

**A LOOK INTO THE PLANNING PROCESSES OF BRING YOUR OWN DEVICE
PROGRAMS IN K-12 SCHOOLS**

by

David S. Palmer

Bachelor of Arts, University of Pittsburgh, 1995

Master of Education, California University of PA, 2005

Submitted to the Graduate Faculty of
the School of Education in partial fulfillment
of the requirements for the degree of
Doctor of Education

University of Pittsburgh

2017

UNIVERSITY OF PITTSBURGH

SCHOOL OF EDUCATION

This dissertation was presented

by

David S. Palmer

It was defended on

May 8, 2017

and approved by

Dr. Jennifer Russell, PhD, School of Education

Dr. Robert Furman, EdD, South Park School District

Dissertation Advisor: Dr. Cynthia Tananis, EdD, Associate Professor, Administrative and
Policy Studies

Copyright © by David S. Palmer

2017

**A LOOK INTO THE PLANNING PROCESSES OF BRING YOUR OWN DEVICE
PROGRAMS IN K-12 SCHOOLS**

David S. Palmer, EdD

University of Pittsburgh, 2017

This study examines the planning and preparation areas of three K-12 school districts in southwestern Pennsylvania in preparing to implement a Bring Your Own Device (BYOD) program. The study examines the structural and cultural planning areas of security of information, infrastructure readiness, stakeholder buy-in, policy and practice, professional development, sustainability, equity concerns, potential impacts and potential issues. Each of these areas is examined through a review of literature on BYOD preparation and the research study examines the experiences of three K-12 school districts. The data was collected through semi-structured interviews with the superintendents, technology directors, teacher and parents of each of the three participating school districts. The study also compares the perceived versus the actual results of the planning process for each of the three school districts and identifies areas each district viewed as vital to other districts considering a BYOD initiative.

TABLE OF CONTENTS

PREFACE.....	IX
1.0 INTRODUCTION.....	1
1.1 PROBLEM OF PRACTICE.....	3
1.2 RESEARCH QUESTIONS.....	4
2.0 REVIEW OF LITERATURE	6
2.1 SECURITY OF INFORMATION	7
2.2 STAKEHOLDER BUY-IN	10
2.3 POLICY AND PRACTICE	12
2.4 PROFESSIONAL DEVELOPMENT	14
2.5 SUSTAINABILITY	16
2.6 EQUITY CONCERNS	18
2.7 POTENTIAL IMPACTS	19
2.8 POTENTIAL ISSUES AND CHALLENGES.....	21
2.9 CONCLUSION	23
3.0 APPLIED INQUIRY PLAN	24
3.1 INQUIRY SETTING.....	24
3.2 STAKEHOLDERS	25
3.3 INQUIRY APPROACH.....	26

3.4	RESEARCH METHODS AND DESIGN.....	28
3.5	DATA ANALYSIS PREPARATION	29
4.0	DATA, ANALYSIS AND FINDINGS.....	31
4.1	DATA ANALYSIS.....	32
4.2	FINDINGS.....	34
4.2.1	Research Question 1: What are the areas of planning and focus when considering implementation of a BYOD program?	34
4.2.2	Research Question 2: What are the perceived and actual benefits of a BYOD program?	39
4.2.3	Research Question 3: What are the perceived and actual challenges or problematic areas of a BYOD program?	41
5.0	CONCLUSIONS AND RECOMMENDATIONS.....	44
5.1	CONCLUSIONS.....	45
5.2	RECOMMENDATIONS	46
5.3	LIMITATIONS AND FURTHER INQUIRY.....	47
6.0	IMPLICATIONS	49
7.0	REFLECTION	54
	APPENDIX A.....	56
	BIBLIOGRAPHY	62

LIST OF TABLES

Table 1. Data collection and analysis procedures	30
Table 2. Alignment of Identified Categories, Interview Questions, and Research Questions.....	33
Table 3. Comparison of School Districts on Perceived Benefits of a BYOD Program.....	39
Table 4. Comparison of School Districts on Actual Benefits of a BYOD Program.....	40
Table 5. Comparison of School Districts on Perceived Challenges of a BYOD program	41
Table 6. Comparison of School Districts on Additional Challenges of a BYOD Program.....	43

LIST OF FIGURES

Figure 1. Diagram of how access points, routers, modems and devices can connect on a network (Image, 2016).....	8
--------------------------------------------------------------------------------------------------------------------	---

PREFACE

First, I would like to thank my wife and daughters for their support and encouragement throughout this process. They never gave me grief when I missed concerts, games, practices and family time. I also want to thank my mother, who always believed in me and always reminded me to do my best and keep my chin up. Second, I want to thank my advisor, Dr. Cynthia Tananis. She was always straight forward with a dry sense of humor that matches my personality to a tee. She kept me and all her advisees on track and was always available to help review drafts and revisions. Lastly, I want to thank Dr. Jennifer Russell and Dr. Robert Furman for sitting on my doctorate committee and taking the time read, review and provide feedback throughout this academic journey.

1.0 INTRODUCTION

The 21st century has brought new innovations within the K-12 school setting; however along with these innovations have come challenges. New technologies now challenge the way schools define knowledge, who are considered content experts and the methods which students can receive and convey knowledge (Stanley, 2016). The expectations for the 21st century student far surpass those in prior times, especially in the area of technology (Carey, 2013). Students need to demonstrate mastery and comfort with digital age literacy, inventive thinking, effective communication and high productivity (Stanley, 2016; November, 2001). Current K-12 schools are tasked with ensuring each of these new skills are mastered by all students in order to give them the skills necessary to be competitive in the global workplace and/or higher education. Having these skills is not considered an advantage, but rather a requirement (Kelly, McCain & Jukes, 2009). Technology use in the 21st century classroom has changed the way teachers teach, students learn and how districts spend resources (Armstrong, 2014).

The challenge for K-12 schools lies in finding ways to provide the necessary access to technology for all students and staff in an era of shrinking school district budgets. In addition, technology is advancing so quickly, it makes it even more challenging for schools to stay current. In 1965, Gordon Moore, the co-founder of Intel, theorized that approximately every two years processing power would double due to an increase in the number of transistors per square

inch on integrated circuits. This became known as Moore's Law and has been readily observed to be true since 1965 thus helping to explain the rapid technological progress over the past forty years (Mulay & ebrary, 2016). The 21st century student is a digital native and has come to want and expect instruction to include technology; it is ingrained in their daily lives and makes little sense to not include it in their formal education (Griffin, Care & SpringerLink, 2015). Armstrong (2014) also adds that today's digital natives consider paper, pencils and textbooks a very traditional approach, but giving these same students a keyboard or touchpad is more likely to elicit a positive attitude turning students into explorers and the teachers into guides. According to a national survey of students, 85% of high school students have access to an iPod, 70% have access to a laptop/tablet/netbook and 67% had a cellular phone (Project Tomorrow, 2010). Further reinforcement of the vast amounts of available technology is the over four billion mobile phones in circulation worldwide, smartphones surpassed PC shipments in 2011, application based internet usage surpassed desktop web access and the cost of mobile phones continues to decrease (Norris & Soloway, 2011). Despite the availability of these technologies outside of the classroom, there is a large gap between mobile technology uses at home and in schools; in fact less than 10% of this mobile technology on average is used in the classroom (Armstrong, 2014). The hurdle for K-12 schools to incorporate technology in daily learning is a common problem that spans across the United States and does not differentiate between where or what type of district (Kelly, McCain & Jukes, 2009).

1.1 PROBLEM OF PRACTICE

Schools are adopting Bring Your Own Device (BYOD) practices, also known as Bring Your Own Technology (BYOT), to assist in increasing access to technology opportunities while helping to address the monetary restrictions of today's public school budgets. Bring your own device refers to a technology model that permits students to use personally owned technology devices at school for the purposes of learning. Within a BYOD program, instead of the students using only school owned devices through class sets of laptops, tablets or access in computer labs, students are permitted to use their own technology devices (Hockly, 2012).

Technology devices that can be part of a BYOD program and brought to school are, but not limited to, laptops, netbooks, iPads, iPods, tablets, E-readers and smartphones (Eisele-Dyrli, 2011). In a BYOD program, digital devices are still purchased by school districts; but by students having the option to use their own technology to complete class projects, access digital learning resources, record audio or video pieces, take class notes and carry out specific tasks assigned while at school; schools are able to budget for fewer devices, thus saving money while student access is expanded.

Getting the technology devices into the schools is only one step of many in implementing a BYOD program. There are other factors that may be examined and need addressed, such as security of information, wireless network infrastructure readiness, buy-in from stakeholders, acceptable use policies and practices, planning and professional development for faculty and strategies for sustainability. In addition, schools also have to consider technical support of non-standard devices, equity concerns, classroom management and pedagogical approaches (Dahlstrom & diFilipo, 2013). Additional considerations for schools regarding bring your own

device programs are if the program will deepen the digital divide, will lessons need to be geared towards the weakest student device, potential student distraction, expert technology knowledge expected of teachers, students exposed to and engaging in dangerous activities and all software and applications will need to be standardized (Nielsen, 2011).

The goal of this inquiry to is gather additional information and a broader understanding of BYOD programs, specifically the planning and preparation processes, from the schools found in the southwestern corner of Pennsylvania. This data will assist in creating guidelines for schools to use as a reference as they begin to research the steps and planning needed to consider implementing a Bring Your Own Device program within their district buildings. Bearing in mind that every district has unique characteristics, stakeholders and situations, the data collected within this inquiry will provide generalized data and may not be applicable in all districts. It will help identify trends and common themes within each of the districts involved within the inquiry.

1.2 RESEARCH QUESTIONS

In order to gain a deeper understanding of the planning steps conducted by districts when they considered a Bring Your Own Device program to their respective schools/districts, the following research questions will serve as a framework that will guide this exploration:

1. What are the areas of planning and focus when considering implementation of a BYOD program? (The intent of this question is to produce a list of areas that need to be considered during the planning of a BYOD program by the members of a technology committee.)

2. What are the perceived and actual benefits of a BYOD program? (The intent of this question is to produce a list of benefits, both real and imagined, to better assist in understanding the importance of a thorough planning process when considering this type of program.)
3. What are the perceived and actual challenges or problematic areas of a BYOD program? (The intent of this question is to produce a list of challenges, both real and imagined, that will enhance a deeper understanding of the impacts of a BYOD program.)

When looking at the inquiry questions as a whole, the overarching goal is to gain a deeper understanding and appreciation of the perspectives of district leaders in the southwestern corner of PA who either have experienced planning and implementing a BYOD program or similar program or at the very least have perspectives that can add to the depth of this problem of practice.

2.0 REVIEW OF LITERATURE

Bring Your Own Device programs were first introduced by the Intel Corporation in 2009 when management noticed an increase in the number of employees using their personal devices during work hours. In an attempt to lower costs and increase productivity, the company unveiled the first BYOD program. Despite the security concerns, in addition to others with the BYOD programs, employees in the business world have seen sharp increases in companies adopting similar practices (Darrow, 2012). BYOD programs in K-12 schools have increased in recent years, but the research in the area of implementation is still one that is emerging. Because every school district has unique characteristics and communities, it is unlikely that there is a universal, foolproof blueprint that will guarantee successful planning and preparation of a BYOD program.

Each of the planning areas can be categorized into a structural and/or a cultural category. Structural areas are typically the nuts and bolts of the system and are essential to the operation of the system and are typically accepted due to having little observable impact on day to day routines. Security of information, infrastructure readiness and policy adjustment fall into a structural category. Cultural areas are considerable more complicated and require a shift in thinking from school faculty, staff and community members because they could change the culture of the setting. These shifts in thinking are not always readily accepted and may take more planning and explanation before the change can occur. Stakeholder buy-in, daily practices,

professional development for staff, and equity are planning areas that can be categorized as cultural. It is important to note that some of the planning areas have parts that can possibly fall into both structural and cultural categories.

2.1 SECURITY OF INFORMATION

Security of information is one of the initial concerns that must be considered when looking into a BYOD program and includes infrastructure, bandwidth, wireless networks, access points, and filters. Schools must provide users the opportunity to safely and securely use devices and the capacity to store content without compromising the devices themselves or network information stored within the system. In a wireless local area network (WLAN), an access point is a device that allows wireless devices to connect to a network and is typically hardwired to network switches or modems (Siddavatam, 2011). A wireless local area network (WLAN) is a wireless network that links two or more devices using a wireless connection located within a limited area such as a school (Siddavatam, 2011). See Figure 1.

All Computers are on the same netsegment, and can see each other

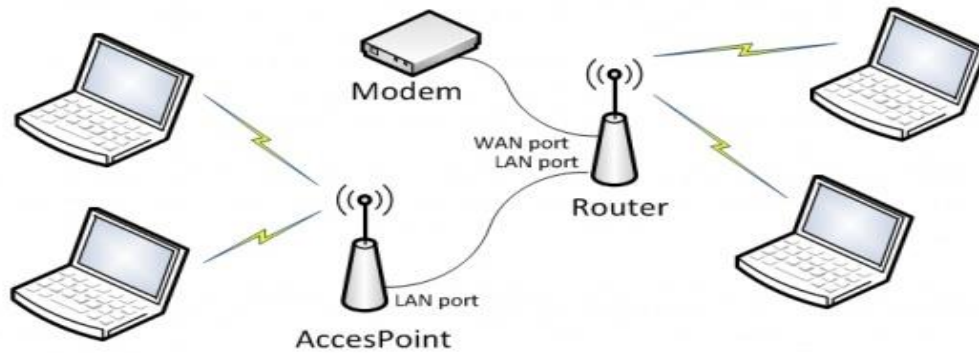


Figure 1. Diagram of how access points, routers, modems and devices can connect on a network (Image, 2016)

Access points are stations that transmit and receive data (sometimes referred to as a transceiver). An access point connects users to other users within the network and also can serve as the point of interconnection between the WLAN and a fixed wire network. Each access point can serve multiple users within a defined network area; as people move beyond the range of one access point, they are automatically handed over to another access point.

Bandwidth can be defined as the total range of frequency required to pass a specific signal that can carry a specific amount of data without distortion or loss of the data (Armstrong, 2014). Bandwidth is commonly connected with how fast a network is able to deliver data and information. Network filters are used to limit access to a server on a network or limit access to specific websites that are listed as restricted by the network administrator (Raths, 2012). Each of these components have a cost connected and schools must weigh that cost against the level of security and access desired for their network and users.

There are multiple approaches to addressing security concerns stemming from a BYOD program. New Canaan High School in Connecticut curbed their security concerns by having their students register their Apple devices within the school network allowing the school to monitor each device individually (Ullman, 2011). Alvarado Independent School located in Texas verifies all devices and users by requiring a sign-in step and users agree to connect to the school network which updates all machines with antivirus tools making them secure for the network much like guests at a hotel (Ullman, 2011).

Hanover High School in Pennsylvania began strengthening their wireless network in anticipation of moving to a 1:1 initiative in their 500 student building, but due to financial constraints moved to a BYOD program and continually upgrades their wireless network in order to ensure the network can support the growing demand from staff and students (Raths, 2012). It is recommended that school districts place BYOD traffic on a separate, dedicated virtual network separate from the district's own network thus eliminating the chance of BYOD devices accessing budget or human resources data (Raths, 2012). Jordan School District located in Utah, which serves approximately 50,000 students, found the best way to assist with the security concerns were to use a vendor site survey and network design tools to assist in calculating the amount of bandwidth needed and where the optimum places for access points to be placed within each school (Raths, 2012). By doing this, the district was able to solve the issue of incompatible equipment and the accompanying radio interference experienced throughout the district.

When looking at the technical and security concerns associated with a BYOD program, district leadership needs to decide on one of three options: outsource the security project to an information technology company, employ consulting assistance or address the security concerns as a do-it-yourself project. Regardless of the option, the security framework that districts need to

focus on are capacity vs. coverage, directory services, device registration, role based access control and application-level filtering (Raths, 2012).

2.2 STAKEHOLDER BUY-IN

Involving and creating partnerships with all stakeholders can create "buy-in" and promote the success of any potential program including a BYOD program. A stakeholder is any individual or group that can be impacted by the program. In the case of a BYOD program in a school district, the list of stakeholders can include the superintendent, principals, supervisors, curriculum directors, parents, students, teachers, technology departments, members of the community, business owners and the school board of directors. These stakeholders must be well informed and recognize the benefits and importance of the initiative because its impacts will reach beyond the classroom and school buildings. All stakeholders can contribute to the success of the program and this support can help maximum the program's effectiveness (Prensky, 2010).

Forsyth County Schools located in Georgia, which are widely considered the most successful BYOD program in the country, cites the biggest challenge in implementing its BYOD program was explaining the value to parents. In the early stages of the program, not all students had a mobile device, but through open and frequent communication through community partnerships, parents have bought in to the program and now ask the schools which devices they should buy for their children (Lacey, 2014). In addition the Forsyth Parent Teacher Association (PTA) and school council gave multiple presentations on how BYOD can improve teaching and learning, keep students safe by employing a filtered wireless network, and knowing that most

families had unfiltered networks at home, teachers taught lessons on safe and appropriate internet use both in and out of school.

Katy Independent School District in Texas fully implemented their BYOD program in the fall of 2010 and strengthened their partnerships with parents by having the teachers email parents prior to the start of the school year to let them know exactly what their students would be doing on their devices and listed the specific applications that needed to be downloaded (Lacey, 2014).

Providing education through frequent communication between teachers and administrators regarding the benefits of a BYOD program is the approach taken by the Fairfax County Schools in Virginia. School officials recognized there are always individuals who will resist change and others will lead the way with a BYOD program. The district identified teachers and administrators who could lead the initiative and created partnerships with those individuals by creating model schools and model classrooms as a resource for those who were reluctant or had questions about the program. In addition there were frequent communications with parents about the learning and projects being completed with the devices thus having parents realize the power of the BYOD program and as a result parents pushed the teachers to use them more frequently in their daily instruction. As a final piece of the program's communication with stakeholders, the district employed a survey to gather student, parent and teacher expectations for the program and devices (Lacey, 2014).

Having a well communicated, shared and common goal is essential in planning a BYOD program in a school district. Recognizing that every stakeholder's contributions may affect the program as a whole, it is vital that everyone understands the benefits of the program (Hockly, 2012). The partnerships formed through this process will provide an opportunity for all to be

involved and excel, and students will be enabled to make connections between school and real life applications.

2.3 POLICY AND PRACTICE

Permitting students to use their personal electronic devices in classrooms and schools requires districts to examine their Acceptable Use Policy as well as the student code of conduct portion of the student handbook (Harris, 2012). Open communication to all students, parents and teachers of these changes due to the BYOD program is essential in securing partnerships and increasing the likelihood of implementation (Harris, 2012). Because students will have increased autonomy, school districts will need to develop policies and practices that teach students proper usage of devices to increase learning while providing a safe learning environment that protects them against potential dangers of using the internet as defined by the Children's Internet Protection Act, also known as CIPA (Quillen, 2011).

Policy development is an important aspect to consider with a BYOD program and must include financial liability of personal devices because these devices are student, not district, owned. Some of the questions that should be considered when developing new policy are: Who is responsible if a device is lost, stolen or broken while at school? Who will repair the devices if it malfunctions? Will the school confiscate a device if the student violates the acceptable use policy? (Harris, 2012). Districts that have implemented BYOD programs have found that developing explicit acceptable use policies (AUP) and communicating those expectations very clearly to parents, students and teachers are essential in the planning process (Lacey, 2014).

Those same expectations set in the acceptable use policy will assist classroom teachers in setting expectations within their classrooms, helping faculty define their classroom management guidelines.

When Forsyth County Schools in Georgia implemented their BYOD program, students were required to sign a 46 point acceptable use guideline. As time passed and students no longer violated the AUP, the policy was reduced to five "I will" statements. Examples of these statements are "I will use digital devices, networks and software in school for educational purposes and activities" and "I will keep personal information, including user password, private." In addition the district allowed student access to some previously block sites and students no longer had to use a sign-on name and password to sign onto the network (Lacey, 2014).

In planning for a BYOD program, teachers, administrators and technology department members collaborated to decide how the program would work in the Fairfax County Schools in Virginia. Upon drafting a framework of the program, it was sent to the district's legal department to ensure the plan is consistent with other district policies and regulations. Some of the parts of the Fairfax County AUP includes a requirement that all teachers must use their district e-mail addresses when interacting with students, both students and parents are required to sign the AUP, students agree to connect to only the school district wireless network, all student owned devices must have updated virus protection software installed prior to connecting to the district network, students will not download illegal material, students must register their devices with the make, model and serial number with the district, each student is permitted to register up to three devices and the district accepts no responsibility for the safety or security of devices (Lacey, 2014).

Because BYOD programs are a relatively new concept within schools, many districts are piloting small scale programs to assist in identifying and ironing out problems with policy and

practice within the program. By using this small scale trial and error approach, districts may be able to gain valuable information to assist in developing or amending existing policies and practices prior to full scale implementation (Quillen, 2011).

2.4 PROFESSIONAL DEVELOPMENT

Today's classroom has shifted from the teacher-centered style to one that puts the attention squarely on the student through various types of learning such as student-centered, problem-based, project-based, case-based, inquiry-based, active learning, constructivism, and learn by doing (Prensky, 2010). With this shift in focus from the teacher to the student, the teacher's role is more important than ever. Teachers must lay a solid foundation for students to acquire the needed skills because technology makes information easily accessible. Teachers are needed to pose higher order thinking questions and skills that promote critical thinking, problem solving, analysis, application of new information and collaboration. Not all teachers are instinctive users of technology, so this new challenge can be a significant one (Hockly, 2014).

Professional development is an area of planning that districts also need to examine when planning for a BYOD program to provide the faculty with effective training and technical support. Professional development provides training to staff that assist in each individual gathering, developing, applying and honing the skills necessary to assist students in reaching learning outcomes. Professional development can come in many forms such as workshops, conferences, webinars, graduate classes, and professional learning communities to name only a few. Bring your own device programs increase student access to technology within the

classroom, thus the need for teachers to expand their knowledge and skill sets with technology becomes essential to support increased student achievement. When teachers are able to implement technology within the classroom, it enhances creativity, collaboration and partnership among the students and staff (Puente, 2012).

One of the main reasons Forsyth County Schools in Georgia has found success with its professional development program in implementing a BYOD program is the use of instructional technology specialists (Lacey, 2014). There is an instructional technology specialist, who acts as a coach and mentor, at every school who goes into the classrooms and models the use of technology tools for both the teachers and students. Teachers have accepted the fact that the students can become the teachers in some instances with using various technologies and applications.

Professional development programs can greatly vary from district to district however there are some commonalities that each may contain. Generally each district may consider a program that will assist teachers in successfully integrating the use of devices in their lessons in a pedagogical sense, how to manage student pairs and groups using devices, the technical aspects of managing multiple devices in the same classroom (classroom management), adjusting pedagogy, instructional aspects of project-based learning, developing and using rubrics, and how to create post activities for students (Hockly, 2012).

Carson City School District in Nevada had their technology department specialists lead 45 hours of professional development for teachers and administrators prior to the rollout of their BYOD program. The professional development plan for the district involved four targets that provided training in implementing uniform online curriculum and assessment tools, establishing a program to facilitate integration of 21st century skills leading to a computer literacy

endorsement, develop professional development opportunities based on data collected from the district classroom observation tool and sustain district technology integration and provide technology implementation assistance at site level. Students were also included in the training and were given classes on digital citizenship and the proper use and expectations of the devices.

Broward County Public Schools in Florida provided their initial professional development the summer prior to the rollout and encouraged parent and community members to attend. The professional development continued throughout the school year where professional learning communities were formed to discuss what was going right, and wrong, with the BYOD program in the classrooms. (Professional Media Group, 2014).

The purpose of professional development is to increase personal growth, knowledge, expertise and awareness by impacting and adding to core knowledge that will lead to increased student achievement. Offering thorough, appropriate and on-going professional development for teachers may contribute to an effective BYOD program and eventual implementation.

2.5 SUSTAINABILITY

Planning for sustainability is another identified area that districts should include in their preparation prior to implementing a BYOD program. One method of thinking for providing long term sustainability is districts could shift funds from textbooks and other supplies and dedicate that funding towards supporting technology initiatives for 21st century learning (Puente, 2012). The financial options will vary greatly from district to district as funding formulas, revenues and expenses can widely differ.

With any new initiative, providing sustainability is a necessary component for long-term achievement. Districts need to realize that after implementation of a BYOD program, there are on-going costs such as monitoring, maintaining and upgrading the infrastructure. School leaders must carefully select hardware and software that is affordable and meets the needs of the students and staff as budgets tighten and technology expands. Eighty percent of school districts predict they will have flat or declining technology budgets in the next several years, thus making sustainability more challenging (Armstrong, 2014). In addition, the professional development for the faculty needs to be on-going to lend additional support to the program which comes at a cost. Although there are no definite funding solutions for K-12 schools regarding technology in the 21st century, schools may approach funding mobile learning using BYOD programs, resource re-allocation and finding support through grants and community partnerships (Herro, Kiger & Owens, 2013). Mobile learning is broadly defined as the ability to access educational resources, tools and materials at anytime from anywhere using a mobile device (Groupe Speciale Mobile Association, 2010). Many schools are using mobile phones as tools to provide digital media access, increase app based learning, increase communication and collaboration skills, and enhance opportunities for immediate learning (Project Tomorrow, 2011; Shuler, 2009).

Some school leaders have been able to add line items for technology in the school district budget which can be an essential component in insuring the sustainability of a BYOD program and the associated costs. A bring your own device program can reduce overhead costs because purchasing devices could be reduced to a nominal amount, while providing students with opportunities that would not otherwise be available in a traditional setting.

2.6 EQUITY CONCERNS

Another question that often arises with BYOD programs is one of the schools being able to address equity. One drawback of BYOD could be that not all students will possess their own devices (Armstrong, 2014). Some districts have the resources to provide extra devices to students, but each district must examine their policy and practices regarding every student having access to technology.

Forsyth County Schools in Georgia has 20% of students who receive free and reduced lunch and many cannot afford to purchase their own electronic devices. The district uses Title I funds to purchase devices for these students (Lacey, 2014). In addition the district realized many students did not have access to the internet at home, so they connected parents to programs which provides low-cost internet access to low-income families. The district also partnered with local businesses which had free wireless connection to place stickers in their windows so students knew they could connect to the internet using the business's wireless connection.

This is just one example of the ways schools can address the issue of equity in students being able to access technology both in and out of schools. Although these items can be done, they could be insufficient in leveling the playing field for all students. Internet speed, software, functionality and ownership of devices can still deepen the digital divide among students varying in socio-economic status.

Obtaining resources is a key piece in the idea of access to information technology. Schools and individuals are able to obtain devices at varying rates. The rate at which equipment is obtained impacts an individual's ability to gain access to information technologies, especially in an educational setting (Marginson, 1993). This discrepancy in the availability of

resources is a significant barrier to equitable educational practice and consequently the equal mastery of technology skills among all students.

When schools are appropriately managed and funded, the equity divide that is created by the personal ownership of devices can be alleviated. Differing home situations, the value given to technology and education at home and the availability of technology within the home, is beyond the scope of schools, however, addressing inequality within educational environments can contribute to a more equitable distribution of equipment for those students. The unequal distribution of resources is experienced across different schools, among individual students and individually between the school and home environments. Until schools are able to better solve inequity issues, the digital divide in regards to students will deepen.

2.7 POTENTIAL IMPACTS

Today's learners have technology infused in their daily lives and K-12 schools can use this understanding to help expand and improve student learning by opening up more real, rigorous and relevant learning experiences for students while allowing for higher order thinking questions to be posed by teachers (Raths, 2012). An area that may determine if a district wants to pursue a BYOD program is the potential impacts the program could have on the staff and students. In a study conducted by O'Sullivan-Donnell (2013) revealed that a BYOD program promoted student and teacher collaboration, project based learning and presentations, increased student engagement and motivation as perceived by teachers, and promoted differentiated instruction. In addition to increasing student engagement, mobile learning can also enhance the teaching of 21st

century skills, such as digital citizenship and literacy, collaborative learning, teamwork, inventive thinking and high productivity. Its also allows for instant checking for understanding with student response applications (Williams, 2012). Sucre (2012) also points out a BYOD program increases student engagement in academic classes because students are familiar with their own devices that are linked to what they are doing in school, additional technology benefits classrooms where the technology was not previously available, and it provides students an opportunity to link their lives with the content they study.

BYOD programs can also increase productivity and overall happiness which can lead to a better school culture (Caldwell, Zeltmann & Griffin, 2012). In addition BYOD programs can also reduce potentially costly expenses of hardware and maintenance from a school's budget and free up money to be spent elsewhere. Having fewer school owned devices within the schools frees up technology department staff thus saving time and money (Caldwell, Zeltmann & Griffin, 2012).

Through the potential increase in technology access provided by a BYOD program, students will have the opportunity to apply problem-solving skills, critical thinking skills, collaboration skills, and self-assessment which can lead to improved self confidence and a life-long love of learning (Sucre, 2012). BYOD programs are ideal for student personalization which makes it possible and beneficial to incorporate and allow students to use the technology they are already comfortable using (Beach, 2014). The teacher would not be assessing a PowerPoint presentation, but rather the mastery of the curriculum knowledge and the student's ability to effectively communicate (Beach, 2014).

Forsyth County Schools in Georgia had an unexpected benefit from their BYOD program, they experienced a decrease in disciplinary problems due to increased student

engagement and students not wanting to lose their BYOD privileges (Lacey, 2014). Professional Media Group LLC (2014) examined the impacts of BYOD programs on four schools located in Kansas, California, Nevada and Florida. School officials in Goddard Unified School District in Kansas also experienced increased student engagement while giving teachers an easier way to make learning more fun. Carson City School District in Nevada saw an increase in student engagement with a sharp increase in students collaborating and contributing to lessons. Officials at Broward County Public Schools in Florida saw an increase in student attendance and engagement while a significant drop in behavioral issues. In addition, the district has reported fewer issues with breakage of devices. East Side Union School District in California notes that in the first semester of their BYOD program, attendance had increased substantially and 75% of students were not failing a single class. Tech savvy students enjoy sharing their knowledge with those who are struggling and intimidated, helping them gain a sense of importance and satisfaction by assisting others while gaining the appreciation of teachers (Armstrong, 2014).

2.8 POTENTIAL ISSUES AND CHALLENGES

Software World (2012) conducted a survey of information technology managers which revealed fears around hidden costs of deployment, class divides and evidence using BYOD to pacify staff. Eighty two percent of the 232 managers who were involved in the survey who had implemented a BYOD program stated they had seen visible improvements in staff morale. However 48% of those surveyed thought BYOD would cost the company in the long run citing that the program will be more expensive to run and may not boost productivity. In addition, technology directors

find BYOD unattractive as they would struggle with managing additional bandwidth demands and different operating systems and licensing issues. Some directors also stated they did not believe BYOD reduces costs, but rather creates rising costs due to the company needing to purchase devices for staff, upgrades to the network infrastructure and security, and device management.

Systems administrators also caution to properly support students, devices will need good warranties to protect against defects and damage and need to be insured to ensure they can be replaced in the event of loss or theft (Sucre, 2012). Another concern mentioned is the different configurations from multiple student devices and repair work on these devices can be lengthy and costly and could lead to students missing work and lack of productivity which may be an unavoidable consequence that should be anticipated in the planning process. Caldwell, Zeltmann and Griffin (2012) add mobile phones and tablets are easily stolen and any data, passwords or e-mails on a device can be accessed by anyone thus compromising data and losing information.

In addition, other concerns for individuals participating in a BYOD program are personal devices can be subject to a discovery request in legal cases involving schools or companies, users could experience personal data loss, personal privacy could be surrendered, devices could be seized and loss of use could result depending on the terms of the acceptable use policy.

2.9 CONCLUSION

All schools have the monumental responsibility of preparing all students in becoming productive members and citizens in their respective communities. Although school districts vary in situation, resources and community partnerships, they share that same responsibility. Keeping this goal in mind, schools have to change their perspectives from a problem based outlook to an opportunity based outlook. Kelly, McCain and Jukes (2009) remind us that today's schools can no longer operate in the Industrial Age when many were founded, but rather need to morph into the Informational Age in order to give today's student the education they need and demand.

When looking at technology access for today's 21st student, schools need to find the appropriate program and realize it is vital that the planning be comprehensive and potentially include, but not necessarily limited to, security of information, infrastructure readiness, stakeholder buy-in, policies and practices, professional development, financial strategies for sustainment and addressing equity concerns when considering a BYOD program to deliver technology access to all students.

3.0 APPLIED INQUIRY PLAN

The applied inquiry plan outlines the setting, stakeholders, approaches and methodology for this inquiry. Although Bring Your Own Device programs have been in schools for several years, there is still varying opinions on these programs and how to properly plan for implementation. This inquiry seeks to gather additional perspectives from school leaders that have experienced a similar technology initiative within their respective school districts.

3.1 INQUIRY SETTING

The setting is not specific to one location with this scope of inquiry, but rather a cross section of varying school types that have implemented and/or are currently employing a BYOD initiative. Schools located within the service areas of the Allegheny Intermediate Unit (AIU3), Intermediate Unit 7 (IU 7) and Intermediate Unit 1 (IU1) were the targeted districts in the collection of data. The AIU3 services 42 schools located in Allegheny County, IU7 services 17 schools in Westmoreland County and IU1 services 36 schools located in Washington, Greene and Fayette Counties. Each of these school districts is located in the southwestern corner of Pennsylvania. Within each of the intermediate units, the schools vary in size, demographics, student achievement levels and include urban, suburban and rural settings.

Each of the schools may vary in the technology available for students to access; some may have computer labs, mobile laptop carts, 1:1 initiatives and/or Bring Your Own Device programs to list a few. In addition, these available technologies vary in capacity, speed and age. Each district also has local policies and practices regarding student technology in the schools. Small, rural school districts may not have the same structures or resources but have the same obligation to their students as large suburban and urban districts - to prepare them for the next stage of their lives by giving them all of the necessary skills and knowledge required by society as a whole, including access to technology (Kivunja, 2014).

3.2 STAKEHOLDERS

The stakeholders within the scope of this issue are students, teachers, district administrators, parents and the community of taxpayers within each district. Twenty first century skills require that all students demonstrate mastery in research, innovation, collaboration and digital citizenship (Stanley, 2016). The idea of students needing to demonstrate mastery and comfort with digital age literacy, inventive thinking, effective communication and high productivity is not a new expectation; these skills were identified in the late 1990's (November, 2001). Education in the 21st century is constantly changing with the stakeholders facing many unknowns while schools struggle to prepare students for careers that have yet to be created in a financially responsible manner (Carey, 2013). Twenty first century students are considered digital natives and are requesting to use the technology they have known since birth while educators are seeking guidance and professional development on how to effectively use these

new tools when delivering instruction (Carey, 2013). For this inquiry, the stakeholders that were the initial focus are the district technology leaders, specifically the superintendent and the technology director of their respective districts as they are typically the facilitators of planning and steering committees regarding any new initiative with such broad reaching impacts. Additional stakeholders that were identified by the superintendents were parents and teachers who are considered vital in the planning process to gain a deeper and broader understanding of various stakeholder perspectives in each of the districts.

3.3 INQUIRY APPROACH

The purpose of this inquiry was to develop a deeper understanding of the context of practice involving the planning process of districts when considering implementation of a BYOD program by interviewing various stakeholders in school districts that have planned and implemented a BYOD program. The various perspectives of district leaders gave a wide range of first hand experiences and well educated opinions regarding technology challenges and changes that each experienced. Because of the wide range of district types, sizes and demographics, the inquiry provided a good cross section on the similar and differing perspectives regarding the planning steps needed when considering a BYOD program. This study used semi-structured interviews to gather data on BYOD planning perspectives of traditional school district leaders. The goal was to interview the planning committee members including, superintendents, technology directors, parents and teachers of districts currently employing a BYOD program within the targeted areas within IU1, AIU3 and IU7. This qualitative research study used one-

on-one, semi-structured interviews with superintendents, technology directors, teachers and parents from three western Pennsylvania school districts who currently employ or have implemented a Bring Your Own Device program within their schools. This method was used to collect data from a total of 11 participants. The qualifying school districts were identified from an intermediate unit survey conducted two years earlier on technology initiatives being used. The survey identified a total of 11 school districts that either currently use or have used a BYOD program. The superintendents of each of the 11 districts were contacted and asked if they would be interested in participating in the study. In addition, the superintendents identified technology directors, teachers and parents in their respective districts that would be willing and able to participate in the study. Three of the 11 districts responded that they would be interested in participating. Upon speaking with each of the superintendents, two of the three volunteered their technology directors to be part of the data collection. The third district outsourced their information technology services and indicated that there was not one specific person who could be part of the study. In addition, each superintendent identified teachers and parents in their respective districts that could and would be willing to participate in the data collection for this study. Each superintendent made the initial contact to their technology directors, parents and teachers about the study and their individual participation. The interview questions were sent to each participant prior to conducting the interview. (See Appendix A)

The interviews were designed to take approximately 60-75 minutes and were conducted by two methods. Three superintendents, two technology directors, three parents (one from each district) and three teachers (one from each district) were interviewed for this study. Three of the 11 total interviews were conducted face to face, while the other 8 interviews were conducted

over the phone. Each interview was conducted by the method that was most convenient for the participants.

3.4 RESEARCH METHODS AND DESIGN

When developing the interview questions and protocol to use in conducting the semi-structured interviews, the main topics were gathered from the available literature on BYOD programs. The interview questions were developed to align with the inquiry questions to assist in gathering data to answer each of those queries. The semi-structured interview questions were open ended in order to provide the opportunity to conduct a thoughtful and organized interview session with each of the participants. Semi-structured interviews should be designed to be highly focused so time is used efficiently and help establish interview priorities making it more efficient to conduct analysis because the responses are easy to find and compare (Patton, 2002).

The sequence of questions was designed to elicit authentic and descriptive responses from each participant. The beginning questions are recollection and experienced based questions followed by questions that may be comprised of attitudes, perceptions and/or beliefs based on each individual's experiences. This sequence is designed to elicit more detailed responses while maintaining a fluid conversational exchange between the researcher and the interviewee (Patton, 2002). Follow up questions were asked within the semi-structured interview format if a response to a question given by the participant requires further elaboration (Mertens, 2007).

3.5 DATA ANALYSIS PREPARATION

The initial data analysis occurred during the interview sessions; remarks from the interviewees were pre-coded by the researcher which the researcher grouped similar thoughts, beliefs and responses which aided in the emergence of themes and assertions (Moustakas, 1994). Following the completion of the interviews, the recorded data was coded by only the researcher to increase reliability (Saldana, 2009). The data was coded and grouped into the following categories developed from the available literature: security of information, stakeholder buy-in, policy and practice adjustments, professional development, sustainability, and equity concerns, or into unidentified recurring themes based on the content of the interviewees' responses. (See Table 1) The goal of this coding process was to identify any patterns in the data and then to determine if any relationships were present among those patterns (Merriam, 2009).

During the final portion of the data analysis, all of the coded data collected from each of the interviews was compared to assist in discovering common and divergent practices and results in regards to the overall planning and preparation for a BYOD program. These practices assisted in determining what these schools deemed essential and non-essential parts of their planning process and if any additional areas that should be considered by a planning committee.

Table 1. Data collection and analysis procedures

Inquiry Question	Data Collection Method	Emerging Data	Planned Analysis
1. What are the areas of planning and focus when considering implementation of a BYOD program?	Semi-structured interviews with identified BYOD school leaders <ul style="list-style-type: none"> • Superintendent • Technology Directors • Parents • Teachers 	<ul style="list-style-type: none"> • Anecdotal notes 	Pre-coding; coding to determine areas of concentration within each site; divergent and common areas of concentration across sites and to determine if data fits into pre-identified planning areas: <ul style="list-style-type: none"> • Security of information • Stakeholder buy-in • Policy and Practice adjustments • Professional Development • Sustainability • Equity Concerns
2. What are the perceived and actual benefits of a BYOD program?	Semi-structured interviews with identified BYOD school leaders <ul style="list-style-type: none"> • Superintendent • Technology Directors • Parents • Teachers 	<ul style="list-style-type: none"> • Anecdotal notes 	Pre-coding; coding to determine areas of concentration within each site; divergent and common areas of concentration across sites and to determine if data fits into pre-identified planning areas: <ul style="list-style-type: none"> • Security of information • Stakeholder buy-in • Policy and Practice adjustments • Professional Development • Sustainability • Equity Concerns
3. What are the perceived and actual challenges or problematic areas of a BYOD program?	Semi-structured interviews with identified BYOD school leaders <ul style="list-style-type: none"> • Superintendent • Technology Directors • Parents • Teachers 	<ul style="list-style-type: none"> • Anecdotal notes 	Pre-coding; coding to determine areas of concentration within each site; divergent and common areas of concentration across sites and to determine if data fits into pre-identified planning areas: <ul style="list-style-type: none"> • Security of information • Stakeholder buy-in • Policy and Practice adjustments • Professional Development • Sustainability • Equity Concerns

4.0 DATA, ANALYSIS AND FINDINGS

The participating school districts vary in size and demographic characteristics but all are in southwestern Pennsylvania and have direct experience with a Bring Your Own Device program. To ensure the confidentiality of all participants, the districts were labeled for the data analysis. School District #1, labeled as SD1, services approximately 3900 students in six schools, is considered in a suburban setting and has approximately 25% of the student enrollment listed as economically disadvantaged. School District #2, labeled as SD2, services approximately 1100 students in two schools, is considered in a rural setting and has approximately 42% of the student enrollment listed as economically disadvantaged. School District #3, labeled as SD3, services approximately 2400 students in 6 schools, is considered in a suburban setting and has approximately 35% of the student enrollment listed as economically disadvantaged. Participating superintendents were labeled with an “S”, technology directors were labeled with a “TD”, teachers were labeled with a “T” and parents were labeled with a “P” followed by their respective school district labels. An example of this identification system is the superintendent from school district #1 would be identified as SSD1, a teacher from school district #3 would be identified by TSD3 and so on.

This study used the perspectives and experiences of all the participants to examine the planning processes used in developing a BYOD program in each of the three districts involved in

the data collection. The comparison across the participants was led by the following three research questions:

RQ1. What are the areas of planning and focus when considering implementation of a BYOD program?

RQ2. What are the perceived and actual benefits of a BYOD program?

RQ3. What are the perceived and actual challenges or problematic areas of a BYOD program?

4.1 DATA ANALYSIS

After each of the 11 individual interviews were concluded, the researcher compared the responses of the superintendents, technology directors, teachers and parents among the same and differing school districts. A total of three superintendents, two technology directors, three teachers and three parents participated in the interviews. This analysis assisted in answering the three research questions to aid in a deeper understanding of the planning processes used in the study. Maz (2013) explained the data analysis process as a constant comparative method contrasting the strengths and weaknesses of data, emerging codes, and categories by using life experiences, perspective from the participants, and the interaction between the participant and the researcher. In this study, data were analyzed using two cycles of coding. The first cycle of coding required the researcher to examine the data, searching for common words, phrases and ideas among the participants' responses. At the completion of the first round of coding, the researcher identified nine categories. These identified categories were security of

information/infrastructure readiness, stakeholder buy-in, policy and practice, professional development, sustainability, equity, program impacts, program issues, and strategic planning. During the second round of coding, the researcher analyzed these nine categories looking for similarities and overlapping characteristics (Saldana, 2010). The breakdown of the categories, corresponding interview questions (found in Appendix A) and research questions are illustrated in Table 2 below.

Table 2. Alignment of Identified Categories, Interview Questions, and Research Questions

Identified Category	Corresponding Interview Question	Corresponding Research Question(s)
Security of Information/Infrastructure Readiness	S1Q10, S1Q12, S1Q15, S1Q16	RQ1
Stakeholder Buy-In	S1Q1, S2Q1, S3Q1, S3Q3, S3Q7	RQ1
Policy and Practice	S1Q5, S1Q7, S1Q8, S1Q9, S1Q13, S1Q17	RQ1
Professional Development	S1Q14, S2Q4, S2Q5, S2Q6	RQ1
Sustainability	S1Q6	RQ1
Equity	S1Q11	RQ1, RQ3
Program Impacts	S1Q18, S2Q7, S3Q6	RQ2, RQ3
Program Issues	S1Q19, S2Q2, S2Q3, S2Q7, S2Q9, S3Q4	RQ3
Strategic Planning	S1Q2, S1Q3, S1Q4, S1Q20, S1Q21, S2Q8, S2Q10, S3Q1, S3Q4, S3Q5	RQ1, RQ3

4.2 FINDINGS

4.2.1 Research Question 1: What are the areas of planning and focus when considering implementation of a BYOD program?

The first six identified areas in Table 2 assisted in addressing research question #1. The first area identified was security of information and infrastructure readiness which were grouped together because all the participants did not see them as two separate areas but rather both being so closely linked they one could not be discussed without the other. Security of information refers to the ability of the network to safeguard the hardware, software and work products of all users on the network connection. While infrastructure readiness refers to the ability of the network to securely support the number of users and traffic on the network with as little delay or interruption as possible. All three districts found it was necessary to add additional access points, increase their bandwidth capacity and update their filtering software in each of their buildings to allow more users to access the network and restrict what could be accessed by the users. Two of the three districts made infrastructure upgrades prior to implementing BYOD, but SD2 did not upgrade their network until after implementing their BYOD program when users became frustrated with the delays in accessing the network. All three districts elected to place all the BYOD traffic on a separate network to limit any security and access issues that could occur with their other networks that housed personnel, payroll, grades, attendance and human resources data. SSD1 stated that their district “split the networks into two different servers with cloud backup on each to make sure all was secure and backed up in case of a breach in either server.”

Stakeholder buy-in is an essential piece of any planning initiative and all superintendents in this study recognized that all stakeholders can contribute to the success of the program and this support can help maximize the program's effectiveness (Prensky, 2010). Each of the three districts identified stakeholder buy-in as a pivotal planning area; however even with that understanding, two of the three district leaders stated they feel they could have done a better job communicating and involving the teachers, students, parents and community members. SD1 and SD2 only had district and building level administration as members of their respective planning committees while SD3 included parents, teachers, community members, school board members, building principals, technology directors and the superintendent. As a result, SSD3 stated that their program had little to no resistance because "all of the stakeholders were represented and informed throughout the planning process." SSD1 and SSD2 both reported that the lack of proper stakeholder representation caused them to spend additional time and effort explaining the program and defending the decisions made regarding the program to various stakeholder groups, specifically parents. PSD2, who is the President of the Parent/Teacher Organization, said that she was not aware of a planning committee or the program until two weeks before school started. The time for the planning process for SD3 was 12 months, with their committee meeting monthly, while SD1 and SD2 spent approximately 14 to 16 months planning prior to implementation with their respective committees not having regularly scheduled meetings. The perspectives of the stakeholders were very different within each district regarding a BYOD program. The superintendents focused on the cost of the program, the potential savings and any necessary policy revisions; the technology directors focused on structural areas such as security of information, content filters and infrastructure; teachers were concerned with how the program would impact their classrooms and instruction; while parents focused on the impact on the

resources for students and if they would now have to buy their students new devices for school. All concerns have merit in the planning process and it was necessary for each district to address each group members concerns to assist in achieving stakeholder buy-in.

Regardless of the make-up of each of the planning committees, all three districts had commonality in their approach to policies and practices. All three districts had to adjust student and staff acceptable use policies to reflect use of personally owned devices while on the district network. Cyberbullying policies were examined and adjusted in all three districts as it was anticipated that the instances of cyberbullying may increase with increased student access to technology during school hours. The electronic device policies within each district were reviewed and adjusted as two of the three districts did not allow personally owned devices to be used during school hours prior to BYOD implementation. Each also stated they had to update their student and faculty handbooks to reflect the changes made in the policies that involved proper use of devices, when and where the devices could be used, digital citizenship and consequences for those who violated the acceptable use policy. SD2 defined “green” and “red” zones within their buildings that informed students when their devices were permitted to be used. SSD2 stated that “The staff was essential in helping to make the program work in practice, it wasn’t easy initially, but eventually students learned what was and was not acceptable behavior regarding the use of their devices.”

Not all teachers are instinctive users of technology, so this new challenge can be a significant one (Hockly, 2014). A BYOD program forces teachers to step outside of their normal operating procedure and creates gaps and needs for each faculty member that needs to be filled with appropriate professional development. Each district took a different approach in deciding what and how they delivered professional development to their staff to prepare them for a BYOD

program in their classrooms. SD1 did not survey the staff but instead had the technology director decide the professional development for the staff. The training focused on using the existing district technology equipment provided by TDSD1 which according to TSD1 “was not very helpful, in fact most of us thought it was a waste of time.” SD2 conducted a needs assessment with the entire staff to sift out what training the staff felt was needed in relation to the BYOD program. It was discovered the clear majority (82%) of the faculty wanted training in the Google Suite applications and as a result the district sent several teacher team leaders to be trained and in turn trained the faculty. SD3 handled their professional development within each of the buildings realizing the differences and needs of an elementary setting is different from a middle school setting and both are different than a high school setting. Building principals explained the BYOD program and then met with individual departments to discuss concerns and questions regarding training needed to help make the program a success. All six schools throughout the district had training tailored to the perceived needs of each of the staff’s requests. The district set-up professional learning communities that enabled teachers in different buildings to share their training experiences with other staff members outside of their own buildings. TSD3 stated, “The training was helpful because they addressed our specific concerns with implementing BYOD in our classrooms and administration recognized that each building is unique and what may be an issue in one building may not be the case in another.”

“Part of successful planning for any program has to involve a sustainability plan to keep the program moving forward,” said SSD3. There was not much variation across the three districts regarding sustainability of the program. Although each experienced unanticipated cost ranging from additional access points to increased bandwidth demands, none considered sustainability beyond a financial outlook. TDSD3 said their unanticipated costs were near

\$100,000, but once they were completed the network would not need any significant upgrades for years. SD1 had to increase the amount of access points in their buildings as they expected every student to use their cellular phone and then an additional 100 devices to be used outside of student phones district wide. TDSD1 said, “We weren’t even close on our estimate, almost every student used their phones and an additional device; we were not expecting that.” The one common theme among all the districts is they all believe that after their initial upgrades, sustainability would be no problem as the BYOD program progresses. With technology ever changing and advancing districts needed to consider if their technology would be sustained along with their professional development over an extended period of time.

The final identified area is equity concerns for students who do not own their device but their school employs a BYOD program. All three districts had identical approaches to solving the equity concerns with BYOD. Students who do not own a device or have forgotten theirs at home are able to use district owned laptops and tablets. SSD1 stated that all lessons are based on district owned technology and the students using their own devices need to adapt to meet the demands of the lessons. However, none of the districts had a plan to address home use of these devices or for students whose device did not have a capability of other devices.

An additional area of planning that was not seen in the literature but uncovered in the study was in the area of strategic planning. This planning is used to set priorities, align resources, set outcomes and goals of the program, insure stakeholders are working towards common goals, and assesses the school’s ability to meet the changes required. All three districts agreed that both short and long term strategic planning are necessary for success with program implementation.

4.2.2 Research Question 2: What are the perceived and actual benefits of a BYOD program?

The perceived and actual benefits resulting from a BYOD program were covered in the questions presented in the “program impacts” section located in Table 2. In each of the three districts, the perceived benefits did indeed differ from the actual benefits from the program. The similar and differing perceived benefits among the districts are listed in Table 3.

Table 3. Comparison of School Districts on Perceived Benefits of a BYOD Program

Perceived Benefits	SD1	SD2	SD3
Will benefit every student	x	x	x
Teachers will embrace the program and become digitally literate	x		x
Easier lesson planning and development for teachers		x	
Program will create richer lessons within the classrooms using differentiated instruction	x	x	
Increased access to technology for all students	x	x	x
Students more productive due to comfort with their own devices	x	x	
Improve the cost effectiveness of technology enhanced learning	x	x	x
BYOD would increase parental involvement through process of consulting parents on the program		x	
Overall cost savings for the district and funds could be allocated elsewhere	x	x	x

The perceived benefits of a BYOD program within these three districts ranges from benefits for students and teachers to overall cost savings for the district. In each of the districts, some of the perceived benefits were realized while others did not experience the expectation. The only common perceived benefits that were realized by all three districts are cost effectiveness of technology enhanced learning, overall cost savings, and increased access to technology for all students. There were additional benefits that were realized that were not perceived by the districts and are listed in Table 4.

Table 4. Comparison of School Districts on Actual Benefits of a BYOD Program

Actual Benefits	SD1	SD2	SD3
Students became “workforce ready” by using technology to problem solve	x		
Easier student to student and student to teacher collaboration	x	x	x
Learning was expanding beyond the traditional classrooms	x	x	
More personalized instruction for students	x	x	x
Lessons became more interactive through virtual field trips and other online resources		x	x
Increased student engagement	x	x	x
Teachers became facilitators giving the students more authority over their own learning			x

Even with all the benefits being realized by the school districts, there were differing points of views among the district leaders, teachers and parents. PSD1 and PSD2 both stated that their students noted that classroom instruction had not changed aside from more students using their phones during the school day for non-educational purposes such as texting friends and

listening to music. TSD2 said, “Students seemed happier because they could use their phones in school, but overall there has been no change for staff or students with instruction.” SSD1 noted, “That instruction had become more vibrant with students receiving a more personalized experience due to the BYOD program.” District leaders had a very positive outlook on the benefits of the program while the everyday users, teachers and students, had an opposite opinion stating that the program did not have as great of an impact as the district would lead people to believe.

4.2.3 Research Question 3: What are the perceived and actual challenges or problematic areas of a BYOD program?

The perceived and actual issues resulting from a BYOD program were covered in the questions presented in the “program issues” section located in Table 2. In each of the three districts, the perceived challenges did indeed differ from the actual problems they encountered with their BYOD programs. The similar and differing perceived challenges across the districts are listed in Table 5.

Table 5. Comparison of School Districts on Perceived Challenges of a BYOD program

Perceived Challenges	SD1	SD2	SD3
The professional development for teachers would not be adequate to support the program		x	x
Infrastructure was not adequate to support program		x	
Upfront cost of infrastructure improvements would outweigh program benefits	x		

Table 5 continued

Increase in device loss/theft	x	x	x
Teachers will end up as unofficial technology support for devices		x	x
Effectively communicating the program to all stakeholders	x	x	
Teachers not embracing the program	x	x	

Even with each district trying to predict all potential challenges that may occur with a BYOD program; each district has unique characteristics and not all the issues were able to be identified prior the program being implemented. All of the perceived challenges were realized by each of the districts with the exception of an “increase in device loss/theft.” Each district reported that they did not see any increase in incidents of loss and theft outside of what they had prior to the BYOD program. Table 6 lists the additional challenges each district encountered after their BYOD program was implemented.

Table 6. Comparison of School Districts on Additional Challenges of a BYOD Program

Additional Challenges	SD1	SD2	SD3
Teachers did not know how to adapt lessons/assessments to accommodate various devices		X	X
Students distracted due to devices	X	X	X
Students finding ways around blocked sites through the network filter	X	X	X
Divide between low and high income students, due to students being able to distinguish private and school owned devices	X		
Increase in cyberbullying instances		X	X
Technology department overwhelmed with device issues			X
Devices infected with viruses gaining access to network	X		

5.0 CONCLUSIONS AND RECOMMENDATIONS

Although each district had different approaches to the planning process for a BYOD program, all three districts had both unique and similar experiences. A common thread that all districts emphasized was the absolute need for strategic planning with a BYOD initiative. Proper planning is the key for any initiative to gather support and help to insure success with implementation. A steering committee that meets on a regular basis and has representation from all stakeholder groups is an essential piece of planning that will allow all perspectives, ideas and concerns to be represented. When specifically examining the planning process for BYOD programs, all districts agreed that communication with all stakeholders is the most pivotal aspect that must be emphasized. Each district had varying degrees of communication with their respective stakeholders, but all stated they could of done a better job overall not only disseminating information about the program, but also in gathering input and concerns from those groups as well. SSD3 stated, “It is easier to implement a program with full participation and transparency so when issues arise, they are received in kind and you have the support of all stakeholders.”

5.1 CONCLUSIONS

Even with every k-12 school district having its own challenges and characteristics, the nine identified areas of planning are relevant and useful for district leaders to consider when looking at a BYOD program. Security of information and infrastructure readiness must be assessed and addressed long before a program can be implemented. Some districts outsourced this assessment to an outside technology company while other chose to perform the assessment in-house through their technology department. No matter which way a district chooses to perform this, it is a vital step in the planning process that will have a financial and performance impact on the effectiveness of the program.

Policy and practices stemming from a BYOD program will need to be either created, reviewed and/or adjusted to address the changes that will follow the implementation of the program. A thorough review of the district's acceptable use policy, as well as any other policies governing the use of technology within the schools, will be necessary. Most districts are more than willing to share their policy and practices with other districts which allows each to get a basic framework and then tweak as necessary to fit the wants and needs of the district. At the building level, the student handbook needs to be adjusted to reflect all the policy and practice changes that have occurred as a result of the program. To insure the understanding and consistency of the expectations resulting from the program, these changes need to be highlighted to not only the students, but the staff and parents as well.

For the program to have desired impact on the education of the students, professional development for the staff is an area that cannot be overlooked or undervalued. The staff must buy-in to the program or it will never reach its intended goal. The faculty will be the linchpin

that will either make the program a great success or a miserable failure and their preparation through professional development training will be key in determining the overall success. Open communication about what a BYOD program is, how it will impact instruction, and the expectations of the district are all conversations that are necessary to get started in determining what professional development is wanted and needed by the faculty. A needs assessment should be conducted after these conversations have occurred to assist in developing a training program that will assist the teachers in preparing properly for a BYOD program. If the staff feels ill-prepared, the likelihood of the program failing increases greatly thus making the entire planning process a colossal waste of time and resources.

Other questions that need to be considered in relation to a BYOD program center on the sustainability of the program and how each school is going to address the equity issue among students. The districts involved in this study all addressed the equity issue in the same way, students not owning their own devices were permitted to use district owned devices throughout the school day. But none had an answer for students not having a device to use at home or if students were targeted by other students as it may be easy to detect if a student is using their own device or a district owned device. This has the potential for bullying based on economic status.

5.2 RECOMMENDATIONS

The devil is in the details of planning for a BYOD initiative, as all the districts in the study alluded to multiple times. SD1 considers a BYOD program a “valuable step in breaking the technology paradigm” and gives the advice to learn all about wireless connectivity and the

different devices that students may own, finding an agnostic professional development platform for the staff, and communicate with all stakeholders as often as possible during the planning process. SD2 suggests making sure the student and faculty handbooks are laid out and thoroughly explain the policy and practices with the BYOD program, gaining complete buy-in with the staff, and making sure parents are always informed so they have faith in the district and the program. SD3 suggests having students on the planning committee as they are reason for the program and will have perspectives that many adults may not see without their input and having students comment on what professional development may be helpful for the faculty in preparing for a BYOD program. SSD3 stated, “Many of us realize that the students are more tech savvy than we are and it is foolish not to tap into the student’s knowledge and perspectives to strengthen the planning process.”

5.3 LIMITATIONS AND FURTHER INQUIRY

This study examined the planning processes of only three k-12 school districts located in southwestern Pennsylvania. This is a small sample size of districts that are all located generally in the same region on the state. One rural and two suburban schools were examined. An urban school district was not involved in the data collection and may have yielded different data than what was identified. With the varying demographic characteristics of each district, what is viewed as an important aspect in one district was not necessarily be the same in another. The data collection was gathered through semi-structured interviews and was limited by the effectiveness of the interviewer to elicit deep and thoughtful responses from the participants.

The planning processes employed by K-12 school districts are an area that crosses over into almost every aspect of school leadership and one that certainly can be researched further. Additional areas for further study could be a comparative study between BYOD and one to one technology initiatives so districts are able to see the programs side by side to make the most educated decision before implementing their own technology initiative. Another area that emerged based on this study is a closer examination of the equity divide is warranted not only with a BYOD program, but within the educational system as a whole.

Whether it is a BYOD initiative, textbook adoption or a new student program, the planning process is a tool that all organizations need to take seriously in order to create lasting and impactful programs for their students and communities. The areas of focus identified in this study cross over into any change initiative that a school district undertakes.

BYOD programs can help districts in bringing additional technology access to students and staff within their schools while potentially reducing the costs associated with technology purchases typically experienced by districts. However proper planning is necessary for a technology initiative such as this.

6.0 IMPLICATIONS

When looking at how this research study could possibly impact practice in k-12 schools, it is important to use the information gathered to help formulate a series of planning steps and areas associated with BYOD programs and develop a list of essential questions that will help guide practitioners in the planning process. Creating a list of frequently asked questions to consider will also help provide guidance to districts considering BYOD as an option for their students.

The areas of planning for a BYOD program have been identified in this study and require practitioners to consider each as a vital part of their preparation. A close examination of the district's acceptable use policy is necessary and requires the policy to address when can students use their devices, access social media sites on the network, text messaging practices, the number of and type of devices that will be permitted for use on the network and guidance on which applications be permitted on devices. In addition the code of conduct within the student handbook needs to reflect the AUP policy including a section on consequences for violating the policy and who is responsible for damage, loss or theft of student owned devices (Harris, 2012). Typically it is beneficial to reach out and examine other districts' AUPs and corresponding student handbooks to form framework in restructuring and tailoring changes to fit each districts policy and practice. A challenge that remains for districts is trying to address all of the situations that may arise as a result of a BYOD program. It is important to realize that it may take several

revisions over time to perfect the AUP and student handbook to assist in directing the program as envisioned.

Network protection and security is another identified area that can have serious implications on a district, especially one that has many different devices operating on the same network. Raths (2012) suggests that districts place all BYOD traffic on a separate network that is separate from the district's operating network thus eliminating the chance a BYOD device accessing confidential data such as budget, payroll and human resources data. In addition a filter system will need to be installed and monitored to protect not only the network, but the students from accessing websites and information not intended for students to access while using the district network. Districts will need to also define a system of how access is granted to the network which will need to include levels of permission and how this going to be monitored. This network and protection has a price tag associated with it and could vary greatly from district to district based on the products and numbers of devices the network has to support. Each district needs to assess what they want and need and cost out what the district can afford to determine if these two dovetail to provide access to students through BYOD while adequately protecting the network and the users.

An extension of securing and protecting the network is making sure the infrastructure is capable handling the number of devices per student as permitted by the AUP. The amount of bandwidth must also be sufficient to support all of the multimedia demands of users in a reasonable amount of time regardless of the device being used. The number and location of access points within the school buildings will need to reviewed and increased when necessary to allow access to all students and staff attempting to access the network. Again there will be a cost associated with purchasing and installing additional access points. Districts will need to map out

the location of their access points and identify areas where there is limited or no access. It will also be necessary to determine how many users are granted access to the network with the current access points and determine if they are sufficient or need upgraded. An additional concern that needs to be considered is the limitations of mobile devices and if students will still have access to desktop computers while at school. Activities such as typing and printing research papers will not be possible if a student only has access to their personal smartphone thus requiring some type of access to a traditional computer.

A big part of any BYOD program's success lies with the professional development provided to prepare the faculty for the shift a BYOD program brings with it. Generally each district may consider a program that will assist teachers in successfully integrating the use of devices in their lessons in a pedagogical sense, how to manage student pairs and groups using devices, the technical aspects of managing multiple devices in the same classroom (classroom management), adjusting pedagogy, instructional aspects of project-based learning, developing and using rubrics, and how to create post activities for students (Hockly, 2012). Ultimately the district needs to be sure the faculty members are ready for a BYOD program and have a plan in place for continued support for staff during implementation. A district cannot simply give some professional development sessions at the beginning of the school year prior to the implementation of the program and think that is sufficient for the staff and students to truly use the program as intended. On-going training on software and devices will be necessary along with teachers being active members of professional learning communities which allow each member to share their experiences and ideas with other members within the community. An additional piece of professional development centers around the curricular concerns associated with a BYOD program. The faculty will need to be supported while rethinking lesson design

and delivery while still addressing the content defined within the curricula. Students and staff will need to be taught the aspects of digital citizenship and it also needs to be determined where in the curriculum this will be added if it currently missing.

Daily operating procedures are areas that are often overlooked during the planning process and typically are the areas of greatest concern for staff and students. Districts need to determine procedures for loaning devices to students, where charging stations will be located within the schools, restricted times and areas for device use and how will devices be stored during gym classes or other times where students are away from their devices to avoid loss or theft. Although these may seem to be minor points of consideration, ignoring them in the planning process can open the building level administration problems that could be easily avoided.

Communication and buy-in with all stakeholders can contribute to the success of the program and this support can maximize the program's effectiveness (Prensky, 2012). Each of the districts involved in this study stated that open communication and buy-in with all stakeholders is one of the most important planning steps involved with a BYOD initiative. Districts need to gauge if all stakeholder groups are represented and on board with the program while insuring everyone understands the program's potential benefits and challenges all while making sure everyone has an active voice in the planning process. One of the greatest challenges is identifying and engaging stakeholder groups to become active members of the planning committee and to truly represent their group's opinions and concerns. There will always be differences in opinions and the district needs to prepare for those moments where not every group sees eye to eye on an issue at hand.

Budgeting and associated costs with a BYOD program has a mixed review from districts that have gone through the planning and implementation processes. Some have experienced more than expected expenses while others have experienced just the opposite. There may be a considerable up front cost associated with upgrading and updating the network to prepare for a BYOD program. This can only be determined once an assessment of the current network is performed. Ongoing professional development for the staff has to be budgeted and districts need to determine if it will be delivered in-house or outsourced. This piece of the planning process needs to include the district technology director, business manager and superintendent at the bare minimum and requires all involved parties to discuss the needs and related costs of the program to formulate a realistic plan for financial sustainability.

Considering implementing a BYOD is not something that should be entered into lightly. Proper planning and consideration of the implications need to be made to first see if a BYOD initiative is a good fit for the students, parents and schools. If it is determined that it is a venture worth exploring, proper planning is involved which has many facets to consider. Referencing all of the planning areas listed will help districts create a checklist to help keep them organized as they work through the planning process.

7.0 REFLECTION

Prior to beginning this research study, I thought the planning process for a BYOD initiative was a simple process with little to consider outside of developing and communicating policy and practices to guide the students and staff. I never considered, or perhaps did not realize, the multitude of other factors to consider in the planning process. Some of them I believe were implicit and obvious, such as stakeholder buy-in and communication, but until I really got into the study did I realize the many facets beyond my thinking that are necessary to properly plan.

Network security and infrastructure readiness was an area I had zero experience and little understanding of how they worked or a solid understanding of their importance to a BYOD initiative. Looking back, these are vital areas that if not addressed in the planning process, could result in the program never coming to reality or causing frustration because the system is not set-up for the amount of new traffic the network will experience. I am now comfortable speaking with the technology department on the needs of a building and being able to sit down and map out a building from a technology service perspective.

It became apparent to me is how easy things can get forgotten or overlooked when you begin adding more and more perspectives, concerns and opinions to the process. Although all of these are necessary and increase the depth and thoroughness of the planning process, it is important to have a facilitator that can keep the committee focused on the goals of the session so

this can be limited. Another statement that always needs to be on the forefront of these sessions is: “Is this best for kids?” This question is always the first on my mind prior to making any decision that will impact students in my building. Although there are other stakeholders in the equation, the students are the driving force for the program.

I still find myself perplexed with the issue of student equity in relation to a BYOD program. As noted earlier, the districts involved in this study all handled the question of equity in the same manner which is allowing students who do not own their own devices to borrow district owned devices during the school day. Students can easily notice other students using district owned equipment and there is no plan for allowing students to take those devices home for use during non-school hours. I have not seen nor do I have any plausible ideas at this juncture to close the equity gap among students.

The most valuable piece of data I have gained from this study is realizing no matter the initiative, the planning process is relatively the same in its development and needs to be a comprehensive process that takes a considerable amount of time to complete properly. Failure to properly plan can and will result in overlaps and gaps in the program which will cost the district more time and resources when they have to be addressed at a later date. It helps me to think of the planning process as a proactive activity and for those who do not plan properly create a reactive environment that prohibits staff and students to work at their potentials. I’m sure some districts do not address all of the areas discussed in this study in their planning, but I am reasonably sure they encountered some issues because of that lack of planning.

APPENDIX A

SEMI-STRUCTURED INTERVIEW PROTOCOL INSTRUCTION/B ACKGROUND SCRIPT

- **WELCOME**

Hello, my name is Dave Palmer and I am a doctoral student in the School Leadership program at the University of Pittsburgh. I am also a practicing administrator in the South Park School District. I am interested in learning more about your district's experiences in the planning process prior to the implementation of your Bring Your Own Device program.

- **PROJECT BACKGROUND**

As part of my doctoral studies, I wanted to identify and examine an area of practice that sparked a personal passion and interest. Throughout my career I have experienced schools searching for answers to address the growing need of the student access to technology regularly during instructional time. Given the financial constraints most districts must operate, a BYOD program is an initiative that can assist in meeting this need and the topic has grabbed my attention, prompting me to want to examine the planning process to add to my understanding of these types of programs.

- **PURPOSE OF THE INTERVIEW**

The purpose of this interview is to gain a deeper understanding of BYOD programs in k-12 schools, specifically the opinions and perspectives of individuals who were involved

in the planning process prior to program implementation. The information collected from this interview, along with additional interviews with other school administrators, teachers and parents, from various BYOD districts will be combined and analyzed.

When analyzing the data I will be looking to group similar answers into categories to help in identifying key planning practices within each district and comparing those categories among the districts for overlapping and emerging themes of planning. In the end, I plan on using the data to contribute and assist other districts who are considering a BYOD program.

○ **INTERVIEW TIMING**

This discussion will last approximately 60-75 minutes and I will hand record the interview to assist in recalling our conversation when I am analyzing the data. Are there any questions before we get started?

DISCUSSION QUESTIONS (For applicable questions, participants will be asked to respond with their expected and actual experiences)

SUPERINTENDENT / TECHNOLOGY DIRECTOR

Section 1 Questions (S1)

1. Why did the district decide to implement a BYOD program? How was this communicated to all stakeholders?
2. How did the district begin the planning process prior to implementing the BYOD program?
3. How much time elapsed from the beginning stages of planning to implementation?
4. If you had a planning or steering committee, who were the members? How were they selected to serve on the committee? How often did the committee meet?
5. Is there one person who has the overall responsibility for the BYOD program?
6. Were there any unanticipated costs with the program?

7. Is there a clear usage policy in regards to text messaging, e-mail, apps, cameras, & wifi usage?
8. What policies needed updated and/or created as a result of the program?
9. Do parents, students and staff sign a technology agreement?
10. Were any restrictions put into place for students and staff?
11. How do you address students who do not have their own device?
12. Is there any kind of monitoring or tracking solutions for student and staff usage?
13. Who is responsible for device damage, loss or theft?
14. How was the professional development for faculty decided and structured to prepare for the BYOD program? What training was provided? By who?
15. Did the infrastructure require any adjustments? Was the bandwidth increased?
16. Was wireless security built into the network or is all wireless traffic on a separate network?
17. Are all users required to register their devices being used at school? Is there a limit on the number of devices?
18. What advantages have you seen from the program?
19. What areas of concern have risen as a result of the BYOD program?
20. In hindsight, is there any area of your BYOD planning that you would have stressed more than another?
21. For schools considering a BYOD program, do you have any advice to guide them in the planning process?

TEACHERS

Section 2 Questions (S2)

1. Were you an active member of the planning committee?
How often did the committee meet? How were you contacted to join the committee?
2. What were your initial concerns with a BYOD program?
3. Did you discuss the potential BYOD program with your colleagues? If so, what were their concerns?
4. How was professional development for faculty rolled out?
5. How were the topics for the professional development chosen?
6. After the BYOD program was implemented, are there areas of professional development you would recommend?
7. What are the positive outcomes from the BYOD program?
Negative outcomes?
8. Was the staff kept in the loop as the planning committee progressed? Were there opportunities for staff to add input in the planning process?
9. What were the biggest hurdles for staff with the BYOD program?
10. How long was the planning process? How much time elapsed between staff training and implementation of the program?

PARENTS

Section 3 Questions (S3)

1. Were you an active member of the planning committee? How often did the committee meet? How were you contacted to join the committee?
2. How was the BYOD program rolled out to parents and the community?
3. Did you feel you were able to voice your concerns and opinions and they were valued by the committee as a whole?
4. What were some of your concerns with a BYOD program in your student's school? Were those concerns addressed or answered during the planning process?
5. Are there any areas that you believe need to be focused on more than others during the planning process?
6. Do you see the BYOD program as an asset to the students and the district? Why or why not?
7. What were your initial thoughts when you learned the district was planning for a BYOD initiative?

CLOSING

- Do you have any final thoughts or comments regarding the BYOD program and/or the planning process you would like to share?

In closing, I want to assure you that your comments and answers are confidential and in no way will your identity be revealed from this interview session. I will be taking all of the data collected today and grouping it with data collected from other interviews to gain a broader understanding of the planning processes used with BYOD programs. I want to

thank you for your time and attention in speaking with me today.

BIBLIOGRAPHY

- Armstrong, A. (2014). Technology in the classroom: It's not a matter of 'if,' but 'when' and how'. *The Education Digest*, 79(5), 39.
- Beach, M. (2014). BYOD: How schools are implementing "bring your own device". 1454119 Ontario Ltd. DBA *Teach Magazine*.
- Caldwell, C., Zeltmann, S., & Griffin, K. (2012). BYOD. *Competition Forum*, 10(2), 117.
- Carey, D. M. (2013). *Bring your own device: A case study of a 10th grade BYOD program in a rural pennsylvania school district*
- Creswell, J.W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (2nd ed.). Upper Saddle River, NJ: Pearson.
- Dahlstrom, E., & diFilipo S. (2013). *Consumerization of IT/BYOD. Research preview*. EDUCAUSE Center for Applied Research. Retrieved from <http://www.educause.edu/ecar>
- Darrow, B. (2012). *IBM stung by byod pitfalls*. Retrieved May 21, 2012, from gigaom.com/2012/05/21/ibm-stung-by-byod-pitfalls
- Eisele-Dyrli, K. (2011). Mobile goes mainstream. *District Administration*, 47(2), 46-48.
- Griffin, P., Care, E., & SpringerLink (Online service). (2015;2014;). *Assessment and teaching of 21st century skills: Methods and approach* (2015th ed.). Dordrecht: Springer Netherlands. Doi: 10.1007/978-94-017-9395-7
- Groupe Speciale Mobile Association (2010). *m-learning: A platform for educational opportunities at the base of the pyramid*. GMSA Development Fund. Retrieved from <http://www.gmsa.com/mobilefordevelopment/wpcontent/uploads/2012/04/>
- Harris, C. (2012). Going mobile. *School Library Journal*. 58(1), 14.
- Herro, D., Kiger, D. and Owens, C. (2013). Mobile technology: case based suggestions for

- classroom integration and teacher educators. *Journal of Digital Learning in Teacher Education*, 30(1), 30.
- Hockly, N. (2012). Tech-savvy teaching: BYOD. *Modern English Teacher*. 21(4), 44-45.
- Kelly, F., McCain, T. and Jukes, I. (2009). *Teaching the digital generation*. Thousand Oaks, CA: Corwin Press.
- Kivunja, C. (2014). Do you want your students to be job-ready with 21st century skills? change pedagogies: A pedagogical paradigm shift from vygotskyian social constructivism to critical thinking, problem solving and siemens' digital connectivism. *International Journal of Higher Education*, 3(3) doi:10.5430/ijhe.v3n3p81
- Lacey, K. (2014). BYOD success story: the technologies, policies and strategies early adopters use to transform their districts. *District Administration*, 50(6), 83.
- Maz, J. (2013). Employing a grounded theory approach: Core characteristics. *British Journal of Cardiac Nursing*, 8(9), 453-458.
- Mertens, D. M. (2007). Transformative paradigm: Mixed methods and social justice. *Journal of Mixed Methods Research*, 1(3), 212-225. doi:10.1177/1558689807302811
- Moustakas, C. E. (1994). *Phenomenological research methods*. Thousand Oaks, Calif: Sage.
- Mulay, A. & ebrary, I. (2016). *Sustaining moore's law: Uncertainty leading to a certainty of lo T revolution*. San Rafael, California: Morgan & Claypool Publishers.
- Nielson, L. (2011). 7 myths about BYOD debunked. *The Journal*. Retrieved from <http://thejournal.com/Articles/2011/11/09/7-BYOD-Myths.aspx?Page=2>
- Nixon, T. (2013). *Mobile devices and the teacher perceived barriers impacting effective integration in the k-5 classroom* (Doctoral dissertation). Retrieved from search.proquest.com.pitt.idm.oclc.org/docview/1372292011?pq-orsite=summon
- Norris, C. A., & Soloway, E. (2011). Learning and schooling in the age of mobilism. *Educational Technology*, 51(6), 3-12.
- November, A. (2001). *Empowering students with technology*. Glenview, IL: Skylight Training and Publishing Inc.
- O'Sullivan-Donnell, B. (2013). *Students' personal mobile devices in the classroom: a case study of a byot district* (Doctoral dissertation). Retrieved from media.proquest.com.pitt.idm.oclc.org/docview/3116780131?pq-origsite=summon
- Opinion fiercely divided on byod despite the hype. (2012). *Software World*, 43(6), 8.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, Calif: Sage Publications.

Prensky, M. (2010). *Teaching digital native, partnering for real learning*. Thousand Oaks, California: Corwin Press.

Preparing for large scale tech rollouts (2014). Professional Media Group LLC.

Project Tomorrow. (2010). *Creating our future: Students speak up about their vision for 21st century learning*. Irvine, CA: Author. Retrieved from <http://www.tomorrow.org/>

Project Tomorrow. (2011). *The new 3 E's of education: Enabled, engaged, empowered: How today's educators are advancing a new vision for teaching and learning*. Irvine, CA: Author. Retrieved from http://www.tomorrow.org/speakup/pdfs/SU10_3Eofeducation_Educators.pdf

Puente, K. (2012). High school pupils bring their own devices. *District Administration*, 48(2), 64.

Quillen, I. (2011). Crafting your BYOD policy. *Digital Directions*, 23.

Raths, D. (2012). Are you ready for byod? *T.H.E. Journal*, v39(4), 28-32.

Shuler, C. (2009). *Pockets of potential: Using mobile technologies to promote children's learning*. New York: The Joan Ganz Cooney Center at Sesame Workshop.

Saldaña, J. (2009). *The coding manual for qualitative researchers*. Thousand Oaks, Calif;London;: Sage.

Siddavatam, I. (2011). Achieving improved performance at access point in WLAN infrastructure mode. *International Journal on Computer Science and Engineering*, 3(7), 2869-2875.

Stanley, T. (2016). *Creating life-long learners: Using project-based management to teach 21st century skills*. Thousand Oaks, California: Corwin.

Sucre, G. (2012). Three BYOD benefits. *Learning & Leading with Technology*, 39(5), 8.

Thomas, K. and O'Bannon, B. (2013). Cell phones in the classroom: preservice teachers' perceptions. *Journal of Digital Learning in Teacher Education*, 30(1), 11.

Ullman, E. (2011). BYOD and security. *Technology & Learning*, 31(7), 32-36.

Williams, C. (2012). Student engagement soars with smartphones. *District Administration*, 48(2), 29.

Winthrop, P. (2012). *The ugly truth about byod*. Retrieved May, 22, 2012, from theemf.org/2012/05/22/the-ugly-truth-about-byod

Yeonjeong, P. (2011). A pedagogical framework for mobile learning: Categorizing educational applications of mobile technologies into four types. *International Review of Research in Open & Distance Learning*. 12(2), 78-102.