, one at a middle school and one at a high school. Participants were asked to fill out a brief five-question questionnaire before the focus group began to help summarize participants' demographic characteristics (Table 4.1).

At high school F, seven teachers participated in the focus group: 57.6 percent of the teachers had between 11-20 years of teaching experience; 57.1 percent of the individuals had only been in the school 1-5 years; 100 percent of the participants taught both students who lived within the school zone and students who attended the academy. A majority of the participants (85.7 percent) were either instructional teaching specialists or elective teachers. Instructional teaching specialists are individuals who are licensed teachers but are not assigned classes. The role of these

specialists is to work with both teachers and students and assist them in the area of their expertise. Teachers either considered themselves very confident (42.9 percent) or confident (57.1 percent) with technology.

Table 4.1
Focus Group Demographic Characteristics as a Percentage

	High School F (N=7)	Middle School B (N=10)
Total Number of Teaching Years		
1-5 years	14.3	30.0
6-10 years	0.0	20.0
11-15 years	28.6	10.0
16-20 years	28.6	10.0
21-25 years	14.3	20.0
More than 25 years	14.3	10.0
Total Number of Years at Current School		
1-5 years	57.1	40.0
6-10 years	14.3	20.0
11-15 years	14.3	0.0
16-20 years	14.3	20.0
21-25 years	0.0	20.0
More than 25 years	0.0	0.0
Subject Area		
English	0.0	50.0
Science	14.3	30.0
Social Studies	0.0	10.0
Foreign Language	14.3	0.0
PE	0.0	10.0
Specialist	57.1	0.0
Tech	14.3	0.0
Type of Students		
Academy		10.0
Zoned		90.0
Both	100.0	0.0
Confidence Level with Technology		
Very confident	42.9	40.0
Confident	57.1	20.0
Usually confident		40.0
Not confident		

At middle school B, ten teachers participated in the focus group. The teaching experience and content specialization of the participants were mostly evenly distributed, but a majority (60 percent) had fewer than 10 years in the school; 80 percent of the participants taught a core subject, such as English or math. Ninety percent of participants taught students who only lived within the school zone and did not attend the academy. A majority of the individuals in this focus group described themselves as either being very confident (40 percent) or confident (20 percent) with technology.

The same 11 open-ended questions were asked in both focus groups (see Appendix F). Although questions were created prior to the focus group meeting, the interviewer asked additional questions to clarify or expand on the respondents' answers. All interviews took place in the schools with minimum interruptions and lasted between forty and forty-five minutes. Each of the focus groups were recorded and transcribed shortly after the focus groups took place. The focus group responses were coded after each interview, and keywords and phrases were combined into 9 different themes (See Appendix G). The codes were verified by another doctoral student who attended both sessions.

Theme 1: Advantages of BYOD

A majority of teachers in both focus groups were in agreement that there are many advantages to a Bring Your Own Device policy in secondary schools. "Instant access," "engagement," and "buy in" were words that were commonly used throughout both focus groups to describe how teachers saw the use of technology as

benefitting student learning within their classroom. Mostly, high school teachers remarked that they thought that students using their own devices appropriately helped prepare students for the job market.

One high school teacher described how technology has become a resource that students immediately use when they need information. He stated "...it's a whole lot easier for them to take out their phone, or their iPad, or whatever and find it" (Focus Group 1,Lines 374-376). Another teacher remarked that if there was a question that students do not know, they would see if "...someone [in class] had a phone with them [so they could] immediately look it up and find us the information" (Focus Group 2, Lines 243-244).

Others describe BYOD as a way to create buy-in for students. One middle school teacher also discovered that their "...students felt more comfortable with using their own device rather than using one of the school's devices [and they were] more productive" (Focus Group 2, Lines 65-67).

Theme 2: Student Ownership of Devices

There was a difference between high school and middle school teachers concerning the percentage of students who owned a personal device. One high school teacher responded that "...for the most part [he would] say that 95% of our kids have a device of some sort" (Focus Group 1, Lines 104-105). One teacher even commented that in his experience that he had even seen that his students "...may have two or three devices in their pocket" (Focus Group 1, Line 153). At this high school, the teachers did admit that there might be "... a couple of kids who don't

have a device" (Focus Group 1, Lines 113-114) but those students could use school resources instead.

Unlike high school teachers, middle school teachers felt that a small percentage of students owned a personal device. Many of the teachers commented that if their students had a device it was most likely a phone. One participant said that students "...may have phones, but don't have Internet connection, and they don't have iPads or tablets or anything like that" (Focus Group 2, Lines 86-87) all of which makes it difficult to implement the policy in their classroom.

Another concern for some of the teachers was the effect that the policy had on students who do not own a device. One teacher was very vocal about how they "...taught lower socioeconomic students and many of them don't have technology [which] sets them apart from the other students [which makes them fell like], have not's" (Focus Group 2, Lines 71-74). Another teacher was concerned that BYOD "...puts more pressure on parents to [provide] technology [and] have their kid have this kind of phone or that kind of phone" (Focus Group 1, Lines 360-362).

Theme 3: Collaboration Between Teachers

Collaboration is an important aspect of trying to get teachers to adopt a new innovation. Participants at both the middle and high schools commented that their "...school does a pretty good job at this point [offering a] few courses where we can pick up a few ideas and tips on how to use the technology in the classroom more effectively" (Focus Group 1, Lines 184-186). Professional learning communities

was a vehicle teachers used to share ideas and offer suggestions. "Word of mouth" as described by one teacher is key to implementing new innovations.

In addition to school collaboration, a number of teachers at the middle school and high school looked outside the building for ideas on how to implement BYOD in their classroom. Teachers mentioned that they are using social media sites like Edmodo, Blendspace, Twitter, and Pinterest for ideas. They also get ideas from conferences they have attended where they have collaborated with teachers from across the school district or other school districts within the state.

Theme 4: Obstacles

One of the biggest obstacles that teachers found when implementing BYOD in their classroom was finding activities that would work on multiple platforms. One teacher discussed how "...everyone has different devices, that makes it a little more hard to manage and it makes uncomfortable for the teacher too. If you have a set of iPads, you know, uniform, and teach this way [but with] so many devices you have to ask 'Is this going to work on a laptop, on his laptop, a Kindle, his iPhone?'" (Focus Group 1, Lines 342-346). Many other teachers shared this concern and also commented that it took more time to create effective activities. Another concern was that the best applications "...cost money and [I] can't expect the kids to pay for it" (Focus Group 1, Lines 221-222).

High school teachers remarked that not only were school-owned devices easier to use, but their school had enough resources where this policy wasn't even necessary. "The thing with BYOD is we have enough resources in the building here

for the most part to bring a set of touches in or iPads, or even the other devices too" (Focus Group 1, Lines 363-365). Teachers at the middle school were very upfront arguing that they did not have enough devices for all their students, so this policy could be a useful alternative to only using school-owned devices.

A second obstacle for BYOD was the amount of bandwidth that all these devices took from the school network. Many noticed, especially in the high school, that the Internet was much slower since the implementation of the policy. One high school teacher said that students are "sucking up all the bandwidth on our network" (Focus Group 1, Line 153)

A third obstacle was the personal view of the teachers concerning the policy. Many teachers still have a negative view of BYOD and the need for the policy. One person hypothesized that "...a lot of teachers still have a negative view about it because they don't really know how to incorporate it well, they really not sure how to manage it well" (Focus Group 1, Lines 403-405).

Theme 5: Professional Development

Professional development is an important component of teacher education in schools. Regarding the issue of BYOD, many teachers felt that the professional development in their school and in the school district was not specific to their content area and was instead presented in a general way. Several teachers were concerned that the professional development that they attended was not very helpful because their content area was very different from the core content areas.

Another issue that many of the teachers voiced was too much information was being presented in their professional development classes and that teachers did not have the opportunity to try it out. One teacher commented, "...it's too much too fast and then I have to go back and do everything else and I can't spend enough time on what I just learned" (Focus Group 1, Lines 445-446). The teachers thought the information was useful, but they could not implement it in their classroom because they had no time to try it out.

Theme 6: Disadvantages

In this theme, teachers focused on how students misused the policy in the school building. "Texting in the bathroom," "taking inappropriate pictures," and using their device "for non-academic purposes" were phrases that were common concerns among the teachers of both focus groups. Many teachers view the biggest disadvantage of BYOD as a lack of control. The same teachers who expressed the advantages to the policy earlier were also very concerned that the disadvantages may outweigh the advantages to this policy. BYOD "...makes it very hard for us teachers sometimes to monitor that they are only used for what supposed to be used for" (Focus Group 1, Lines 38-39). Teachers were unable to keep students from going to social media sites such as SnapChat and Instagram. Another teacher commented "If one kid has his out using it for productive reasons, it could be five kids doing something different" (Focus Group 1, Lines 60-61). This lack of control may outweigh some of the benefits of the policy.

Another comment that was made at the high school was that they had "...heard a conversation between two teachers who said that it is destroying education" (Focus Group 1, Lines 355-356). The other teachers within the group quickly agreed with this statement. One teacher had said that they thought that it made their students lazy. One individual said "...instead of taking notes, they take pictures. The whole purpose of them writing the words is that maybe, hopefully it will connect. So they are trying to do that being lazy, and of course who is going to look at pictures of vocab?" (Focus Group 1, Lines 129-133). One teacher also mentioned that they " have not seen [their students] grow into the maturity level yet with it" (Focus Group 2, Lines 99-100).

Theme 7: Policy

In this theme, the discussion centered around the teachers' concerns that students were not aware of all the components of the policy. One teacher remarked, "...we don't address it enough. Individual teachers may address it if it comes up, but I think we probably assume that they are going to use them ethically and we don't talk about the privacy issue the way we do other issues" (Focus Group 1, Lines 263-265).

Another concern emerged regarding consistency in the policy implementation between classrooms. One teacher said that other teachers allow their students to listen to music so students "...think that this is the norm of how it is to be used in the academic classes and it's not" (Focus Group 2, Lines 142-143).

In both groups there were teacher who argued that "Teachers just need to make those expectations, they need to post them in their classroom, they need to go over it. Maybe each time you use BYOD, hey we are going to go over these real quick" (Focus Group 2, Lines 138-140). These teachers noted that not everyone is comfortable with the policy and since it is not mandatory, they can choose not to use it.

Theme 8: Privacy

Some of the teachers were very vocal about the issue of privacy concerning the BYOD policy. The main concern was students taking pictures of other students without their consent. One teacher argued that her students did not have the maturity to use the devices responsibly. Another teacher's experience was that students think "...BYOD is their own personal property and so they think they can treat it like it's their own right to do whatever they want with it" (Focus Group 1, Lines 269-270).

Many teachers in each group agreed that students do not understand the importance of individual rights to privacy. Teachers attributed this lack of clarity to the fact that many teachers do not address the issues and concerns in class. The main argument around individual privacy is that students feel like they can use their device as they see fit since it is their personal property.

Theme 9: Teacher Responsibility

In this theme, participants focused on how this policy introduced additional responsibilities to their job. Although the district policy states that teachers are not responsible for lost or stolen devices, participants still felt that they had some responsibility if a device were lost or stolen in their class.

A majority of the participants in the high school group commented that they have experienced someone in their class having a device stolen. One person said that they "...don't want to have [personal devices] out because they don't want them to go missing and then they have to figure out who, and how that happened" (Focus Group 1, Lines 281-283). Another teacher agreed, commenting that "...once something goes missing, you have to go through that process" (Focus Group 1, Lines 248-249). That process included time out of their class schedule and planning time to conduct an investigation to find the missing item. Many individuals said they prefer using school devices because they don't have to worry about missing devices. Others commented that regardless of implementing the policy or not, students will still bring the device to school, so they will still have to deal with it.

Unlike the high school group, many in the middle school felt that it is the students' responsibility, not the teacher, for protecting their device from theft or damage. They refer back to the policy that the school district has implemented. They also felt that some of the responsibility should be on the parent. One person stated that "...if a parent is going to allow their student to bring the iPad then they have some understanding [that] it is not our responsibility if it is broken or stolen" (Focus Group 2, Lines 218-220). Although this was shared by many in this group,

one person said that they still "...felt responsible [if a] device were stolen" (Focus Group 2, Lines 189-191).

In addition to the problem of a device being lost or stolen, teachers did not want the additional responsibility if student-owned devices were used inappropriately. One middle school teacher commented that the "...greatest fear in [her] area is that a kid is going to come into the locker room and take a picture and post it. Then [teachers] butts are on the line and there is nothing we can do about that" (Focus Group 2, Lines 308-310). Other teachers were concerned about students recording fights and both groups mentioned that there had been instances of recording fights in the bathroom and posting it. These teachers were concerned about that it was their responsibility to prevent this.

Cheating was not a concern for either high school or middle school teachers. One commented that "...these kids are masters at cheating" (Focus Group 2, Line 370). Another teacher noted that students take pictures of a completed assignment and turn it in as their own. One teacher did not see it as their responsibility to prevent cheating. "Is it our fault that we are not teaching them ethics? I mean if we mention it, it is up to the person to figure out if they want to be truthful or not, Right? I mean it's not my fault that they are cheating" (Focus Group 1, Lines 312-315).

In this theme most teachers were supportive of the policy as long as they could "...set expectations at the beginning of the class and this is how it was going to work and this is how it is going to be used" (Focus Group 1, Lines 73-74). After setting expectations, teachers in both groups did not want any other

responsibilities, when implementing the policy such as investigating lost or stolen devices.

Summary of Stage 1

Nine different themes emerged from analyzing both focus groups: advantages of BYOD, student ownership of devices, collaboration between teachers, obstacles, professional development, disadvantages, policy, privacy, and teacher responsibility. Many of these themes were a reflection of topics discussed in the literature. The focus groups discussed factors in the framework such as teacher beliefs about ease of use and usefulness, privacy and security, school culture, and professional development. One of the factors that did not seem to have an impact on BYOD adoption was the faculty age and experience. Individuals' experience did not appear to be more positive or negative towards BYOD.

Teachers generally supported the policy overall, seeing the benefit of using BYOD in their classroom. "Instant access," "engagement," and "buy in" were all words that were used to describe the advantages of BYOD. Respondents saw the policy as both easy to implement and useful in the classroom, ideas supported by the literature.

Those teachers who were less enthusiastic of the policy stated that BYOD was more work than using school-owned technology devices, because teachers had to find applications that would work on any type of student-owned device. Some respondents also expressed that it was harder to monitor students when students

use their own devices. These teachers commented that they seldom and reluctantly use BYOD in their classroom.

Privacy was another factor that was discussed during both focus group sessions. Similar to the literature review, cheating was not an issue that concerned respondents, but cyberbullying was a big concern. Respondents from both focus groups commented that they were concerned about students taking inappropriate pictures of other students. Video recording fights, taking pictures in the locker room, or taking pictures in other inappropriate ways and posting them on the Internet were a big concern.

Professional development was also addressed in both the focus groups and the literature. Responders at both locations either felt that there was too much professional development and they did not have a chance to try it out or the professional development was not applicable to their own content area.

One of the themes not covered in the literature review but which emerged from the focus group discussions was that of the possibility of theft. Respondents were concerned that students might have their device stolen during class. High school teachers generally were concerned that theft of a student personal device would take a great deal of their time because they would have to investigate and report the stolen device. This possibly made them more reluctant to implement BYOD in their classroom. Middle school teachers were less concerned about theft stating that it was the students' responsibility.

Another item that teachers were vocal about was concerning whether or not school-owned devices were available. Many of the respondents in the high school

focus group said that there were enough devices for students and that this policy was not necessary. In the middle school focus group, respondents said that there were not enough devices for teachers to use, so they used BYOD because it was sometimes the only way to use technology. Some respondents were also very insistent that their students do not own any technology devices, and they could not use BYOD in their classroom.

As a result of the focus groups, two new themes, collaboration and BYOD training, were added to the conceptual framework in Figure 4.1. The survey instrument was also amended to include questions concerning theft, availability of school-owned devices, and privacy.

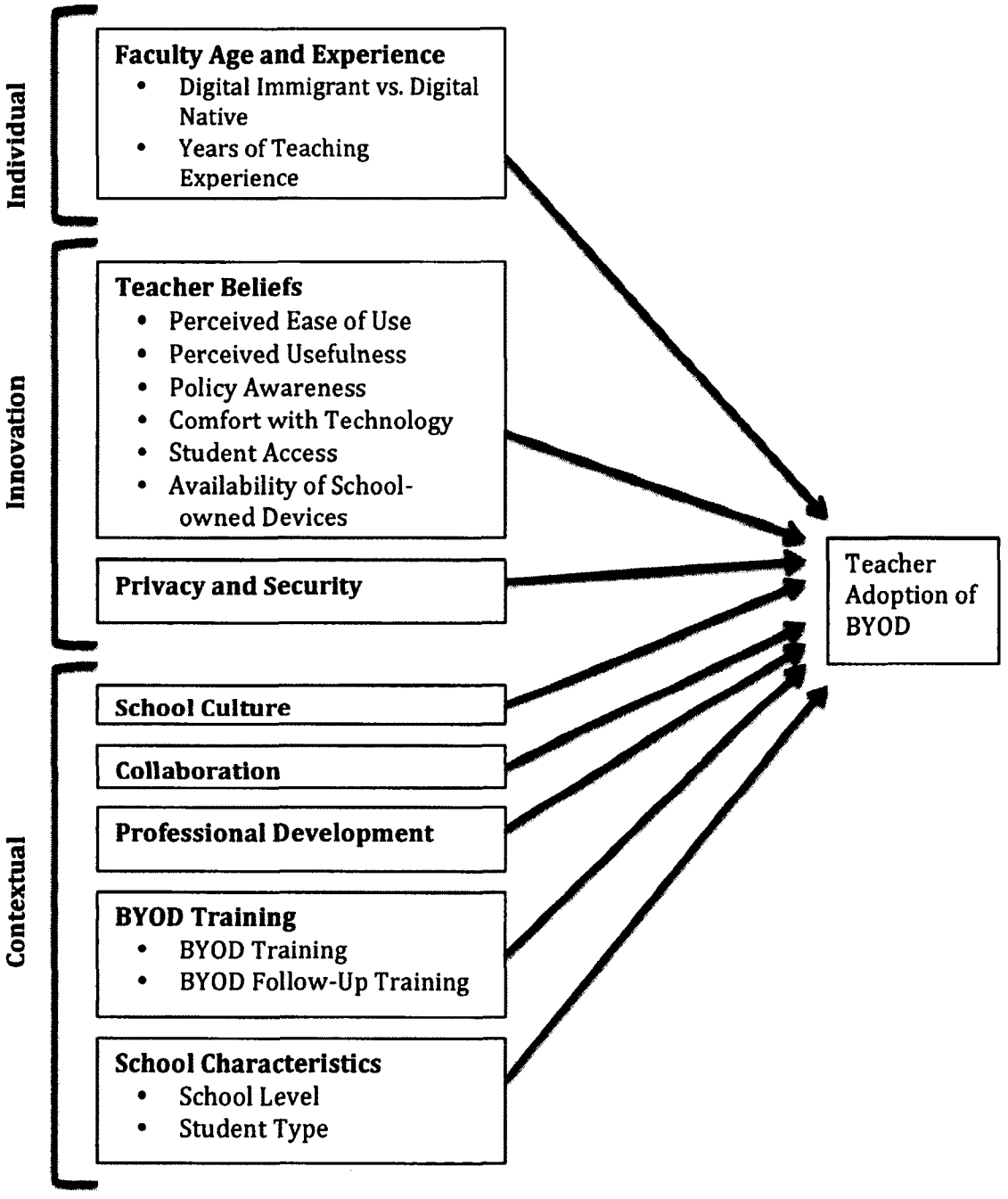
Stage Two Quantitative

Following both focus groups, the survey instrument was modified to include predictor variables that were not addressed in the literature. Questions concerning theft of student-owned devices, availability of school-owned devices and appropriateness and usefulness of professional development were added to the survey.

Profile of Survey Respondents

The survey respondents were teachers from six different schools located in school district X. The total number of respondents who completed the survey was 191 of which 178 were used for analysis (N=178). The data was checked for inconsistencies and all items were analyzed. 13 online surveys were excluded because of missing data.

Figure 4.1 Revised Conceptual Framework



As mentioned in Chapter Three, there were a total of 607 teachers who worked at the six different schools that participated in the survey during 2013-2014 school year. This survey captures 29.3 percent of the sampling frame. Table 4.2

presents the total number of instructional staff for each of the schools, the number of people who completed the survey and the response rate for each of the schools. Overall, middle schools had a higher response rate than high schools with the highest at 42.5 percent and the lowest response rate at 18.2 percent.

Table 4.2
Instructional Staff for Six Schools in the Study

	Instructional Staff	Sampling Frame	
	N	N	Percentage
Middle School A	72	19	26.4
Middle School B	87	37	42.5
Middle School C	91	37	40.7
High School D	112	34	30.4
High School E	113	27	23.9
High School F	132	24	18.2

Tables 4.3 through 4.6 and Chart 4.1 present a profile of individuals who completed the survey. Many of the schools that participated in the survey were close in representation (Table 4.3). In this study, 52.2 percent of the sample was middle school teachers and 47.8 percent were high school teachers. The total number of teaching years was evenly distributed. 21.3 percent of the teachers had 16-20 years of teaching experience. The second largest group of teacher experience was 11-15 years with 20.8 percent. 6-10 years and 21-25 each had 15.2 percent. 14.6 percent had more than 25 years of experience and 12.9 percent had 1-5 years of experience. The average number of years of teaching experience in school district X is 14.7 years.

The number of years in the same school was skewed towards fewer years with 54.0 percent spending 10 years or fewer at the same location. A majority of the sample is considered Digital Immigrants (83.1 percent). Only 16.9 percent of the teachers who responded to the survey were Digital Natives, defined as being born after 1980.

A majority of those surveyed taught a core subject (61.2 percent) which includes English (19.1 percent), math (11.8 percent), science (12.9 percent), social studies (11.2 percent), and special education (6.2 percent). Twenty-eight percent of the respondents taught an elective class; 9.6 percent were specialists; and 1.1 percent were considered other, which is either a guidance counselor or an administrator.

Table 4.3
Total Number of Teaching Years

	N	Percentage
1-5 Years	23	12.9
6-10 Years	27	15.2
11-15 Years	37	20.8
16-20 Years	38	21.3
21-25 Years	27	15.2
More than 25 Years	26	14.6

Table 4.4
Total Number of Years at Current Location

	N	Percentage
1-5 Years	69	38.8
6-10 Years	27	15.2
11-15 Years	39	21.9
16-20 Years	22	12.4
21-25 Years	8	4.5
More than 25 Years	13	7.3

Table 4.5
Subject Area

	N	Percentage
Arts	11	6.2
English	34	19.1
Foreign Language	6	3.4
Math	21	11.8
PE/Health	16	9
Reading	2	1.1
Science	23	12.9
Social Studies	20	11.2
Specialists	17	9.6
Technical and Career Education	15	8.4
Special Education	11	6.2
Other	2	1.1

Similar to the focus group, most of the respondents consider themselves either confident (43.3 percent) or very confident (38.8 percent) with technology. The respondents mostly taught students who were zoned for the school (70.8 percent) as opposed to either academy students or both zoned and academy students.

Chart 4.1
Type of Students Taught by Participating Teachers

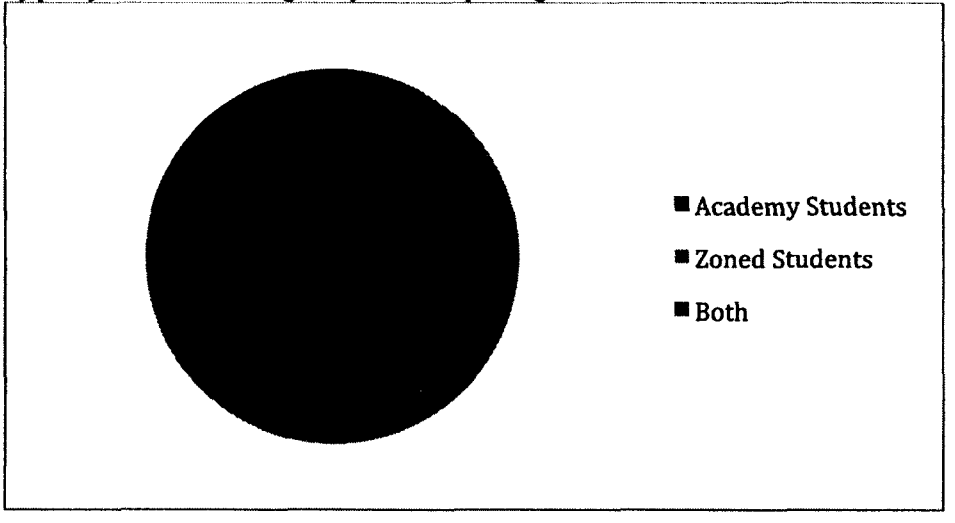


Table 4.6
Comfort Level with Technology in the Classroom

	N	Percentage
Very Confident	69	38.8
Confident	77	43.3
Usually Confident	29	16.3
Not Confident	3	1.7

Table 4.7
Teacher Perception of School-Owned Devices Not Always Available

	N	Strongly Disagree	N	Disagree	N	Neither	N	Agree	N	Strongly Agree
Middle School	2	2.2	8	8.6	4	4.3	45	48.4	34	36.6
High School	0	0	7	8.2	6	7.1	45	52.9	27	31.8

Unlike the discussions during each of the focus groups, when teachers from both middle school and high schools were asked in the about school-owned devices not being always available, a majority of teachers from both levels either strongly agreed or agreed with this statement. These results conflicts with the views from many of the high school teachers in the focus groups which indicated that school-owned devices were plentiful making BYOD an unnecessary policy. Middle school teachers from both the survey and the focus group commented that school-owned devices were not always available.

Exploratory Factor Analysis

Exploratory factor analysis was employed to reduce the number of related variables into a smaller number of factors. The principal axis factor with Promax rotation was used with SPSS 21 for Mac. After running the factor analysis a number

of times, five variables were excluded from the final analysis because they either had a low loading of less than .3, they did not load on the pattern matrix or they had high cross-loading with other variables. Tabachnick and Fidell (2001) refer to cross loadings as an item that loads on two or more factors. Three of the variables that were excluded concerned collaboration outside of the building, one concerned a belief that school resources were not available, and one had to do with reviewing the policy with students. The final factor analysis included the remaining 26 variables.

The Kaiser-Meyer-Olkin, which measures the sampling adequacy for analysis of the remaining 26 variables, was .742 which is higher than the .6 recommended value (Hair, Anderson, Tatham, & Black, 1995). The Bartlett's Test of Sphericity was statistically significant $p<.001$. Both measures indicate the appropriateness of factor analysis. Seven factors emerged with eigenvalues exceeding 1 explaining 66.638% of the variance. The items that load on the same factor suggest that those items represent the same factor. Five items were removed either because they loaded on two or more factors or they had a loading of less than .3.

Determining which rotation of factors to use was based on whether or not the factors were likely to be correlated (Hair et al., 1995). Since many of the variables were likely to be correlated as all are related to technology in education, the researcher used oblique rotation (Promax) instead of the orthogonal rotation. Using oblique rotation produces two matrixes: structure matrix and pattern matrix of unique relationships (Tabachnick & Fidell, 2007). Tabachnick and Fidell (2007)

recommend only interpreting variables that load greater than .32. The final factor analysis included 26 variables and all remaining variables loaded higher than .368.

After running the factor analysis there were a few correlations between factors that were between .3 and .461 as shown in the Factor Correlation Matrix suggesting a problem with multicollinearity (Table 4.8).

Table 4.8
Factor Correlation Matrix

	Perceived Usefulness	Professional Development	Privacy and Security	Perceived Ease of Use	Policy Awareness	Collaboration	School Culture
Perceived Usefulness	1.000						
Professional Development	.254	1.000					
Privacy and Security	.225	.290	1.000				
Perceived Ease of Use	-.461	-.015	-.205	1.000			
Policy Awareness	.225	.281	.352	-.133	1.000		
Collaboration	.287	.410	.133	.028	.315	1.000	
School Culture	.341	.008	.102	-.098	.102	.153	1.000

Extraction Method: Principal Axis Factoring
Rotation Method: Promax with Kaiser Normalization

To check for multicollinearity, which can be understood as high intercorrelations between variables, a multiple linear regression was performed between BYOD adoption as the dependent variable and the 16 independent variables. Tolerance for all the variables was greater than .10 and the Variance Inflation Factor (VIF) was well below 10. These results show that multicollinearity is not an issue for analysis.

The sample size of 178 is an adequate number to determine if there are any correlations among the variables. Although Tabachnich and Fidell (2007) recommend that the sample size should "...have at least 300 cases for factor analysis" (p. 613), Hair, Anderson, Tatham, and Black (1995) recommend as a general rule that a "...minimum of at least five times as many observations as there are variables to be analyzed" (p. 373). The 178 cases meet those criteria.

Once the factors were identified, the researcher used SPSS to create seven composite variables: perceived usefulness, professional development, privacy and security, perceived ease of use, policy awareness, collaboration, and school culture. These seven new variables were used as predictor variables in the logistic regression discussed later in this chapter. Cronbach's Alpha was computed for each variable to measure reliability (Field, 2013, p. 708). Cronbach Alpha ranged from .70 to .83 indicating high internal validity/reliability. The predictors and the variables that are associated with each are described below.

Perceived Usefulness

Four of the five the variables contained in this factor relate to the individual's belief that BYOD helps them teach their content (Perceived Usefulness). The highest loading for this factor was the belief that "BYOD helps me differentiate my lessons to all types of learners. The only variable that loaded that was not related to the individual's belief was "after learning new strategy I use it in class right away". This question was created to measure professional development. Including this variable

in this factor seems logical because if an individual thinks that a strategy is useful, they would be willing to implement it right away.

Table 4.9
Factor One: Perceived Usefulness

Variable	Loading	Item Statement
belief_diff_lessons	0.91	BYOD allows me to differentiate my lessons to all types of learners
belief_works_students	0.763	BYOD works well with the students enrolled in my class
belief_support_lessons	0.758	BYOD supports the lessons/curriculum that I teach
belief_ness_comp	0.547	I design lessons in which BYOD is a necessary component of the lesson
belief_integrate_byod	0.508	It is easier to integrate technology into my lessons using BYOD
pd_usestrategy	0.494	After learning a new strategy I use it in class right away
Cronbach's Alpha	0.813	
Eigenvalue	5.812	
Percent of Variance	22.354	

Professional Development

The five variables included in this factor all related to professional development. One question asked if the teacher felt that administrators in their building were supportive of teachers using technology. The other four questions assessed whether professional development courses were offered for all content areas and on technology.

Table 4.10
Factor Two: Professional Development

Variable	Loading	Item Statement
pd_strategies	0.856	My school offers professional development classes on different teaching strategies for all content areas
pd_allcontent	0.813	My school offers technology based professional development classes for all content areas.
pd_adminsupport	0.687	My building administrators support teachers using technology in the classroom.
pd_mycontent	0.62	My building offers technology based professional development that is specific to my content area.
pd_timetry	0.368	I have enough time to try the strategies that I learn in professional development classes
Cronbach's Alpha	0.786	
Eigenvalue	3.182	
Percent of Variance	12.239	

Privacy and Security

The reliability test had the highest score of all the factors with a Cronbach Alpha of .834. The three variables included concerned the school's policy of dealing with cyberbullying, cheating, and the inappropriate use of a camera.

Table 4.11
Factor Three: Privacy and Security

Variable	Loading	Item Statement
ps_cyberbullying	0.945	The school has a system in place to prevent cyberbullying when using BYOD in the classroom
ps_cheating	0.777	The school has a system in place to prevent cheating when using BYOD in the classroom.
ps_camera	0.729	There are measures in place to prevent students from using the device's camera in class
Cronbach's Alpha	0.834	
Eigenvalue	2.377	
Percent of Variance	9.141	

Perceived Ease of Use

This factor ostensibly covers three different areas: perception of student ownership, privacy and security, and perceived ease of use. Despite these intended topics, four of the five questions concerned how BYOD was more difficult and took more time than using a school-owned device. The highest loading for this factor had to do with the individual's concerns about the student's feelings who did not own a device. This question may have loaded on this factor because it would take the teacher more time to gather resources for that student or they would have to deal with that student's concern.

Table 4.12
Factor Four: Perceived Ease of Use

Variable	Loading	Item Statement
belief_student_feelings	0.695	The feelings of students who do not own a device is one of the concerns about the BYOD.
belief_theft_concern	0.619	Theft of a student's personal device one of the concerns about the BYOD.
belief_byod_use_diff	0.606	BYOD is more difficult to use in class than using school-owned devices
belief_byod_manage_diff	0.605	BYOD is more difficult to manage in class than school-owned devices
belief_more_time	0.529	BYOD takes more time to plan than using school-owned devices
Cronbach's Alpha	0.756	
Eigenvalue	1.907	
Percent of Variance	7.335	

Policy Awareness

The three variables comprising policy awareness focused on how the school and the teachers in the school ensured that students are aware of the BYOD policy.

Table 4.13
Factor Five: Policy Awareness

Variable	Loading	Item Statement
ps_divpol	0.946	The school ensures that teachers understand the division's policy on BYOD
ps_studentaware	0.9	The school ensures that students are aware of the division's policy on BYOD
ps_reviewpol	0.38	To the best of my knowledge, teacher who use BYOD in my building frequently review the division's policy and the appropriate use of BYOD with students
Cronbach's Alpha	0.793	
Eigenvalue	1.620	
Percent of Variance	6.230	

Collaboration

Two variables were included that relate to collaboration. Both concerned how teachers share new strategies with others.

Table 4.14
Factor Six: Collaboration

Variable	Loading	Item Statement
coll_ishare	0.772	After taking a professional development class, I share the new ideas/strategies with other teachers in my department.
coll_othersshare	0.69	After teachers in my department take professional development class, they share the new ideas/strategies with me and other teachers
Cronbach's Alpha	0.705	
Eigenvalue	1.236	
Percent of Variance	4.755	

School Culture

The two variables contained in this factor relate to school culture. Both questions focused on the teacher's perception of how people within their department viewed BYOD. Other people within the department thinking BYOD is useful loaded the highest. This is logical since department members influence the individuals within that department more than the administration or school.

Table 4.15
Factor Seven: School Culture

Variable	Loading	Item Statement
cult_other_dept_useful	0.753	The other teachers in my department find BYOD to be useful in the classroom
cult_teachers_useful	0.56	Teachers in my building find BYOD to be useful in the classroom
Cronbach's Alpha	0.7	
Eigenvalue	1.192	
Percent of Variance	4.583	

BYOD Adoption

In order to properly analyze the data and to answer one of the research questions, the teachers who adopted BYOD needed to be separated from and compared with the teachers who either just tried it once or chose not implement the policy at all. Since the survey only asked if the individual used BYOD in their classroom and not whether BYOD has been adopted for the classroom, a new variable was created, BYOD adoption. A cross tabulation was run comparing individuals who used BYOD and how much they used it (Table 4.16). Two criteria were used for this new variable: the teacher should have said yes they have used

BYOD and they should have used it more than once in their classroom for the given school year. BYOD adopters are shown in the non-shaded cells in table 4.16. Teachers who answered "Once every 9 weeks" were considered adopters since they used it more than once and presumably have used it throughout the past school year. These teachers have established a pattern of using the policy and may be considered adopters. This dissertation will consider using BYOD more than one time as adoption.

Table 4.16
Cross Tabulation of Use with Frequency of Use

Used BYOD	Never	Once this school year	Once every 9 weeks	Once a month	2-4 times a month	More than 5 times a month	Total
Yes	0	9	42	27	52	24	154
	0.00%	5.80%	27.30%	17.5%	33.8%	15.60%	100.00%
No	17	7	0	0	0	0	24
	70.8%	29.2%	0.00%	0.00%	0.00%	0.00%	100.00%
Total	17	16	42	27	52	24	178
	9.60%	9.00%	23.60%	15.20%	29.20%	13.50%	100.00%

Table 4.17
BYOD Adoption

	Frequency	Percent
Yes	145	81.5
No	33	18.5
Total	178	100

Research Question One

Question 1: How are teachers currently implementing BYOD in middle and high school classrooms?

During each of the focus groups, one conducted at a high school and the one conducted at a middle school, teachers discussed how they allowed students to use BYOD devices in their classrooms. In high schools, where BYOD is more common according to both the pre-focus group questionnaire and prior studies, teachers primarily had students use their devices as a resource to look up other information on the Internet or to use it as a dictionary. Teachers also allowed and encouraged their students to use their device as an organizational tool to keep track of assignments and set alerts for upcoming projects or tests. All teachers at the high school focus group said that they did not allow students to listen to music or take pictures with their personal devices.

Middle school teachers, like high school teachers, primarily allowed their students to use their personal devices to look up information on the Internet. Middle school teachers, however, allowed their students to use their devices in a variety of other ways. These teachers allowed their students to use their devices to access websites to create review games and flash cards to reinforce course content. Students also used their devices to scan QR codes to open websites, play videos, or to ask questions. Finally, middle school teachers allowed their students to access an educational social networking site to download and turn in assignments. Students also used this site to communicate with other students and the teacher for educational purposes. Although no one in the focus group permitted it, everyone

commented that they knew of other teachers whose students, while completing classwork, used their devices to listen to music through headphones.

After the focus groups were conducted and the discussions were transcribed and analyzed, the survey instrument was refined before it was distributed to teachers at six schools, three high schools and three middle schools. One of the questions included in the survey asked teachers how they used BYOD in their classroom. The five most frequently discussed topics from the focus group were included in the survey: listen to music, lookup information, use interactive application, poll students to collect data, and record video for projects. The survey also included an "other" option in case there was a way that a teacher used BYOD that was not included in the original five choices.

A cross tabulation was run comparing individuals who adopted BYOD and how they are currently implementing it in their classroom (Table 4.18). To answer the first research question, teachers who were considered adopters of BYOD primarily allowed their students to lookup information during class and record video. This mirrored the responses of teachers during each of the focus groups. These teachers were less likely to allow students to listen to music or poll their students to check for understanding.

A majority of those surveyed used BYOD in their classroom to lookup information, work with an interactive application, and record video. These findings are consistent with the responses from both focus groups. At least one of the findings, that teachers allow students to use their devices to look up information, is consistent with the findings from the focus group.

Table 4.18
How Teachers Allow Students To Use Their Devices

	N	Never	N	Rarely	N	Sometimes	N	Often	N	Always
Listen to Music	43	29.7%	35	24.1%	49	33.8%	17	11.7%	1	0.7%
Lookup Information	3	2.1%	3	2.1%	42	29.0%	67	46.2%	30	20.7%
Use an Interactive App	20	13.8%	26	17.9%	48	33.1%	45	31.0%	6	4.1%
Poll students to collect information	64	44.1%	30	20.7%	35	24.1%	13	9.0%	3	2.1%
Record Video	33	22.8%	25	17.2%	47	32.4%	35	24.1%	5	3.4%

Research Question Two

Question 2: What factors influence teacher adoption of Bring Your Own Device (BYOD) in middle and high school classrooms?

Logistic Regression

The 16 predictive variables are summarized in Table 4.19. Using the revised conceptual framework, BYOD adoption can explained by these variables: perceived ease of use, perceived usefulness, privacy and security, school culture, collaboration, professional development, digital generation, years of teaching experience, comfort with technology, BYOD training, BYOD follow-up training, student access, availability of school-owned device, school level, and student type.

Table 4.19
Factors and Variables (N=178)

Variables	Definition	Mean	SD
BYOD Adoption	Has the teacher used BYOD in their classroom more than once this year. 0 (No), 1 (Yes)	0.81	0.390
Perceived Ease of Use	Composite variable	3.358	0.795
Perceived Usefulness	Composite variable	3.378	0.635
Privacy and Security	Composite variable	2.388	0.828
Policy Awareness	Composite variable	3.508	0.767
School Culture	Composite variable	3.497	0.700
Collaboration	Composite variable	3.739	0.699
Professional Development	Composite variable	3.789	0.704
Digital Generation	To which group do you belong? 0 (Digital native-born 1980 or later), 1 (Digital immigrant-born before 1980)	0.83	0.375
Years of Teaching Experience	Including this year, what is the total number of years you have been teacher? Values: 1 (1-5 years), 2 (6-10 years), 3(11-15 years), 4(16-20 years), 5(21-25 years), 6(More than 25 years)	3.54	1.588
Comfort with Technology	How would you describe your comfort level using technology in your classroom? Ranges from 1 (Very Confident) to 5 (Not Confident)	1.81	0.765
BYOD Training	Have you received training on how to implement BYOD in your classroom? 0 (No), 1 (Yes)	0.61	0.490
	Do you receive follow-up training sessions on how to implement BYOD in your classroom? 0 (No), 1 (Yes)	0.24	0.426
Student Access	To the best of your knowledge, what percentage of your students have a device that they can bring to school?	77.57	19.403
Availability of School-owned Devices	School-owned devices are not always accessible. Ranges from 1 (Strongly Disagree) to 5 (Strongly Agree)	4.08	0.914
School Level	0 (Middle School), 1 (High School)	0.48	0.501

Table 4.19 continued

Variables	Definition	Mean	SD
Student Type	What type of students do you teach? Academy Students Zoned Students Both	2.13	0.525

A logistic regression was performed through SPSS 21 for Mac to predict the usage of BYOD. Table 4.20 summarizes the results of the logistic regression, presenting the p-values. The model was statistically significant and the Cox and Snell Pseudo R Square result was 0.315 and Nagelkerke Pseudo R Square result was 0.520. The model correctly classified the outcome 88.6 percent of the time, predicting the 'yes' outcome 97.9 percent of the time and the 'no' outcome 45.2 percent of the time. Although 45.2 percent is a high percentage, the purpose of this research is to find out why teachers are using BYOD rather than why they are not using BYOD in the classroom. Correctly predicting a 'yes' outcome was the focus of this research.

Table 4.20
Logistic Regression of BYOD Adoption

	B	S.E.	Sig.	Exp(B)
Perceived Ease of Use	-0.286	0.425	0.500	0.751
Perceived Usefulness	2.676	0.707	<.0001***	14.534
Privacy and Security	-0.724	0.449	0.107	0.485
Policy Awareness	-0.029	0.422	0.946	0.972
School Culture	1.258	0.474	0.008**	3.520
Collaboration	-0.118	0.452	0.794	0.889
Professional Development	-1.330	0.585	0.023*	0.264
Digital Generation	0.261	0.906	0.773	1.298
Years of Teaching Experience	0.236	0.215	0.272	1.266
Comfort with Technology	-0.400	0.357	0.262	0.670
BYOD Training	0.965	0.680	0.156	2.624

Table 4.20 continued

	B	S.E.	Sig.	Exp(B)
Student Access	0.016	0.015	0.258	1.017
School-owned Device	0.204	0.331	0.537	1.227
High School	1.768	0.660	0.007**	5.862
Academy Students				
Zoned Students	2.811	1.157	0.015*	16.622
Both	0.758	1.1	0.491	2.135
Constant	-8.78	4.048	0.03	0
N	176			
X^2	66.647			
Cox and Snell Pseudo R^2	0.315			
Nagelkerke Pseudo R^2	0.520			

Note. N=178. *$p<.05$. **$p<.01$. ***$p<.001$.

Of the 16 independent variables, only five variables were significantly related to BYOD use: perceived usefulness ($p<.001$), school culture ($p<.01$), professional development ($p<.05$), the level of school that they taught ($p<.01$), and teachers who only taught students who lived within the school zone ($p<.05$). Professional development was the only indicator that was a negative predictor.

Those who perceived BYOD as useful are 14.534 times more likely to adopt BYOD than other teachers. This means that the odds of using BYOD in the classroom for teachers who perceived BYOD as useful are 1353% higher than the odds of those who do not perceive BYOD as useful. Other factors that increase the likelihood that teachers will adopt BYOD are teachers who work in a department where BYOD is considered useful (odds ratio, 3.520), having received professional development (odds ratio, .264), working in a high school (odds ratio, 5.862), and teaching only students that lived within the school zone (odds ratio, 16.622).

Individuals who received building-based professional development on technology was the only factor that significantly decreased the likelihood that teachers adopt BYOD (odds ratio 0.264). This means that the odds of using BYOD in the classroom for teachers who received technology based professional development are 73.6 percent less than the odds of those who do not receive professional development. This result may be a reflection that teachers receive a great deal of professional development with very little time to try it out or implement it. This was one of the concerns that teachers expressed during each of the focus groups.

Overall, the results of the logistic regression suggest the importance of both school culture on an individual teacher's decision to adopt BYOD and the perceived usefulness of BYOD. This model also controlled for perceived ease of use, privacy and security, policy awareness, collaboration, digital generation membership, total number of years teaching, comfort level with technology, receiving BYOD training, receiving BYOD follow-up training, and the belief concerning the availability of school-owned technology resources.

Summary

This chapter presented the results of the mixed methods study and was divided into two parts. The first part of the chapter presented the results from the focus group (Stage 1). It included a description of the participants and the nine themes that emerged from the two sessions. The second part of the chapter presented the results from the survey (Stage 2).

Finally, a logistic regression was performed and showed that only five of the 16 assessed variables were significantly related to BYOD use: perceived usefulness, privacy and security, school culture, professional development, teaching only students who lived within the school zone, and the level of school the teach taught. Of these, only professional development was a negative predictor.

Chapter Five will discuss the findings of the study in the context of the literature, present the contributions and the limitations of the study. The chapter will conclude with recommendations for future research.

CHAPTER 5

CONCLUSION AND IMPLICATIONS

Introduction

Chapter Four presented the results from the mixed methods study, with explanations of the qualitative stage and quantitative stage. This chapter is organized into the following sections: (a) summary of the study, (b) discussion of the findings, (c) management and policy implications, (d) limitations, and (e) recommendations for future research.

Summary of the Study

The purpose of this research was to examine if and how Bring Your Own Device (BYOD) is implemented in schools by focusing on teacher adoption of BYOD in the classroom. Two research questions guided this study:

1. How are teachers currently implementing BYOD in middle and high school classrooms?
2. What factors influence teacher adoption of BYOD in middle and high school classrooms?

During the qualitative portion of the study, two 45 minute focus groups were conducted to see if any themes emerged that were not included in the literature and that helped to explain how or why teachers adopt BYOD in their classrooms. Participants in both focus group sessions, one for middle school teachers and one for high school teachers, responded to the same 11 open-ended questions. During the quantitative portion of the study 178 teachers from six different schools, three

middle and three high, responded to an online survey asking about their adoption or non-adoption of BYOD for their classroom.

The first research question was addressed in both stages of the study. In the first stage as part of a focus group discussion, participants answered questions about how they used BYOD in their classes. In the second stage, participants answered similar questions in a survey. Results from the focus group discussion and the survey provided a context to how teachers were currently using BYOD in their classroom.

The second research question was also answered in both stages of the study. In the first stage, the discussion was transcribed, analyzed, and coded. The nine themes that emerged from the focus group discussion helped to illuminate why teachers decided to adopt or not adopt BYOD and were used to adjust the survey instrument given in stage two. In the second stage of the study, exploratory factor analysis was used to reduce related variables into a smaller number of factors. Those seven factors along with demographic variables were then analyzed in a logistic regression to determine their influence on teacher adoption.

Discussion of the Findings

This study tried to uncover why teachers adopt BYOD in their classrooms. The following discusses the findings from both stages of the study.

Research Question One

How are teachers currently implementing BYOD in middle and high school classrooms?

This research question was answered using results from both the focus group and the survey. Findings from both stages indicated that teachers allowed students to use their own devices primarily to look up information and to record video for assignments.

In the first stage of the study most of the teachers reported adopting BYOD in their classroom. Some of the teachers were more skeptical of the educational benefit of the policy, but only two people did not implement the policy at all. The reason those teachers gave for not using the policy was that a majority of their students did not own a personal device. Teachers who do use BYOD in their classes found the policy to be very helpful. Both high school and middle school teachers allowed students to use their own devices during classes, mainly to look up information on the Internet. Some of the high school teachers allowed their students to record videos for an assignment. Some of the middle school teachers allowed students to use educational collaboration websites to post assignments and interact with other students from different classes.

Similar views from the focus groups were also reflected in the results from the survey. Eighty-one percent of the respondents have adopted BYOD for their classrooms. A majority of teachers who adopted BYOD used it more than two times a month (52.5 percent). This indicates that teachers view BYOD as a useful policy since they have frequently made it a part of their lessons.

As discussed in Chapter Four, and similar to the discussion from the focus groups, a majority of the teachers allowed their students to lookup information (75.2 percent). Although teachers were not specifically asked in the survey about the usefulness of the BYOD policy, teachers indicated that they found BYOD to be beneficial for supporting student research or as a means to provide additional resources in the classroom. A majority of teachers also incorporated BYOD policy by having students run interactive applications on their devices (64.1 percent) and record video (56.5 percent). Unlike the results from the focus groups, there was very little difference between how teachers at the middle or high school level allowed their students to use BYOD.

The responses related to this research question provide a context for how teachers are currently using BYOD in their classroom. This research question was developed by the literature, followed by results from two focus groups and ended with a survey. Although there were many different ways that the teachers use BYOD in their classroom, the two most popular ways were allowing students to look up information in class and to take videos.

Research Question Two

What factors influence teacher adoption of BYOD in middle and high school classrooms?

The revised conceptual framework for this study consisted of eight themes: faculty age and experience, teacher beliefs, privacy and security, school culture, collaboration, professional development, BYOD training, and school characteristics.

The results from research question two showed five factors to be statistically significant as predictors of teacher adoption of BYOD: perceived usefulness, school culture, professional development, the school level in which the teachers worked and the type of student they taught. Interestingly, not all factors from the model were statistically significant, which contrasts with prior studies reported in the literature. Despite their recognition as predictors for technology adoption in the literature, perceived ease of use, privacy and security, faculty age and experience, comfort level with technology were all found not to be statistically significant predictors of teacher adoption of BYOD.

Perceived Ease of Use

In this study, perceived ease of use was not statistically significant as a predictor of BYOD adoption in the classroom. Previous research on perceived ease of use indicated that if the innovation is more difficult to use, the innovation would take longer to adopt (Davis et al., 1989; Rogers, 2003). The findings were also different from the focus groups. Teachers commented during the focus groups that using BYOD in the classroom was difficult because it required them to find universal applications that would work on any device. Other teachers commented that they spend extra time planning for it. Despite many respondents' comments during the focus groups regarding theft and the fact that some students lacked personal devices, in the survey these did not present as teacher concerns.

Perceived Usefulness

In this study, perceived usefulness was found to be the strongest predictor of whether or not a teacher used BYOD in their classroom. This is consistent with previous studies and models (Davis et al., 1989; Oncu et al., 2008; Venkatesh et al., 2003). In the Unified Theory of Acceptance Use of Technology (UTAUT), for example, Venkatesh stated that perceived usefulness was the strongest predictor of whether or not a person adopted technology. This finding shows teachers must view the innovation useful, otherwise they will not use it in their classrooms. Both the focus group and the survey reflected this.

School Culture

School culture was found to be statistically significant. This reflects the literature in that the culture of the school must be supportive of new technologies in order for them to be adopted. Rogers (2003) had mentioned that "...most individuals evaluate an innovation not on the basis of scientific research by experts but through the subjective evaluations of near peers who have adopted the innovation" (p. 36). If teachers and administrators see the benefit of information technology, then they will more likely use it (Ertmer & Ottenbreit-Leftwich, 2010). Teachers are more likely to adopt an innovation due to social pressure than if they believed the innovation is useful (Frank et al., 2004; Zhao & Frank, 2003).

Privacy and Security

Privacy and security was found not to be statistically significant. This result is interesting since it conflicts with the concerns teachers expressed during both

focus groups. This may be consistent with the literature regarding cyberbullying. Eden et al. (2013) explained that the older the child, the more likely the teacher may believe that the student can handle the situation. Since the survey was sent to teachers at both middle and high schools, this may explain why this is not statistically significant. This may also help explain why high school teachers are more likely than middle school teachers to implement the policy.

Professional Development

The examination of the professional development variable produced surprising results. This was the only variable that was statistically significant and had a negative relationship with BYOD adoption. All the questions that were included in this area had to do with technology-based professional development in content areas and allowing teachers the opportunity to try out information from the training. It is possible that the negative response is related to the amount of professional development and the lack of time a teacher has to implement the information. It is also possible that even though professional development was offered specific to the teacher's content area, the teachers may not have seen BYOD as useful to their classes. As mentioned previously, if teachers do not see the benefit or usefulness of a strategy, such as technology, they will not use adopt or use it in their classroom (Bahr, Shaha, Farnsworth, Lewis, & Benson, 2004; Vrasidas & McIsaac, 2001)

Faculty Age and Experience

Faculty age and experience was not found to be statistically significant when considering BYOD adoption. Some literature had supported how different generations integrate technology to different degrees in the classroom (Oncu et al., 2008; Prensky, 2001). In the current study the number of years a teacher was in the profession or which digital generation they were from was not significant. This may be a reflection that most of the teachers in both the focus groups and the survey felt comfortable with technology. Comfort level with technology, or self-efficacy with technology, may have more of an influence on adoption than the age of the teacher. The other possibility is that school district X prohibits employees from trying to troubleshoot student-owned devices. It is possible that even people who are older and are not as confident with technology do not have to worry about fixing devices should they not work.

Peer Collaboration

Peer collaboration was found to be not statistically significant in considering whether or not a teacher uses BYOD in the classroom. Previous research had argued that peer collaboration can help teachers overcome barriers in using information technology in the classroom (Kanaya et al., 2005). Survey questions relating to this factor covered collaboration inside the school and outside the school, such as on the Internet or through social media. Responses concerning collaboration outside the school were removed during the exploratory factor analysis, since it cross-loaded on many of the other items. The data from those

questions were not reintroduced into the final model because teachers in both focus groups were more vocal regarding the importance of collaboration with their peers inside the building rather than collaboration with others on the Internet or through social media.

School Level

The high school level was found to be statistically significant on BYOD adoption. High school BYOD adoption rates were 92 percent for teachers compared with 72 percent of middle school teachers. It is possible that teachers adopt BYOD in high schools because high school students have access to personal devices as reflected in the findings from Project Tomorrow's study indicating older students' likelihood of owning a device. Although the teacher's belief in what percentage of their students' owned a personal device was not a statistically significant predictor of teacher adoption, this was supported when comparing the two focus groups. Teachers at the high school stated that almost all of their students had a device and that many of their students usually had multiple personal devices. High school teachers commented in the focus group that school-owned devices were adequate and the policy was not needed. Middle school teachers commented in the focus group that their students did not always have a device.

Policy Implications

The results from this study showed that several factors predicted teacher adoption of BYOD. Perceived usefulness of BYOD, school culture, teaching at a

secondary school level high school, and teaching at a traditional program at a zoned school were all significant positive predictors of BYOD adoption. Professional development was a negative predictor, in that teachers who reported receiving professional development were less likely to report adopting BYOD than teachers who did not report receiving professional development. The findings could be important to school officials and policymakers. Policymakers and other types of government workers are tasked to use taxpayer dollars in the most effective way. In addition to budget shortfalls, schools must find ways to implement policy that are not only cost effective, but also beneficial to student learning. As school districts look towards integrating technology into all aspects of education, BYOD can be a way to supplement, if not replace, school-owned devices. As more school districts adopt BYOD, and as more applications become available to all devices, it would be beneficial to have a better understanding of how and why teachers use this policy.

There are many benefits to implementing a BYOD policy. Personal technology devices are ubiquitous throughout society. Despite what some teachers may perceive, student ownership of personal technology devices is in the high percentages regardless of the SES of the school. This was reflected in the literature and in both stages of this study. This policy would also be more beneficial at the high schools since a higher percentage of students own devices and have a greater variety of devices than at the middle school level. Since students usually have these devices on their person at all times, they can be used at any point in the lesson.

Considering these benefits and the results from this study, there are five important policy implications. First, it might be possible to shift priorities from

buying resources for teachers and students to investing in more technology resources that will improve, maintain, and support the infrastructure that allows the use of personal devices. Creating a strong computer network would not only save the school districts money on replacing computers, but this change would help the district move towards one-to-one computing and personalized learning. Although student-owned devices are more prevalent in the high schools according to previous studies and this study, student-owned devices at the middle school level are becoming more common. Each year that the Pew Research Center and Project Tomorrow conducts a survey of middle and high school students, the percentage of students who own a device increases which makes the BYOD policy increasingly more relevant every year. This study, like other studies, shows that even in low SES schools a large number of students own a device.

The second policy implication is as technology advances and new innovations emerge, the results from this study will help explain what motivates teachers to adopt a new innovation especially when the policy is a voluntary program. If a majority of teachers are implementing this policy, even though the policy is voluntary, changes to the way schools purchase devices and ways teachers teach can be made throughout the district.

The third policy implication is regarding professional development. As mentioned previously, in this study professional development had a negative effect on whether or not teachers adopted BYOD in their classrooms. School districts should consider that even though information is disseminated through district-wide and school-wide professional development, these training sessions can have a

negative impact rather than a positive one when trying to encourage teachers to use a new innovation. A majority of teachers received BYOD training, but very few teachers received follow-up training. During both the focus groups and the survey, many teachers commented that they were not given enough time to try new strategies after a professional development session.

A fourth policy implication is the importance of perceived usefulness. School districts need to encourage teachers to use an innovation. If teachers see the usefulness of an innovation, they will adopt it. This can be achieved by highlighting the advantages and the reasons why it would be beneficial to incorporate the innovation in their classrooms.

The final policy implication concerns school culture. School districts must find ways to target the school culture not only by gaining the support of the school leadership, but also by soliciting the subcultures, or content areas for policy reinforcement. School districts and policymakers should also investigate school practices that build supportive cultures and demonstrate the usefulness of BYOD. As mentioned previously, if the school culture is not supportive of the innovation, teachers will be less likely to adopt the innovation.

Recommendations for Future Research

Four suggestions for future research are recommended: first, conduct more research to see if there is a link between BYOD and student learning; second, increase the sample size either by including an entire school district or multiple

school districts; third, improve the survey instrument; and fourth, determine ways that the program can be expanded to impact student learning.

Future research should be conducted to see if there is a link between BYOD use in the classroom and student performance. Although there have been many studies over the years considering the link between technology and student performance, very little has been done regarding whether or not BYOD has any educational benefit to students. Before school districts and policymakers advocate for a shift in budgetary resources for technology, more research needs to be done to determine if BYOD makes a positive impact on student learning.

A second recommendation would be to include an entire school district or multiple school districts. Including a larger sample size with teachers from different districts may provide better insight into why teachers adopt an innovation. Even though this study included schools with different socioeconomic backgrounds, the network resources, BYOD district policy, and teacher training are similar throughout the district since the district spends its technology budget equitably for every school. Including other districts with varying resources might show how resources affect whether teachers choose to adopt or not adopt BYOD in their classroom. For example, other school districts may spend different amounts on technology per school. This may affect the number of school-owned devices available for students or the strength of the wireless network to support school-owned and student-owned devices. An unreliable network infrastructure may cause teachers not to adopt BYOD in their classrooms. The school district may provide

more money for professional development or more support for BYOD. This might vary between schools within the districts.

School districts that do not have a strong tax base may not have enough money to support the infrastructure required to have many devices use the same access points. A smaller percentage of students in impoverished school districts may not own a device, making a BYOD policy pointless.

Another reason to include additional school districts is that other school districts may have more clearly defined BYOD policies than the one in this study. The policy may impact not only the percentage of teachers who use BYOD, but also implementation in their classrooms.

A third recommendation for future research would be to improve the survey instrument. Given the newness of BYOD in the classroom, the researcher used a mixed method design to investigate BYOD in the classroom. Two models originally created to assess technology adoption were used to investigate this topic. The purpose of this research was to explore, from the teachers' point of view, reasons they have adopted this new policy and not to create a reliable instrument. To create a reliable instrument would require "...larger numbers of subjects, frequent retesting, and sophisticated statistical models" (Rudestam & Newton, 2015, p. 111). Although many precautions were taken to ensure reliability and validity, the retesting was not performed. The survey instrument used for this study should serve as a starting point.

Finally, now that teachers are allowing students to use devices in the classroom, research is needed to uncover ways that teachers can fully integrate this

technology into their lessons to improve student performance. Teachers in this study commented that they see the beneficial aspects of BYOD and think that it is useful, but they are only allowing students to use it at the most basic level. Future research could investigate how expanding BYOD for other purposes, such as online assessment, collaborative work with students online, or individualized instruction, can influence teaching practices and ultimately enhance student learning.

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APPENDIX A

DEFINITIONS OF TERMS

In order to provide a general understanding, the following definitions will be used in the study:

Academy Programs

The school district offers academic and career based specialized programs to middle and high school students. Each program is located within a middle or high school and has a different curriculum focus and educational philosophy. Any student from the school district can apply for admission. Students are selected based on their academic performance, community service, and extra-curricular activities.

Adoption

Adoption will be defined as whether or not a teacher has accepted or rejected the integration of Bring Your Own Device. This dissertation will consider using BYOD more than one time as adoption.

Bring Your Own Device (BYOD)

Bring Your Own Device will be defined as a school district policy that allows students to use their own mobile devices in the classroom for educational purposes.

Instructional Staff

Instructional staff will be defined as any person who currently has a teaching license and teaches students. This includes classroom and specialists such as computer resource, library media, and gifted resource.

Personal Device

A personal device for this study will be defined as any student-owned mobile device that can be used to access the Internet. This includes, but is not limited to, laptop computers, tablets, smart phones, and MP3 devices such as an iPod. A device, such as a tablet or laptop, assigned to a student by the school district will not be considered a personal device even though the student uses it in all their classes.

Professional Development

In Title IX section of the No Child Left Behind Act of 2001 defines professional development as activities that "...advance teacher understanding of effective instructional, strategies that [are used] for improving student academic achievement" (U.S. Department of Education, 2002). Although this section states that professional development cannot be a 1-day or short-term workshop, but should be on going and can include mentoring programs or provide follow-up training sessions, this dissertation will consider any training sessions as professional development.

Socioeconomic Status

Socioeconomic status (SES) refers to "...an individual's or family's ranking on a hierarchy according to access or to or control over some combination of valued commodities such as wealth power, and social status" (Sirin, 2005, p. 418). Typically schools are identified as being high SES, middle SES and low SES based on the percentage of students that receive either free or reduced lunch. Schools that have more than 50% of free and reduced lunch will be considered a low SES school.

APPENDIX B

BRING YOUR OWN DEVICE (BYOD) POLICY FOR SCHOOL DISTRICT X

Student/Parent Guidelines for use of a Privately Owned Electronic Device

[redacted] will allow students to use privately owned electronic devices to access the [redacted] wireless network. This wireless access provided to the devices is designed to enhance the students' educational experience and outcomes. Connecting to the [redacted] Wi-Fi network with personal devices is a privilege, not a right, and *it is not a requirement* for division students. Permission to bring and use privately owned devices is contingent upon adherence to [redacted] guidelines. If a privately owned device is used by a student to disrupt the educational environment, in the sole opinion of [redacted], that student's privileges may be limited or revoked.

Answers to frequently asked questions concerning BYOD are available.

Guidelines

1. Students may use a privately owned electronic "Internet ready" device on the [redacted] wireless network with teacher or administrator permission.
2. The use of a privately owned electronic device is to support and enhance instructional activities.
3. Students are prohibited from accessing the Internet using any external Internet service.
4. No privately owned electronic device may be connected to the [redacted] network by a network cable plugged into a data outlet. Network access is provided via Wi-Fi access only.
5. No student shall establish a wireless ad-hoc or peer-to-peer network using his/her electronic device or any other wireless device while on school grounds. This includes, but is not limited to using a privately owned electronic device as a cabled or wireless hotspot.
6. Voice, video and image capture applications may only be used with teacher or administrator permission.
7. Sound should be muted unless the teacher or administrator grants permission for use of sound associated with the instructional activities. A teacher or administrator may permit the use of ear buds or other types of headphones.
8. The privately owned electronic device owner is the only person allowed to use the device.
9. No division-owned academic or productivity software can be installed on personal devices.
10. No student shall use any computer or device to illegally collect any electronic data or disrupt networking services.

11. Devices are brought to school at the students' and parents' own risk. In the event that a privately owned device is lost, stolen or damaged, [redacted] is not responsible for any financial or data loss.
12. Violation of school or division policies, local, state and/or federal laws while using a personal electronic device on the [redacted] wireless network will result in appropriate disciplinary and/or legal action as specified in the *Student Handbook* and *Code of Student Conduct,* School Board policy and regulation as well as by local, state and/or federal law.
13. The school division and school division personnel cannot attempt to repair, correct, troubleshoot or be responsible for malfunctioning personal hardware or software.
14. The school division reserves the right to examine the privately owned electronic device and search its contents if there is reason to believe that school division policies or local, state and/or federal laws have been violated. In the event that a student believes that his/her password has been compromised, he/she should immediately reset his/her password using a school division computer.

Note: The name of school district X has been suppressed for privacy.

APPENDIX C

APPLICATION FOR EXEMPT RESEARCH APPROVAL LETTER

March 20, 2014 Approved Application Number 201401092

Dr. Jennifer Kidd
Department of Teaching and Learning

Dear Dr. Kidd:

Your Application for Exempt Research with Wie Yusuf and Shawn P. L. Hirano entitled "Factors that Influence Adoption of Bring Your Own Device," has been found to be EXEMPT under Categories 6.1 and 6.2 from IRB review by the Human Subjects Review Committee of the Darden College.

The determination that this study is EXEMPT from IRB review is for an indefinite period of time provided no significant changes are made to your study. If any significant changes occur, notify me or the chair of this committee at that time and provide complete information regarding such changes.

In the future, if this research project is funded externally, you must submit an application to the University IRB for approval to continue the study.

Best wishes in completing your study.

Sincerely,

Theodore P. Remley, Jr., J.D., Ph.D.
Professor and Batten Endowed Chair in Counseling
Department of Counseling and Human Services
ED 110
Norfolk, VA 23529

Chair
Darden College of Education Human Subjects Review Committee
Old Dominion University

tremley@odu.edu

APPENDIX D

E-MAIL TO SOLICIT PARTICIPATION IN THE FOCUS GROUP

Focus Group

Shawn Hirano, Doctoral Candidate in the College of Business and Public Administration at ODU, is sponsoring a focus group to find out what factors explain or influence teacher adoption of Bring Your Own Device (BYOD) in middle and high school classrooms.

You are invited to join a small group of teachers to discuss why you use or why do not use BYOD in your classroom. Your participation in this focus group is voluntary and your responses will remain anonymous. There will be a person taking detailed notes of responses during the session. The feedback from this focus group will be used to develop a survey questionnaire given to teachers in several schools across the district.

Time:
When:
Where:

Refreshments will be provided.

To participate in the focus group please call Shawn Hirano at (757) 617-6179 or click the following link: (Survey Monkey link)

APPENDIX E

PRE-FOCUS GROUP QUESTIONNAIRE

Please fill out this brief pre-focus group questionnaire. The purpose of this questionnaire is to identify characteristics of the teachers involved in the focus group. Please **do not** write your name on this form.

Pre-Focus Group Questionnaire

- Including this year, what is the total number of years you have been teaching?
    - 1-5 years
    - 6-10 years
    - 11-15 years
    - 16-20 years
    - 21-25 years
    - More than 25 years
- Including this year, what is the total number of years you have taught in this school?
    - 1-5 years
    - 6-10 years
    - 11-15 years
    - 16-20 years
    - 21-25 years
    - More than 25 years
- What subject(s) do you teach?
- What type of student do you teach?
    - Academy Program
    - Zoned School
    - Both
- Using the scale below, how would you describe your comfort level using technology?
    - Very confident
    - Confident
    - Usually confident
    - Not confident

APPENDIX F

FOCUS GROUP QUESTIONS

Focus Group Questions

- To the best of your knowledge, what type of access do your students have to personal devices they could use under a BYOD policy? How do you determine your students' access?
- Describe how you are using BYOD in your classroom. How often do you use it?
- For those of you who have adopted the BYOD policy into your classroom, can you share why you decided to implement it? What, if any, benefits have you found?
- What are some obstacles to you using BYOD in your classroom?
- What are some of your concerns with using BYOD in the classroom?
- Has your view of BYOD changed since the policy was first implemented last year? If so, how? Why do you think that has occurred?
- Are there any other comments that you would like to add?

APPENDIX G

CODEBOOK

Theme: Advantages

Code	Description	1	2
AV	What are some of the benefits to using BYOD in the classroom?		
AV-1	Allowing students to use their own devices creates buy in for students	X	X
AV-2	Instant Access-Always available and on	X	X
AV-3	Students are more comfortable and productive using their own device	X	X
AV-4	Students are more engaged when using their own devices		X
AV-5	Using their own devices appropriately can help prepare students for when they enter the job market	X	X
AV-6	BYOD is a useful policy because there are not enough school resource available		X

Theme: Student Ownership

Code	Description	1	2
SO	What type of access do your students have to personal devices that they could use under BYOD?		
SO-1	Many students do not own a device		X
SO-2	Some students only have a phone that does not include a data plan	X	X
SO-3	Teachers poll students at the beginning of the year to gage the level of access		X
SO-4	The first use of BYOD in the classroom show who owns a device	X	X
SO-5	Students carry with them multiple types of devices	X	

Theme: Collaboration

Code	Description	1	2
CB	How do teachers share ideas with other teachers?		
CB-1	Professional development	X	X
CB-2	Interactions between colleagues-word of mouth	X	X
CB-3	Social Media-Twitter and Edmodo		X
CB-4	Passed down from Central Office	X	X
CB-5	Through national conferences		X

Theme: Obstacles

Code	Description	1	2
OB	What are some obstacles to using BYOD in the classroom?		
OB-1	Students use the device for non-academic purposes	X	X
OB-2	Network is overwhelmed with all the devices	X	
OB-3	Difficult to implement because there are many different types of devices.	X	
OB-4	There is an expense to using different applications and teachers cannot expect students to purchase those applications to use in class	X	
OB-5	Free applications are too limited to use in classes	X	
OB-6	BYOD implementation depends on the comfort levels of teachers	X	X
OB-7	Many of teachers still have a negative view of BYOD and the need for the policy	X	

Theme: Professional Development

Code	Description	1	2
PD	What role has professional development played in BYOD implementation?		
PD-1	Too much information is presented in professional development sessions	X	
PD-2	Teachers do not have enough time to try new policies, like BYOD	X	
PD-3	Professional development needs to be content specific and presented in a general way	X	X
PD-4	Schools offer a number of professional development classes on technology integration	X	X

Theme: Disadvantages

Code	Description	1	2
DS	What are some of the disadvantage to using BYOD in the classroom?		
DS-1	Traditional teaching strategies are sometimes more effective than allowing students to use their own device in the classroom		X
DS-2	Teachers cannot monitor what students are doing when students are allowed to use their own device	X	X
DS-3	Teachers would feel personally responsible if something were to happen to a student's personal device	X	X
DS-4	Teachers are not familiar with all types of devices and different operating systems	X	

Theme: Policy

Code	Description	1	2
PY	Is the BYOD policy clear to all stakeholders?		
PY-1	Students do not remember and follow all components of the policy	X	X
PY-2	Inconsistent policy implementation between classrooms	X	X
PY-3	Students will bring the device to school despite policy in place	X	X
PY-4	Students feel like they can use it as they see fit since it is their personal property	X	
PY-5	Policy isn't needed because other school devices can be used instead.		X

Theme: Privacy

Code	Description	1	2
PV	What concerns do teachers have concerning privacy in relation to BYOD?		
PV-1	Students do not understand the importance of individual rights to privacy	X	X
PV-2	Inappropriate use such as taking pictures or videos of fights or in other situations	X	X
PV-3	Many students do not have the maturity to use the devices responsibly	X	

Theme: Teacher Responsibility

Code	Description	1	2
TR	What responsibilities do teachers have when implementing BYOD?		
TR-1	Teachers are reactive when something happens rather than proactive when implementing the policy.		X
TR-2	Not really the teachers responsibility to teach ethics in using the devices	X	
TR-3	Easy on teacher because they do not have to borrow school devices. They can have students use their own devices at a moments notice	X	
TR-4	Teachers would have to investigate theft if someone's device is stolen or missing. This could take a lot of time.	X	
TR-5	Teachers do not want to be responsible for inappropriate use	X	X
TR-6	Teachers are not comfortable with using non-school-owned devices in school	X	

APPENDIX H

SURVEY INSTRUMENT

This survey is part of a doctoral research project designed to examine what factors explain or influence teacher adoption of Bring Your Own Device (BYOD) in middle and high schools. The significance of the study will help school districts understand the factors that explain or influence teacher adoption of BYOD.

BYOD for this study will be defined as any student owned mobile device that can be used to access the Internet. This includes, but is not limited to, laptop computers, tablets, smart phones, and MP3 devices such as an iPod.

Previous research about the topic has indicated that there are a number of reasons why teachers choose to implement this policy. Social influence, perceived usefulness, and perceived ease of use are all factors that influence teacher adoption.

Your participation is voluntary and involves completing this survey, which should take about 10-15 minutes. The data will then be summarized with no individual responses being identified for reporting purposes. If you have a concern about a question, you do not have to answer it. At the end of the survey, you will have an opportunity to enter a raffle for a chance to win one of four $50 Amazon gift cards.

By completing this survey, you are consenting to the terms of this research listed above and granting permission for the use of the information in the write-up, presentation, and any publications. All information gathered through this survey will remain anonymous. You are contributing to the knowledge base about how BYOD is being implemented in schools.

Thank you in advance for your time and agreeing to participate in this study. If you have any questions about this study, please contact Shawn Hirano at shira001@odu.edu.

Demographic Data

1. What is your currently teaching location?
    a. Middle School A
    b. Middle School B
    c. Middle School C
    d. High School D
    e. High School E
    f. High School F

2. Including this year, what is the total number of years you have been teacher?
    a. 1-5 years
    b. 6-10 years
    c. 11-15 years
    d. 16-20 years
    e. 21-25 years
    f. More than 25 years
3. Including this year, what is the total number of years you taught in this school?
    a. 1-5 years
    b. 6-10 years
    c. 11-15 years
    d. 16-20 years
    e. 21-25 years
    f. More than 25 years
4. To which group do you belong?
    a. Digital immigrant (born before 1980)
    b. Digital native (born 1980 or later)
5. What subject area(s) do you teach?
    a. Arts (Band, Chorus, Drama, Orchestra, Visual Arts)
    b. English
    c. Foreign Language
    d. Math
    e. PE/Health
    f. Reading
    g. Science
    h. Social Studies
    i. Specialist (Computer Resource, Gifted, Library Media)
    j. Other
6. What type of students do you teach?
    a. Academy Students
    b. Zoned School
    c. Both
7. Using the scale below, how would you describe your comfort level using technology in your classroom?
    a. Very Confident
    b. Confident
    c. Usually Confident
    d. Not Confident

Student Population

8. To the best of your knowledge, what percentage of your students have a device that they can bring to school?
9. How do you determine your students' access to electronic devices?
10. To the best of your knowledge, what type of devices do your students bring to school that they could use for BYOD?

- MP3 Player
- Phone
- Smart Phone
- E-Reader (Kindle, Nook, etc)
- Tablet
- Laptop

Professional Development

11. Please indicate the extent to which you agree or disagree with each statement.
    - My school administrators support teachers using technology in the classroom.
    - My school offers professional development classes on different teaching strategies for all content areas.
    - My school offers technology based professional development classes for all content areas.
    - My school offers technology based professional development that is specific to my content area.
    - After learning a new strategy I use it in class right away.
    - I have enough time to try the strategies that I learn in professional development classes.

Collaboration

12. Please indicate the extent to which you agree or disagree with each statement.
    - After taking a professional development class, I share the new ideas/strategies with other teachers in my department.
    - After teachers in my department take professional development class, they share the new ideas/strategies with me and other teachers.
    - I find ideas/strategies for my classroom on technology on the Internet.
    - I find ideas/strategies on social media sites such as Edmodo or Twitter.
    - I find ideas/strategies on technology on social media sites such as Edmodo or Twitter.

BYOD

13. During the 2013-2014 school year, have you used BYOD in your Classroom?
    - Yes
    - No

14. Have you received training on how to implement BYOD in your classroom?
    - Yes
    - No

15. What type of training have you received on BYOD? Check all that apply
    - District Rules and Policies
    - General implementation strategies
    - Web-based organization tools
    - Web-based applications for student assessment
    - Use BYOD as a reference tool
    - Game based learning
    - Podcasting
    - Digital Storytelling
    - Strategies to prevent cheating
    - Strategies to prevent cyberbullying
    - Other

16. Do you receive follow-up training sessions on how to implement BYOD in your classroom?
    - Yes
    - No

17. Do you think BYOD is a useful resource to use in the classroom?
    - Yes
    - No

18. Please indicate the extent to which you agree or disagree with each statement.

    - Teachers in my school find BYOD to be useful in the classroom.
    - The other teachers in my department find BYOD to be useful in the classroom.
    - Theft of a student's personal device is one of the concerns about BYOD.
    - The feelings of students who do not own a device is one of the concerns about BYOD.
    - BYOD is more difficult to use in class than using school-owned devices.
    - BYOD is more difficult to manage in class than school-owned devices.
    - BYOD takes more time to plan than using school-owned devices.
    - School-owned devices are not always accessible.
    - It is easier to integrate technology into my lessons using BYOD.
    - BYOD supports the lessons/curriculum that I teach.
    - BYOD allows me to differentiate my lessons to all types of learners.
    - BYOD works well with the students enrolled in my class.
    - I design lessons in which BYOD is a necessary component to the lesson

19. How often do you use BYOD in your classroom?
    - Never
    - Once this school year
    - Once a 9 weeks
    - Once a month
    - 2-4 times a month
    - More than 5 times a month

20. Do you allow students to use their own portable electronic devices in your classroom to...? Please rate the following on a scale below
    - Listen to music
    - Look up information on the internet
    - Using interactive applications
    - Poll students to collect data
    - Record video for projects
    - Other

21. Has your view of BYOD changed since the policy was first implemented last year? If yes, how has it changed?

Privacy and Security

22. Please indicate the extent to which you agree or disagree with each statement.

    - The school ensures that teachers understand the division's policy on BYOD?
    - The school ensures that students are aware of the division's policy on BYOD?
    - To the best of my knowledge, teachers who use BYOD in my building frequently review the division's policy and the appropriate use of BYOD with students.
    - I frequently review the division's policy and the appropriate use of BYOD with students.
    - There are measures in place to prevent students from using the device's camera in class.
    - The school has a system in place to prevent cheating when using BYOD in the classroom.
    - The school has a system in place to prevent cyberbullying when using BYOD in the classroom.

APPENDIX I

SURVEY VARIABLE DEFINITION

	Code	Question	Topic	Factor
1	dem_current_location	What is your currently teaching location?	Location	
	dem_level			
2	dem_total_yrs	Including this year, what is the total number of years you have been teacher?	Individual	Faculty Age and Experience
3	dem_yrs_in_building	Including this year, what is the total number of years you have taught in this school?	Contextual	School Culture
4	dem_digital_group	To which group do you belong?	Individual	Faculty Age and Experience
5	dem_subject_area	What subject area(s) do you teach?	Subject	
	dem_subject_area2	What subject area(s) do you teach? (Fixed based on Other)		
	dem_sub_3	What subject area(s) do you teach? (Divided into Core, Elective, Other)		
	dem_subject_area_o	Other		
	dem_subject_area_o2			
6	dem_student_type	What type of students do you teach?	Individual	Perception Of Student Ownership
7	dem_comfort_level	Using the scale below, how would you describe your comfort level using technology in your classroom?		
8	access_byod_access	To the best of your knowledge, what percentage of your students have a device that they can bring to school?	Individual	Perception Of Student Ownership
9	access_determine_access	How do you determine your students' access to electronic devices?		
	access_determine_2	How do you determine your students' access to electronic devices?		

	Code	Question	Topic	Factor
10		To the best of your knowledge, what type of devices do your students bring to school that they could use for BYOD?	Individual	Perception Of Student Ownership
	access_mp3_player	MP3 Player	Individual	Perception Of Student Ownership
	access_phone	Phone	Individual	Perception Of Student Ownership
	access_smart_phone	Smart Phone	Individual	Perception Of Student Ownership
	access_ereader	Ereader	Individual	Perception Of Student Ownership
	access_tablet	Tablet	Individual	Perception Of Student Ownership
	access_laptop	Laptop	Individual	Perception Of Student Ownership
11		Please indicate the extent to which you agree or disagree with each statement		
	pd_adminsupport	My building administrators support teachers using technology in the classroom.	Contextual	School Culture
	pd_strategies	My school offers professional development classes on different teaching strategies for all content areas	Contextual	Professional Development
	pd_allcontent	My school offers technology based professional development classes for all content areas.	Contextual	Professional Development
	pd_mycontent	My building offers technology based professional development that is specific to my content area.	Contextual	Professional Development

	Code	Question	Topic	Factor
	pd_usestrategy	After learning a new strategy I use it in class right away	Contextual	Professional Development
	pd_timetry	I have enough time to try the strategies that I learn in professional development classes	Contextual	Professional Development
12		Please indicate the extent to which you agree or disagree with each statement		
	coll_ishare	After taking a professional development class, I share the new ideas/strategies with other teachers in my department.	Contextual	Collaboration
	coll_othersshare	After teachers in my department take professional development class, they share the new ideas/strategies with me and other teachers	Contextual	Collaboration
	coll_ideasonint	I find ideas/strategies for my classroom on technology on the Internet	Contextual	Collaboration
	coll_ideassocial	I find ideas/strategies on social media sites such as Edmodo or Twitter	Contextual	Collaboration
	coll_techsocial	I find ideas/strategies on technology on social media sites such as Edmodo or Twitter	Contextual	Collaboration
13	use_byod	During the 2013-2014 school year, have you used BYOD in your Classroom?		
14	pd_byod_training	Have you received training on how to implement BYOD in your classroom?		

	Code	Question	Topic	Factor
15		What type of training have you received on BYOD? Check all that apply		
	pd_district_rules	District Rules and Policies	Contextual	Professional Development
	pd_general_strategies	General implementation strategies	Contextual	Professional Development
	pd_org_tools	Web-based organizational tools	Contextual	Professional Development
	pd_student_assessment	Web-base applications for student assessment	Contextual	Professional Development
	pd_reference_tools	Use BYOD as a reference tool	Contextual	Professional Development
	pd_game_based	Game based learning	Contextual	Professional Development
	pd_podcasting	Podcasting	Contextual	Professional Development
	pd_digital_storytelling	Digital Storytelling	Contextual	Professional Development
	pd_prevent_cheating	Strategies to prevent cheating	Contextual	Professional Development
	pd_cyber_bullying	Strategies to prevent cyberbullying	Contextual	Professional Development
	pd_training_o	Other	Contextual	Professional Development
16	pd_followup_training	Do you receive follow-up training sessions on how to implement BYOD in your classroom?		
17	belief_byod_useful	Do you think BYOD is a useful resource to use in the classroom		
18		Please indicate the extent to which you agree or disagree with each statement		
	cult_teachers_useful	Teachers in my building find BYOD to be useful in the classroom	Contextual	School Culture
	cult_other_dept_useful	The other teachers in my department find BYOD to be useful in the classroom	Contextual	School Culture

	Code	Question	Topic	Factor
	belief_theft_concern	Theft of a student's personal device one of the concerns about the BYOD.	Innovation	Privacy and Security
	belief_student_feelings	The feelings of students who do not own a device is one of the concerns about the BYOD.	Individual	Perception Of Student Ownership
	belief_byod_use_diff	BYOD is more difficult to use in class than using school-owned devices	Innovation	Perceived Ease of Use
	belief_byod_manage_diff	BYOD is more difficult to manage in class than school-owned devices	Innovation	Perceived Ease of Use
	belief_more_time	BYOD takes more time to plan than using school-owned devices	Innovation	Perceived Ease of Use
	belief_so_not_assess	School-owned devices are not always accessible	Innovation	Perceived Ease of Use
	belief_integrate_byod	It is easier to integrate technology into my lessons using BYOD	Innovation	Perceived Ease of Use
	belief_support_lessons	BYOD supports the lessons/curriculum that I teach	Individual	Perceived Usefulness
	belief_diff_lessons	BYOD allows me to differentiate my lessons to all types of learners	Individual	Perceived Usefulness
	belief_works_students	BYOD works well with the students enrolled in my class	Individual	Perceived Usefulness
	belief_ness_comp	I design lessons in which BYOD is a necessary component of the lesson	Individual	Perceived Usefulness
19	use_byod_freq	How often do you use BYOD in your classroom	Implementation	

	Code	Question	Topic	Factor
20		Do you allow students to use their own portable electronic devices in your classroom to...?	Implement ation	
	use_listen_music	Listen to music	Implement ation	
	use_lookup_info	Look up information	Implement ation	
	use_interactive_app	Use interactive application	Implement ation	
	use_poll_students	Poll students to collect data	Implement ation	
	use_record_video	Record video for projects	Implement ation	
	use_byoduse_o	Other	Implement ation	
21	belief_view_change	Has your view of BYOD changed since the policy was first implemented last year? If yes, how has it changed?	Individual	Perceived Usefulness
	belief_change_desc			
22		Please indicate the extent to which you agree or disagree with each statement		
	ps_divpol	The school ensures that teachers understand the division's policy on BYOD	Innovation	Policy
	ps_studentaware	The school ensures that students are aware of the division's policy on BYOD	Innovation	Policy
	ps_reviewpol	To the best of my knowledge, teacher who use BYOD in my building frequently review the division's policy and the appropriate use of BYOD with students	Innovation	Policy
	ps_ireview	I frequently review the division's policy and the appropriate use of BYOD with students	Innovation	Policy

	Code	Question	Topic	Factor
22		Please indicate the extent to which you agree or disagree with each statement		
	ps_camera	There are measures in place to prevent students from using the device's camera in class	Innovation	Security
	ps_cheating	The school has a system in place to prevent cheating when using BYOD in the classroom.	Innovation	Security
	ps_cyberbullying	The school has a system in place to prevent cyber bullying when using BYOD in the classroom	Innovation	Security

APPENDIX J

PERMISSION TO USE SPEAK UP DATA

Permission to Use Speak Up Data

Organization Name	Old Dominion University				
Contact:	Shawn P. L. Hirano				
Mailing Address	[redacted]				
City	Norfolk	**State**	VA	**Zip**	23503
Email address	Shira001@odu.edu	**Phone**	[redacted]		
Speak Up Years	2012-2014	**Usage**	Dissertation		
When will data be published:	August 2015				

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Julie Evans
Chief Executive Officer

Date Permission Granted: June 8, 2015

VITA

Shawn P. L. Hirano received a Bachelor of Arts Degree in History from Old Dominion University in December 1996. He received a Master of Public Administration Degree from Old Dominion University in August 2006. He earned a Doctorate in Public Administration and Urban Policy from Old Dominion University in August 2015. Shawn Hirano has been a teacher in public schools since 1997 and is currently an Instructional Technology Specialist for a school in southeast Virginia.