Implementing Bring Your Own Device and

One-to-One Computing Programs in

K-12 Schools

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December 8, 2013

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A Pew Internet research report on teens (ages 12-17) and technology found that 95% of teens are online and 93% of teens have a computer or access to one at home (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013). "Today's students are the first generation of students to grow up with this new technology" (Prensky, 2001, p. 1). In school, students want to build relationships, be entertained, and find their place in the world. Technology is one avenue that meets all of these needs. Facebook, for example, helps students to build relationships with their peers. The fast pace and vast array of games, media, and applications helps to keep them entertained, while the never-ending wealth of information on the Internet gives students a glimpse into the world. To meet the needs of these “digital natives” (Prensky, 2001) in schools, a variety of technology programs including computer labs, portable laptop carts, and mobile devices are available. Two such programs are one-to-one computing and Bring Your Own Device (BYOD). One-to-one computing programs provide students with their own laptop and access to the Internet (Penuel, 2006). BYOD programs allow students to bring their own electronic devices to the classroom for instructional use.

 The research on one-to-one computing programs and BYOD programs in K-12 schools is growing rapidly. For the purpose of this paper, the literature reviewed focuses on the common themes related to the implementation strategies of both one-to-one computing programs and BYOD programs as well as the benefits and challenges of each program.

**One-to-One Computing Programs**

 School districts that implement one-to-one laptop programs need to consider several factors. These factors include vision, hardware & software, training & professional development, and program evaluation (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). Before any implementation can take place, schools must clearly articulate a vision and plan (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). School leaders need to communicate to their stakeholders why the technology is important, what classroom teaching and learning will look like, and what the goals are for student learning (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). Communication to parents and students regarding technology policies and use agreements for the new devices needs to be a part of this plan (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). School leaders also need to have a plan in place for ongoing funding for the program as training and technical support of laptops can be costly (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). Establishing partnerships with businesses and local universities can be helpful in offsetting these funding costs (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). A logistics plan needs to be developed that details how the laptops will be protected, distributed, managed, and used (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013).

 The next step in the process is the training of staff. Teachers need to be trained not only on how to use the laptops but also how to integrate them into their curriculum (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). Training needs to be ongoing and come in a variety of forms from inservices to after-school professional development to teacher driven support groups (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). Teachers need time to become comfortable on the machines and to plan out new curriculum and lessons (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). Students and parents also need to be trained on the laptops and given time to learn about the new devices (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013).

 Hardware and software need to be considered in any new technology implementation. Districts need to look at their infrastructure and bandwidth and determine what, if any, improvements need to be made (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). Software needs to be purchased or licensed for teachers and students to use (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). Additional support personnel may need to be hired to manage the new hardware and software and work with teachers and students on technical issues (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013).

 The final piece of a technology implementation program is the monitoring and evaluation of the program. Program monitoring needs to be ongoing (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). Technology evaluation is complex and school leaders need to determine which aspects of the program they wish to evaluate (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013). Some of those questions might include if teachers are using the devices effectively, if devices are being maintained properly, and if student learning is occurring (Bonifaz & Zucker, 2004; Burns, 2013; Costello, 1997; Holcomb, 2009; Levin & Schrum, 2013).

While the implementation process of a one-to-one laptop program can be lengthy and arduous, when a program is successful it can have many benefits to student learning. Individualized instruction, student engagement, and anywhere, anytime learning are just a few examples of the impact of one-to-one laptop programs. According to a study done by Mabry, Radlick, and Doane (2010), "students want personalized and customized learning" (p. 76). Through one-to-one computing, teachers tailor curriculum to student needs. Students actually create their own academic pathways. "The increased abilities to individualize instruction and provide self-paced instruction are critical qualities of a learner-centered environment” (Dunleavy, Dexter, and Heinecke, 2007, p.449). "The one-to-one environment makes learning more interesting and fun because students are able to access programs that allow them to explore content in and on their own terms rather than just being passive recipients" (Prettyman, Ward, Jauk, and Awad, 2012, p.11). “The one-to-one environment has the potential to promote authentic learning, enabling students to create both semantic and personal significance with academic concepts in the context of the world around them” (Spires, Wiebe, Young, Hollebrands, and Lee, 2009, p.8).

With one-to-one computing, students have access to information anytime anywhere. Using these devices helps students extend their learning beyond the boundaries of the school and classroom walls (Downey and Bishop, 2012; Hill, 2011; Spires et al., 2009). Prettyman et al. (2012) notes that learning does not occur in a vacuum, in the container of the classroom or the textbook, but rather it exists in a dialectic relationship to all that they can now find and access with the technologies they have (p. 11). This technology empowers students to access an abundance of information, quickly and easily without the constraints of time or space (Downes & Bishop, 2012; Prettyman et al. 2012).

One-to-one computing moves students to be active learners and connect with content in a more personalized and hands on way (Downes and Bishop, 2012; Prettyman et al., 2012; Spires et al., 2009). “Technology tools can actually serve as an extension of student thinking and learning, with students literally tapping into endless networks of imagination”(Spires et al. 2009, p. 8). Students become creators of knowledge instead of passive consumers. They are connected to an entire world through their technology (Prettyman et al. 2012, Spires et al., 2009). Students are steeped in inquiry based learning with this technology as they use it to solve problems, analyze problems, and construct meaning about content being learned (Downes & Bishop, 2012; Prettyman et al, 2012, Spires et al., 2009).

While one-to-one computing does afford many opportunities to middle school students, there are some challenges in bringing this kind of program to a school. Issues of equity sometimes referred to as the digital divide, have to be addressed including access to devices and the Internet at home. Approximately 16% of our nation’s students lack home access to the Internet (Downes and Bishop, 2012). Not all one-to-one initiatives are successful or even show positive influence on the learning and teaching process (Holcomb, 2010). Some schools terminated their one-to-one initiatives because of students’ misuse of laptops (Holcomb, 2010). Other challenges include management problems, an increase in teacher workload, and difficulty linking laptop use to learning outcomes and standards (Dunleavy et al., 2007)

**BYOD Programs**

According to a Pew Internet Research report, 78% of teens (ages 12-17) now have a cell phone, and almost half (47%) of those own smartphones (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013). In addition to this, one in four teens owns a tablet computer. It's no surprise then that 65% of cell phone owning students at schools who ban those devices still bring them every day to class and 58% still use them (Lenhart, Ling, Campbel, & Purcell, 2010). Some schools are embracing this trend by adopting Bring Your Own Device or BYOD programs.

 There are several reasons that schools are moving towards BYOD programs. The biggest reason is economic. Schools just cannot afford to fund one to one technology for their students. Schools want their students to use technology in the classroom and they want all students to have their own device or laptop. “For those schools facing funding issues mobile learning device programs present the chance to integrate technology, but at a smaller cost ratio per student"(Hill, 2011, p. 23). Other reasons contributing to the popularity of BYOD programs are that many students are able to afford their own devices; teachers are becoming increasingly familiar with applications and strategies that use technology to increase student engagement; and adults are experiencing the power of technology in their own lives (Johnson, 2012).

 In implementing a BYOD program, there are several factors for school administrators to consider. These include creating policies for electronic device use, training staff, managing the devices in the classroom, and communicating these plans to all stakeholders. Electronic device polices and acceptable use agreements need to be in place to establish guidelines and rules for device use. Policies should describe when and how devices can be used, which devices can be brought to school, and the school's liability policy regarding these devices (Johnson, 2012).

 Staff training is crucial to the success of BYOD programs. Training should be focused on how to use the devices. Teachers need to be comfortable using a cell phone, tablet, or other device before asking students to use them in the classroom. Teachers need to create guidelines for classroom use (Herro, Kiger, & Owens, 2013; Hockly, 2012; Johnson, 2012). Teachers also need time and guidance to create appropriate lesson plans for productive use of technology in their classrooms (Herro, Kiger, & Owens, 2013; Hockly, 2012; Johnson, 2012).

Managing the devices within the classroom is the responsibility of both the school and the teacher. Schools have to have policies in place for technology use and teachers have to have specific guidelines for classroom use. According to Hockly, "teachers need to understand that there are several different configurations possible in the BYOD classroom, such as pairs or groups working with one device" (Hockly, 2012). Productive uses of technology include student polling, researching, writing, and constructing multi-media projects (Johnson, 2012).

 Communication between stakeholders is essential in creating a successful BYOD program. Informing parents about how students will be using technology at school is helpful in getting the devices brought to school (Johnson. 2012). Parents need to understand what the rules are for bringing devices to school and what the liability issues are. It may also be helpful to list minimum specifications for devices to help parents in purchasing a device for their child (Johnson, 2012).

 BYOD programs have many benefits for students. BYOD programs turn a classroom from an I teach environment to an I learn environment (Costa, 2013; Hill, 2011). According to Costa "it's giving the students access to the Web to solve problems, create work, and add value to their educational journeys (Costa, 2013, p. 5). BYOD extends the school day beyond the boundaries of the school (Hill, 2011). BYOD allows for differentiated instruction by giving students greater ownership of their device and what to do with it (Hill, 2011).

 BYOD programs are not without their challenges. Issues include equity of access, safety, classroom management, and hardware problems. Equity is arguably one of the biggest issues surrounding BYOD programs. Having students bring their own devices to school can create an atmosphere of haves and have nots as some students may have the latest smartphone and others may have a less powerful model (Chadband, 2012; Hockly, 2012; Norris, 2011). Another issue is students not having any device. BYOD programs are intended to solve the one to one student to technology issue but with some students not able to afford their own device, it merely creates more problems. Hockly and Johnson both argue this same idea noting that equity problems can be solved by providing extra devices for students who need them (Hockly 2012; Johnson, 2012). Costa notes that when the majority of students have devices, districts can use their funds to buy devices for students who don't have them (Costa, 2013).

 Issues of safety include cyberbullying, Internet safety and downloading of inappropriate materials, as well as the safety of the actual device. Cyberbullying and Internet safety are a concern for all schools whether students are using their own devices or school issued devices. Firewalls and acceptable use policies are needed to help curb these problems. Unfortunately, firewalls are their own subject of frustration because as often as they block inappropriate sites for students, they also keep students from accessing appropriate sites and content (Hill, 2011). Most schools address the issue of the safety of student devices within their technology policies. Classroom management is key to ensuring that devices are used properly. Hockly notes that some teachers are worried that students will use their devices for texting, social media, and other inappropriate tasks (Hockly, 2012). Some teachers also fear that the device will distract their students from learning (Hockly, 2012; Johnson, 2012). Hockly and Johnson both note that teacher training on classroom management of devices is important to help curb misuse of devices in the classroom (Hockly, 2012, Johnson, 2012).

 Hardware and technical support are a problem for any technology program. In a BYOD program, school districts grapple with providing enough infrastructures to support multiple mobile devices. Both Hockly and Johnson agree that districts need to ensure that reliable Internet access is available for all users (Hockly, 2012, Johnson, 2012). School districts need to reroute their technology funds to increasing wireless access points and increasing bandwidth. Districts also face the issue of supporting or troubleshooting multiple devices. Some districts have adopted the stance of supporting only district provided devices (Costa, 2013). Students are responsible for supporting their own devices (Hockly, 2012). It can also be difficult coordinating multiple devices in a classroom (Hill, 2011). One solution is to use cloud-computing programs such as google docs and open office (Hill, 2011).

**Discussion**

Student’s perspectives and perceptions of technology in school can give us great insight into how we can address their needs as learners and make learning more meaningful. (Downes & Bishop, 2012; Fox, 2006; Prettyman et al., 2012). Students feel that technology makes learning more fun and enjoyable (Downes & Bishop, 2012; Prettyman, et al., 2012). Students commented, "It is interesting. It is a very immersive experience" (Downes & Bishop, 2012, p. 9). In Lei and Zhao’s study (2008), students had very positive evaluations on their laptop program. 87.5% of students reported that the laptops were important to them. 89% of the students believed that the laptops had significantly helped them with their homework and 83.6% of them reported that the laptops had significantly helped them increase their computer knowledge and skills (p. 115). Students have strong opinions about how they want to learn. They want information fast, they want to talk to their peers through Instant Messaging, they want to search for information and build things online. They want to use video games to learn new concepts. They want to be able to access their work at home and at school (Downes & Bishop, 2012; Prettyman et al., 2012; Stefl-Mabry, Radlick, & Doane, 2010).

 While there are common themes of technology integration between BYOD and one-to-one programs, there are some distinct advantages and disadvantages to both programs. The most notable advantage for BYOD programs is cost. Students bring their own devices, eliminating the need for the district to purchase devices. Teachers do not have to learn a specific device and can focus their training and planning on how to integrate the devices productively in lessons. Alternatively, in one-to-one programs, all students are guaranteed a device, thereby eliminating any equity issues. One-to-one devices are all the same, making the technology easier to manage and support. With BYOD programs, districts eliminate the need to support student devices and only have to worry about supporting district hardware. Both programs require the district to maintain a strong wireless network and bandwidth for Internet access. There is no clear cut advantage in choosing one program over the over. Districts need to choose the option that best fits the needs of their students.

This study focused on the implementation of BYOD and one-to-one programs. As I researched these programs, I chose articles that focused on the implementation of programs. Because of this focus, I did not present findings on other aspects of BYOD and one-to-one programs. One major area that was lacking research was student achievement in classes that have BYOD or one-to-one programs. The research in this area was inconclusive. "There has been a consistent series of results that indicate that student scores are higher for those participating in a technology-based environment" (Fox, 2006, p. 49). "More research is needed in the area of student outcomes" (Penuel, 2006, p. 341). "No large scale, controlled studies have measured the impact of 1-1 computing on student achievement” (Shapley et al., 2011, p.302). "The effect of technology immersion on students’ achievement was not statistically significant" (Shapley et al., 2011p. 311). "Findings related to laptop use in schools and their impacts on student achievement are inconclusive" (Cavanaugh, Dawson, and Ritzhaupt, 2011, p. 362). In all of the studies mentioned in this review, it has been stated that this is an area where further research is indicated.

As school districts move to implement BYOD or one-to-one programs in their schools, they need to do it with a strategic plan in place less they face a myriad of challenges and roadblocks along the way. Technology use policies, teacher training, and communication are key pieces of successful programs. The research reviewed here shows a positive impact on learning from both BYOD and one-to-one computing initiatives. When students are allowed to use their devices or laptops to use, they are engaged and immersed in their learning. Students learning goes beyond the school day and students become active learners. With students being digital learners and so comfortable with technology, it is important that we continue to listen to their perspectives on using technology in schools. With the constant flow of new technology in our society and in our schools, it will be important to continue to study how these changes affect learning. Issues warranting further consideration and research are the relationship between student achievement and technology and more gender specific studies on the relationship between technology and student learning and engagement.

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