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Using Technology With Low-income Students:How Schools can Help Students Succeed

Rachael Anne Cappola
Bethel University

USING TECHNOLOGY WITH LOW-INCOME STUDENTS: HOW SCHOOLS CAN HELP

STUDENTS SUCCEED

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Thesis Advisor: Nathan Elliot, M.A.

Program Director: Lisa Silmser, Ed.D.

Abstract

This thesis examines the effects of the digital divide on students primarily coming from low socioeconomic areas and how schools can help close the digital divide. It will look at who has access to technology and how access differs between different groups of people. The way in which technology is used in classrooms and also how students are taught using available technology will also be examined. The schools examined serve a student population that is made up of families from low-income areas. Lastly, it will look at what schools can do to better enable these students to be proficient in technology use. This includes examining programs that schools have in place, teacher beliefs and attitudes, and also how schools are training teachers to better use technology in their classrooms. Schools can best help students benefit from technology use by ensuring access, as well as altering the way they utilize devices and programs within classrooms. Schools need to provide teachers with meaningful technology training so that they feel more comfortable using it and can better enable student use at a more meaningful level.

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CHAPTER I: INTRODUCTION

Context

Over the last few decades, there has been a big push to incorporate technology into all areas of education. This applies to not just classrooms, but also to work being done by students out of school. As educators, we are no longer merely preparing students to become 21st-century learners; instead, we need to prepare them to live, grow and thrive in a world where technology will be a part of their everyday lives.

Schools

Many schools throughout the country have enough devices so that every student has access to one throughout their day. Entire classes are being conducted via online platforms, wherein students learn, collaborate, submit work, and receive feedback digitally. These schools have the infrastructure in place to support multiple classes using devices at the same time. They have enough bandwidth to support these classes streaming and using media-rich sites throughout the school day. Schools are sending laptops, Chromebooks, or other devices home with students to complete their work or continue to be part of the class.

Full access is not a reality for all schools though. Some schools have inefficient or outdated technology. There are schools that lack the infrastructure to support multiple classes being online at the same time. These same schools often lack the resources to provide devices for students in school or at home.

Teachers and Students

Teachers and students also fall somewhere on this spectrum of having full access to technology and resources or having little to no access to technology and resources. The teachers

at schools where resources are abundant have likely been trained to use the tools and devices available to them; they also have support to get help when needed. The students at these schools are most likely on the receiving end of technology-rich learning and experiences, experiences where they are learning by making connections to the real world, collaborating with peers, and creating content to share with others.

Teachers and students who are at schools who do not have similar access to resources have likely not had the same experiences and exposure to technology as their counterparts. Teachers at these schools have likely not been trained in best practices for using technology. They also probably do not have the same access to support in their building if they try to use the technology that is available. Students at these schools typically have less access to technology outside of school as well. Part of the reason is that schools are less able to send home devices. Another contributing factor is that students are generally coming from lower-income homes where families might not financially be able to access technology or afford internet access.

Many schools fall somewhere between having access to every device they could want or need to help students thrive in this digital world and having minimal access to basic technology. Similarly, students also fall somewhere on this spectrum. This discrepancy is often referred to as the *digital divide*. At a basic level, the digital divide separates the "haves" from the "have nots" where technology is concerned.

The Digital Divide

The first part of the digital divide is often broken up into two parts. The first part separates people who do have access and people who have limited or no access by geographic location. People who live in suburban cities tend to have better access to devices and internet

connectivity versus those who live in more rural areas or central cities (Wang, 2013; Wilhelm et al., 2002). In rural areas, it is not uncommon to have basic internet service, which will not adequately support video streaming and multimedia-rich sites (Harlan, 2014). Limited access hinders schools in the content they are able to use because these types of sites are frequently used in classrooms.

The second way people are split at the first level of the divide is socioeconomic status. Those living in higher socioeconomic areas tend to have better access to high-speed internet and access to more technology devices. People living in lower socioeconomic areas tend to have limited access to both the internet and devices. Similar to looking at the divide from geographic location, this limits what schools in these areas are able to do with technology in and out of the classroom.

Moving on to the second level of the divide, it is also essential to reflect on how technology is being utilized. In school settings, this means how students are being taught to use these tools and what they are doing with what they learn. Schools need to think about how they can take students beyond the pencil and paper learning they are accustomed to and instead provide access to technological rich experiences. In many schools with a high concentration of students from low SES backgrounds, technology use doesn't extend beyond practicing skills or remediation. If every student in a classroom has their own individual iPad, but they are completing a PDF of a worksheet on it, they are not using technology to increase their understanding of a topic or engaging in a technology-rich experience. They are only using a device for the sake of using technology.

The third level of the divide looks at how teachers can change the purpose of the technology they are using to meet the needs of their class. Wang (2013) describes the third level of the divide as expanding on the divide to include "how to empower the individual within the context of a school" (p. 128). This level of the divide has not been researched as extensively as the other two levels and therefore will not be talked about as much throughout this paper.

Theoretical Framework

The digital divide is composed of three different levels. Wang (2013) explains that the first level looks at access to technology concerning both devices and infrastructure. The second level of the divide looks at the reasoning behind technology use, such as how it is being used and why. The third, and final level of the divide, looks at how teachers modify technology use to best meet their students' needs (Wang, 2013).

This first level of the divide causes discrepancies in the education of students from lower socioeconomic areas based on accessibility. There are schools where there aren't enough devices in classrooms for individual student use, much less enough to send one home with a student for use outside of school. There are schools where there aren't enough devices for full classes of students to be online at the same time. In schools like this, teachers often share sets of devices among their classes, thus limiting them to only be utilized when they are free. Some classrooms may have a computer or two for student use, which teachers have to rotate among those in the classroom. In addition, some schools also lack the infrastructure to support so many students being online at the same time.

In order for schools to help narrow the digital divide at this first level, they must first determine who has access to devices and the internet. If a student doesn't have access to devices

or the internet at home, the school needs to help find a solution so that all students can participate. Many schools have implemented programs to help distribute devices and increase internet access for students. This helps to ensure that all students can continue their learning when not at school.

The second level of the digital divide examines how technology is being used and what students are able to do with what they learn. Teachers need to not only be using technology in their classes, but they also need to be making sure their students can effectively use it in various situations. Students need to be proficient in 21st-century skills, which include technology literacy. Twenty-first-century skills revolve around four main components: communication, creativity, critical thinking, and collaboration. When educators are incorporating technology into their classroom and their lessons, they should strive to meet these four areas while using technology. This will help students learn how to use technology in a way that is beneficial to them. It will also help ensure they have the necessary skills to participate at the same level as their peers who come from higher socioeconomic areas.

How technology is utilized is often dependent on the teacher leading the classroom. If a teacher has been well trained and is comfortable using technology at a deeper level, they most likely will use the technology available in that manner. Conversely, if a teacher is uncomfortable with technology, they will tend to be more hesitant using it in their classroom. Teachers who are not as comfortable using technology need more support and training in order to utilize this resource more effectively in the classroom. In order to ensure teachers feel comfortable with the technology available to them and their students, schools need to focus on adequate training and support for teachers.

Rationale

Morgan and VanLengen (2005) state that "less affluent black and other minority students predominantly use drill and practice software" (p.706). Being used in this manner, schools are not setting students up to be successful in the future. The same researchers go on to state that, when used in a limited way, students will need supplementary use and exposure if they are going to be expected to integrate technology into their daily life by the time they complete high school. Researchers Hutchinson and Henry (2010) further state the importance of using technology in schools by pointing out that "educators need to frame instruction to foster and develop the new literacies of the Internet among these at-risk students" (p.64). They give two reasons for this, the first being that it will keep students engaged in school. The second reason is that it will provide students with the needed skills to be competitive in their future.

Schools and educators need to know if there is a benefit to teaching using technology if students have limited access outside of school. They also need to determine if the benefits of teaching students how to further their understanding by means of technology are still present if students don't have consistent access to technology. Schools need to consider how to change their approach, especially in a setting with students coming from a low SES area, so that all students can benefit from the use of technology in classrooms.

Definition of Terms

The digital divide is a term that has been around for many years. It was first used in the mid 1990s by then President Bill Clinton (Huffman, 2018). George and Petter (2016) define the digital divide as information access inequality. They further explain that it does not apply to just literal access to the Internet, but it also applies to access to devices and the knowledge needed to

retrieve information. Currently, the focus is on the second level of the divide and the access that is needed for success in an increasingly digital world.

Research Focus

This review will focus on the benefits of using technology as well as the best practices for incorporating technology into the education of students who come from a low-income background. The author seeks to answer the question: how does the use of technology in an educational setting benefit students who come from a low socioeconomic background? When using technology in a classroom setting and incorporating technology into daily activities, schools need to know if there is a benefit to students who have limited or no access to technology outside of school. Schools need to ensure that students, especially those from low socioeconomic backgrounds, benefit from using technology in the classroom even if they have limited access outside of school. Within the scope of how it benefits students, this paper will look at what the best practices are for using technology with low-income students. Students from low-income homes tend to attend schools that have less access to technology. These schools need to address the best ways to incorporate technology and how they can make it meaningful to the students. It will serve as a means to help educators know where to focus their energy in regard to using technology in the classroom.

CHAPTER II: LITERATURE REVIEW

Literature Search Procedures

Chapter two of this literature review will examine what access to technology for education looks like for students from a low-income setting and how both access and usage impact their education. Strategies for how to provide the most benefit while using technology with these students will also be described. The literature published between 2000 to 2018 was used for this study and was located through searches of ERIC, JSTOR, Academic Search Premier, and EBSCO as well as Hennepin County Library. The findings were limited by looking through peer-reviewed journals that focused on education and technology. The search was further limited by using the following keywords: "digital divide," "low income," "technology use," "teacher training," and "best practices." The structure of this chapter is to review the literature in regard to best practices for helping to close the digital divide in regard to students from low SES areas. The literature is broken into three sections: those who have access, what these individuals are able to accomplish with this access, and what schools are doing to close the digital divide.

What is the "Digital Divide"

There has been a big push in education to teach students 21st-century skills, or the skills that students will need to be successful, productive citizens in this century. Included in this list of skills are ways to use and access technology as a means to not only communicate but also to retrieve information. Aaron Fowles states the importance of this in a clear way "for kids to be given a fair shake in a modern economy, they are going to have to be computer literate" (as cited in McCollum, 2011, p. 4). Pachon, Macias and Bagasao (2000) explain the importance of

teaching kids these skills even further by saying that "the approaching 21st century is developing as an information-based, global society in which digital literacy will be a prerequisite for full participation. Therefore, anyone not digitally literate will be seriously disadvantaged" (p. 14). In 2002, the U.S. Bureau of Labor Statistics showed that 8 out of 10 of the fastest-growing jobs dealt with computers (Wilhelm, Carmen, & Reynolds, 2002).

The problem with teaching these 21st-century skills is that not everyone has access to technology or is taught how to use it in meaningful and relevant ways. This gap is often referred to as the 'digital divide.' The digital divide can refer to not only access to technology but also the divide between how students use technology in their homes and the restricted practices being used in some schools (Henderson & Honan, 2008).

Different researchers have brought to light that there are now different levels of the digital divide within schools. Researcher Pei-Yu Wang (2013) describes the first level of the divide as focusing on access to the resources needed in schools such as hardware, software, and access to the internet. The researcher explains that the second level goes on to look at how and why the technology is being used in the classroom by both teachers and students. The third level of the divide is explained by looking at how teachers modify the use of the technology to suit both their students and students' needs (Wang, 2013).

Who has Access?

Many factors make up the first level of the digital divide. One of those factors is the accessibility to technology both in and out of schools. When referring to the digital divide, access can be defined as "the right or ability to log on to a computer system or use a computer program" (Banister & Fischer, 2010, p. 3). However, these researchers further explain that this

often means when discussing access, the number of computers or the ratio of computers to people is what is analyzed, and that doesn't ensure that the computers are used or usable. It is essential to look not only at access in schools but also at access and use outside of school since that has an impact on students.

This divide can be examined by breaking down students in many different ways, including but not limited to geographic location, SES, gender, and even the highest level of education obtained by family members. Wang (2013) conducted a study exploring the differences between rural and urban schools regarding the gap in technology integration in Southern Taiwan. Using quantitative data collected via surveys, Wang (2013) was able to assess the differences in available technology and the attitudes of both teachers and students in two different locations. He surveyed 322 teachers and 322 students coming from 46 different public elementary schools, half of each group coming from a disadvantaged rural school and a regular urban school. Wang (2013) reported that, at the time, access to technology within schools was increasing in the U.S. "58% of public schools have laptops on carts, 73% have interactive whiteboards, and 4% provide handheld computing devices"(p.127). However, the results showed that the urban school fared far better in terms of its access. Urban schools had almost twice as many interactive whiteboards, netbooks, and tablets for student use. The rural schools had less technology available to students in every category. Despite the differences in availability, teachers in both groups used interactive whiteboards at a similar rate, but teachers from the urban schools integrated their use with other tools. In 2013, the National Telecommunications and Information Administration reported that "in very rural areas, 65 percent of homes rely on basic wired services" (as cited in Harlan, 2014, p.38). Harlan (2014)

further states that this is fine for basic services but it will not hold up for media rich sites which are frequently associated with e-learning.

A study by Wilhelm et al. (2002) reported that in 2000 only 53% of children living in central cities had access to a home computer, whereas 73% of students in the suburbs had home computers. In terms of accessing the internet, the researchers reported that 24% of students living in central cities could access the internet at home, whereas 35% of suburban kids could do so. Their study went on to examine geographic locations throughout the United States as well as home internet access. They found that the ten lowest states (states that had 45% or fewer of households with children accessing the internet) were located in the south or southwest part of the country (Wilhelm et al., 2002). In contrast, the New England region had the highest rates of Internet access at home.

Another study by Morgan and VanLengen (2005) analyzed data from a survey on computer use conducted by the U.S. Department of Labor and Statistics and the Census Bureau. The most recent survey, conducted in 2003, polled approximately 22,000 students aged 6 - 18 years old. Their findings showed that by location, the Southern region had the lowest rates of non-school computer usage at 73% of kids saying they used a computer outside of school. Similar to the study by Wilhelm et al. (2002), the Northeast continued to have the highest rates, with 83% of students saying they used a computer outside of school. The two studies once again had similar findings regarding location type, as Morgan and VanLengen (2005) reported that students living in a suburban area had much higher access at home (81%) than those living in a central city (69%). While both locations increased access over the years, students in suburban areas continued to have higher access rates than their counterparts living in central cities. The

location of students is significant because it shows that the gap isn't limited to just those in low SES settings; rather, this gap also affects students in geographically diverse locations.

The socio-economic status of students served by a school is probably one of the most significant factors of the divide. Singleton and Mast (2000) reported that between 1994 - 1997, computer ownership by minorities with a household income of less than $15,000 increased by 117 percent. While that jump is significant, it does not mean that everyone has computer access at home. Wilhelm et al. (2002) reported that by 2001, only one-third of households with children and an income of less than $15,000 had a computer. Data from three years later showed that the percentage of out-of-school use at the same income level jumped to 52% (Morgan & VanLengen, 2003). One potential discrepancy with that number is that the researchers were looking at out-of-school use and not necessarily home computer ownership like the Wilhelm et al. study. Comparing those numbers to students coming from families with an annual income of $75,000 or higher Wilhelm et al. (2002) reported that 95% of children coming from these homes have access to a computer at home. These findings align with Morgan and VanLengen's (2003) data as they state that 92% of students coming from households that make $75,000 or more annually are accessing a computer outside of school. These numbers are significant because without access to the internet at home, even if a school was to send home a device for student use, these students will still be at a disadvantage.

Increasing Access

 Mouza (2008) reported on a study done in 2003, where an urban school in New York City got laptops leased to the school and then gave them to students for use. The school chose three classrooms to look at from grades 3 - 5. The school population consisted of 1,277 students

in grades K - 5, and of those students, 94% were Hispanic and qualified for free lunch. These laptops were refurbished and not connected to a network because the school did not have the infrastructure to support it, but the students could use it during the school day.

Getting access to students is not a new idea or trend. As schools have increased available technology, some have, in turn, started providing students devices to use both on and off-campus. Technology companies have also worked towards making this a reality for schools by financially backing them. Other companies have provided means to allow more those in less privileged areas accessible and affordable internet options.

Denver School of Science and Technology was the first public charter high school in Denver, Colorado, to become 1:1 after receiving a gift from Hewlett - Packard (Zucker, 2009). Their school requires that 40% of their population comes from low-income households. Through the use of surveys, interviews, classroom observations, and document reviews, the researchers were able to obtain enough data to understand teachers' experiences through this program entirely. The school, both during and after implementation, has some of the highest test scores in the state, and at the time of the study, every graduating senior was accepted into a 4 - year college (Zucker 2009). By providing laptops to students, students could collaborate with others with ease and teachers were able to provide timely feedback allowing them to change the course of their instruction if necessary. Throughout the study, it was noted that their success was not solely due to the implementation of the laptops. The success of the program relied upon not only teacher use and training but also having a clear vision for implementation and support for both students and staff.

In the Fall of 2006, Butte Community College in Northern California randomly assigned free computers to entering students who were receiving financial aid (Fairlie, 2012). By providing laptops to students, the college sought to see if that would help close some of the achievement gap they saw within their community. Fairlie (2012) reported that there was a gap between their minority and non - minority students in terms of achievement and attributed some of the difference to access outside of school. Students who received the computers were required to do a questionnaire and also release their academic records to the college for the study. Two hundred eighty-six students participated in the study, half of which were in a control group and did not receive free computers. Of the students in the study, 102 were minority students, and of those, 52 received free computers. The researcher found that the academic marks of students who received computers were better than those in the control group. They also found that minority students who received a laptop had a higher success rate in courses and a higher completion rate than their counterparts in the control group. Overall, the percentage of courses completed by the students who got free laptops was 8-11 percent higher than average (Fairlie, 2012)). Fairlie (2012) does point out that there was less of an effect on the non-minority students.

As access is increasing, some corporate companies are trying to help get internet to homes that may not have access. In 2016, George and Petter (2016) sought to answer the question, "If communities have access to free/low-cost fast internet at home, does it improve educational outcomes in K- 12 schools" (p.1)? They did a qualitative study in Kansas City, Missouri, which was the first city to receive Google Fiber in 2012. Google Fiber is an internet broadband and cable service that offers free or low-cost service to low-income areas. The study found that even with having access, there was "little to no improvements in educational

outcomes" (George & Petter, 2016, p. 4). Many of the households that used this service were middle to high-income homes. The lower level income neighborhoods had minimal sign up even after free devices were set up.

Part of the concern with schools providing technology for students to use away from school is that not all students can access the internet at home. Not having internet access makes using the computer for school work much more challenging. For the most part, access to technology is increasing as we progress into the 21st century. As access is increasing, there remains a gap between students' abilities. What students can do and what they choose to do with these resources is contributing to the gap between groups. If that gap is present, we still have work to do in our schools.

What Are We Doing With Access

Most research on this topic is now being focused on the second level of the digital divide. As access to technology has continued to grow both inside and outside of schools, various programs and initiatives have shifted the focus to how technology is being used and the impact it has on student learning. This second-level divide is sometimes referred to as the digital use divide. It more closely examines the gap between students who use technology for content creation versus those who use it more for content consumption. Researchers are looking at how students in different demographics are utilizing the resources they have, what differences there are among demographic groups, and the implications of those differences.

There will be differences in how technology is accessed and used regardless of how groups of students are categorized. These differences can be due to many reasons, but some factors that will contribute to the differences are age, education level, and amount of experience

with technology (Reinhart, Thomas & Toriskie, 2011). Reinhart et al. (2011) state that it is hard to identify all the factors that influence the second-level digital divide. "The divide is not simply due to differences in access to physical/digital technology, but rather there appears to be SLDD (second-level digital divide) which is due to differences in physical/digital, human and social factors that influence how members of society use the technology" (Reinhart et al., 2011, p. 182). Later in their research, they point out that there is a big difference in how information and communication technology is being used within schools and creating this second level divide. The two main reasons for that come from the human factor and the physical/digital factor. The human factor is how teachers use technology and the physical/digital factor consists of things such as infrastructure, use of time within a school, and flawed technology. It is important to note that this is not due to a lack of access to technology. "Simply having the physical access to technology within the school does not significantly change learning outcomes" (Reinhart et al., 2011, p. 183).

Reinhart et al. (2011) set out to answer the questions; "how do K - 12 teachers use technology in their classroom" (p.185) and "is there a difference in how technology is being used based on socio-economic factors" (p.185)? The researchers did an exploratory study with teachers that worked in a Midwestern city and were graduate students attending the university where the researchers worked. The study consisted of 94 graduate students who voluntarily answered an inventory survey based on their current teaching experiences within a K-12 setting.

Reinhart et al. (2011) found that the way technology gets used was driven by the population the school serves. Schools that use technology in such a way as to promote higher-level thinking skills tend to serve a community that has a lower percentage of students

who receive free and reduced lunch (Reinhart et al., 2011). Another thing they found was that technology facilitators are more likely to be found in schools with a lower percentage of students receiving free and reduced lunch. This means that teachers serving a lower SES population of students are not using technology to promote higher-level thinking at the same rate as teachers who work with students from a higher SES population. They also aren't receiving the same level of support and training as teachers that work in schools with a lower percentage of students receiving free and reduced lunch. The researchers concluded that there is an apparent divide in how technology is used. It would be beneficial to conduct further research on pedagogical practices that would elicit higher-order thinking skills when utilizing technology (Reinhart et al., 2011).

Greenhow, Walker and Kim (2010) conducted a study to find what low - income students' access, use, activities, and capacity for using the internet are compared to other students and what implications, if any, this had on teaching and learning. The researchers gathered qualitative and quantitative data from 852 students from 13 urban high schools. Participants were all part of an after school program, which aimed to improve college access for low-income youth. The participants all came from families who were at or below a median income of $25,000. What they found was that almost all of the students used the internet in some capacity. The vast majority of the students were using desktop computers to get online and doing so from their homes (Greenhow et al., 2010). In fact, in terms of ownership and use, it seems that the low-income students from this sample are not lagging behind the levels of their peers coming from higher-income homes. These results suggest that there may be a narrowing of the divide concerning these factors (Greenhow et al., 2010). However this study found a more significant

gap with internet access. The students from the sample reported that, for the most part, they accessed the internet once per day. In contrast, higher-income students report accessing the internet multiple times throughout the day.

As for how low-income students were using the technology, Greenhow et al. (2010) found that students use their access for many different things, with the highest usage being: sending or reading emails (97.1%) and getting information about college (93.1%). The next highest percentage was to go online for news (81.5%)followed by sending or receiving instant messages (74.2%). However, these statistics may contradict the norm, since all the students surveyed were part of a program focused on college readiness. Typically, in low-income schools, students are more likely to be using computers for skills and practice, rather than higher-level work or engaging with information (Mouza, 2008). The researchers even stated that the sample of students they used was a limiting factor within their research because the students were enrolled in a program specifically aimed at increasing college admissions.

Researchers Du et al. (2004) analyzed data from the Educational Longitudinal Study of 2002 to compare the in-home computer use versus use at school of disadvantaged students and their peers. The study was carried out with 10th-grade students in the spring of 2002 within 752 schools. The data came from questionnaires, two different achievement tests, and a school observation form. Du et al. (2004) analyzed the data to determine whether disadvantaged students lag behind their peers in computer usage in and out of school, how computer usage relates to academic achievement and the differences between different SES groups.

In reference to computer usage, Du et al. (2004) found that computer use at school was very similar for all subgroups, but computer usage outside of school had significant gaps.

Minority students lagged behind home computer use compared to Caucasian, Asian, Hawaiian, and Pacific Islander students. The researchers found that owning a home computer was significantly related to higher academic achievement. Meaning, that in terms of academic achievement, minority students also lagged behind their counterparts.

Du et al. (2004) found that using a computer for school work produced a more significant benefit for Caucasian, Asian, Hawaiian, and Pacific Islander students than it did for minority students. Far fewer minority students reported using a computer for school work versus their counterparts. They did, however, report using a computer to learn on their own more than the Caucasian/API group of students. The researchers conclude with the fact that, while there needs to be equity in computer access, it is more imperative that there is "equity in consideration of the learning needs of low income and minority students" (Du et al., 2004, p. 281).

In 2010, Hutchinson and Henry (2010) did a study looking at the literacy skills and online usage of seventh-grade students who were identified as being at high risk of dropping out of school. They used a questionnaire to gather information from 12 middle schools in the northeast and southeast regions of the United States. Their research looked at the online literacy skills that students possessed and investigated the internet usage of these students. They found that access to computers was present (81%) both inside and outside of school. They also found that computer use inside the school was much higher for African American students than for Caucasian students. Outside of school, the lowest usage came from Hispanic students.

Hutchinson and Henry (2010) also looked at how the students were using the internet regularly both inside and outside of school. Inside school, the highest reports of usage came from; using the internet (45.4%), using search engines (32.1%), for school-related tasks (30.4%),

and playing online games (25.5%). Outside of school, students reported engaging in online activities most frequently for; using the internet (43.3%), reading about entertainment topics (40.4%), playing online games (39.3%), and non-school related tasks (39.1%). Something of note is that when looking at the time when students access the internet for school-related tasks, the percent is higher for students who engage in this outside of school (34.1%) versus inside of school (30.4%) (Hutchinson & Henry, 2010). These findings are similar to the results of Du et al. (2004) and Greenhow et al. (2010). All of these studies found that students are accessing and engaging with information online to do school work or participate in outside learning.

The last thing Hutchinson and Henry (2010) analyzed was how skilled the students were in the literacies of internet-based reading, writing, and communicating. Their results showed that students with a computer at home have higher skill scores than students without a home computer. Female students are more skilled than male and rural students have higher skill scores than urban. Their results also show that there are differences in the skill level of students in different racial groups and that overall, this demographic of students (high risk of dropping out) has not developed the necessary skills for reading, writing, and communicating on the internet. The researchers conclude that the discrepancy in skill levels comes from the amount and quality of instruction that students receive and not just their access to technology.

Henderson and Honan (2008) did similar study out of Australia looking at the usage of computers in school and exploring their perceptions of usage in relation to their usage at home. The data they collected came from two classrooms of young adolescents in a low SES suburb of Australia. In this study, 84% of the students reported having a computer at home, and the rest reported having access to a computer when not at school. The students said that, while they

occasionally used the computer for gaming and watching videos, many also reported that they used it to access the internet or use various programs to create things (Microsoft Word or Excel).

To the dismay of the researchers, the students' background knowledge was not utilized in the classrooms. In one of the classroom observations, the teacher was spending time teaching the necessary skills to students while the students were sitting and listening. In the other classroom, students were engaged in a task while being led through a set of instructions and creating a PowerPoint (Henderson & Honan, 2008). The students in the study came in with background knowledge and skills, yet they did not get addressed within the classroom. The students knew how to use computers and were spending time outside of school learning and creating with the tools available to them. The teachers appeared to underestimate student's abilities and not acknowledge them within the classroom.

Henderson and Honan (2008) conducted interviews with the teachers as part of their study and found out that the teachers had pre-existing assumptions about what the students were bringing to the table. One teacher reported that she used a direct teaching approach because she assumed that students did not have background knowledge or experience with a program like Excel. The teacher also stated that the direct teaching approach was a school practice that she had not questioned. When interviewed, the other teacher said she was aware of student's access at home but was unaware of how that would connect to what they do in the classroom. In the conclusion of their research, Henderson and Honan (2008) point out that it is a challenge for teachers to understand the diversity of knowledge students bring concerning their understanding of digital technologies. However, it is essential if they want to prepare students to be successful in a technological world.

How is Technology Utilized in Schools

How technology is accessed and used in classrooms can go a long way to help close the second-level digital divide. The U.S. Department of Education (2017) stated that a "digital use divide continues to exist between learners who are using technology in active, creative ways to support their learning and those who predominantly use technology for passive content consumption" (as cited in Strawser & Apostel, p. 7). Students should be stretched to use technology for content creation and go beyond entry-level use as 21st-century learners. One issue that stands in the way of that is that first, students need to be taught how to use technology to go beyond passive consumption and use.

Schools, teachers, and students have lots of resources and tools at their disposal, but Strawser and Apostel (2018) pose the following questions: "are we using these tools in a way that elevates instruction? Are we using new technology to create a student-centered environment for all students'"(p. 56)? As teachers are utilizing more hardware and software in their classrooms, they need to keep in mind that some students have access outside of school and some do not, so the knowledge they are bringing to the table is going to be different for each student and it will need to be addressed. This was also addressed in the study by Henerson and Honan (2008). Strawser and Apostel (2018) suggest that teachers allow students to complete their work in a way they feel most comfortable. This can be done by using a range of tools, as opposed to allowing only one way for learning to transpire and be assessed.

Technology use in schools varies greatly depending on the school. Watulak, Laster and Liu (2011) did a qualitative study of one urban elementary/middle school in a mid-Atlantic school district. The researchers collected data to gain insight and to see students' perspectives of

literacy, their range of literacy engagements in and out of school, and their vision for literate citizenship in the future. The school's population is primarily African-American (92%), and the school has met AYP (Annual Yearly Progress) in all categories except Special Education for the year 2009. To gather data, the researchers conducted interviews consisting of 19 students as well as four teachers, four administrators, and twelve community members. The researchers also conducted classroom observations in first grade, second/third combination class, fourth, seventh, and eighth grades about the range of technology-supported literacies and strategies used in the classroom. Observations were conducted in five different classrooms anywhere from 4 - 19 times.

Watulak, Laster, and Liu (2011) found that throughout the school, the computer lab and resource center were well equipped. However, the classrooms did not have computers or internet access readily available. Over the course of their data collection, they reported that the number of computers in classrooms fluctuated from one to three computers and many didn't have wired internet access until partway through the school year. In most classes, there was an overhead projector or ELMO that teachers could use except for 1st grade. The computer lab at the school had 32 computers that had software downloaded and the computers connected to a printer at the teacher's desk in the lab. The observations that took place in the classrooms revealed low-level use by both students and teachers. Most of the technology use observed in the elementary rooms was teacher-initiated through the use of the overhead projector or the ELMO (Watulak et al., 2011). The students' roles in the use of these was minimal. Even in the upper grades, the researchers observed very little student use of technology. In the seventh/eighth grade room, the teacher used the ELMO to project a video clip to students so the use of the available technology

was a little higher. However, the student interaction with it was still minimal. As for computers used in the classroom, the researchers observed minimal use, and some of the use they saw was for non-instructional reasons. They go on to point out this non-instructional use is unique because they were able to observe parts of the 21st-century framework in that the use was student-initiated and student-directed. However, those were not visible within instructional use in the classrooms (Watulak et al., 2011). Overall, the technology use that researchers saw was not supporting 21st-century literacies and instead was used for teacher-directed instruction, and student use was limited to drill and practice type instruction (Watulak et al., 2011).

Despite minimal use within classrooms, Watulak et al. (2011) observed many instances of students' knowledge of technology concepts. This knowledge presented itself within classroom discussions and vocabulary instruction. In the 4th grade classroom, technology concepts were part of the word wall and in the 7th-grade class, specific terms got taught as part of the lesson. While both of these teachers utilized technology during their instruction, both used it in a basic way, and students in these classes did not use it for educational purposes at any point during observations. The researchers point out how it is interesting that students are exposed to terms surrounding technology use and can use their understanding of technology concepts in class to make connections even though the technology is accessed minimally throughout the school.

After conducting observations and interviews, Watulak et al. (2011) found some areas that need to be addressed in terms of how to address the second level divide within the school setting. They state that "in order to move toward technology integration that supports 21st-century skills, cultural competencies and experiences, teachers need to be supported to use

new technologies and also learn how to incorporate them into their content and pedagogical approaches" (Watulak et al., 2011, p. 13). Teachers must learn how to do this and get support in their development of these practices to effectively change their practices to incorporate more student-centered technology use and content creation or inquiry. Throughout the interviews with students, the students reported they use digital texts outside of school, but it was still surface-level use. For students to be successful using 21st-century skills, teachers need to help them develop these skills and also teach using these skills. Teaching 21st-century skills will require teachers to be comfortable with the skills, which supports the researcher's conclusion that teachers need to be encouraged to learn and use these skills. Watulak et al. (2011) follow that up by pointing out that in order for any of this to happen, there needs to be support at the district and state level as well as support from school administration at the classroom level.

Not all technology use at low-income schools looks like the study by Watulak et al. (2011). There are plenty of instances where schools with high populations of low-income students are having success in integrating technology and teaching students to use 21st-century skills. In the Midwest, Watson and Watson (2011) looked at how a low-income alternative high school used computer-based instruction (CBI) to support learning. They sought answers to the questions:

 (a) what roles do technology and CBI play in the culture of learning and learning process at this disadvantaged alternative school, (b) what CBI technology features are used at this alternative school and what are the negative and positives of these and (c) how can CBI technology be better used to meet the needs of disadvantaged learners for learner-centered instruction? (Watson & Watson, 2011, p.42 - 43)

The alternative high school served approximately 70 students during the 2008 school year, when the study was done, and had five staff members. The school was located near the district high school but served students who were expelled from there and no longer allowed on school grounds. Students came to school at a predetermined time each day that they set up with the teachers. Researchers gathered data from observations, field notes, focus group interviews, and also individual interviews. The participants they interviewed included ten students, five staff from the school, and two district administrators.

The school was an alternative school, so all of the students in attendance had failed at traditional high school, yet Watson and Watson (2011) noted that the overall atmosphere was positive upon walking into the school. When asked, students talked about how learning at the school was fun because their choices and input got heard throughout the learning process. The students in the school had options in how they received instruction. Their choices were: learning packets, technology projects (creating PowerPoint presentations, brochures or WebQuests), CBI through Plato or traditional lecture. The students had a choice in how they wanted to meet standards, and the teachers gave them suggestions and options as well in how they completed tasks.

The school had a very learner-centered approach, which lent itself well to the implementation of CBI (Watson &Watson, 2011). Teachers reported that students had good results when using Plato for their instruction. The researchers reported that students tended to use it more with content they were comfortable with, such as math and science, even though it was available for all areas. Students reported they liked using the program because they got to use it how it made sense to them as opposed to being told how to use it. Some students would use it for

practice or relearning materials. Since the program is self-paced, students could go back and review when needed. Another positive feature the researchers mentioned was that the program provided feedback for students and allowed them to see where they were successful versus where they needed to focus.

There were some negatives to the use of CBI in the school as well. One issue that teachers brought up to Watson and Watson (2011) was the lack of help features available. Students got frustrated when they were stuck and had to wait for a teacher to help them. Teachers expressed frustration at the rigidity of the program. The teachers "were unable to customize the instruction and instead had to rely on what the program offered and nothing more" (Watson & Watson, 2011, p.49). They also voiced disappointment in the amount of drill and practice within the program as opposed to more project-based learning. With the drill and practice set up, teachers felt that students were not always learning the material but instead just memorizing it for the immediate need to pass and then forget it. Overall, the results demonstrate that there is an important role for CBI use in this environment. Both teachers and students expressed the importance of technology and how "it provides endless resources for learning in this marginalized and disadvantaged alternative school's situation of extremely limited resources" (Watson & Watson, 2011, p. 52).

While the overall feedback of the program was positive from both teachers and students, the researchers report on areas that could make the use of CBI better and more beneficial. One area is in teacher training and support. The teachers felt some questions and problems would arise that they didn't feel equipped to deal with. The district administrator that was interviewed said that it was a problem across the district and that staff got trained when they first acquired the

program but hasn't been retrained since then (Watson & Watson, 2011). The researchers go on to discuss that limited district support is visible. They feel the district did not plan well enough ahead to fully support the implementation at a sustained level and in a way that would maximize its impact. The researchers think that more consideration should have gone into the development of teachers and how the program would look in a classroom.

While both of the previously mentioned schools utilized technology in a low - income setting, both did so in very different ways and both had different results. The first school used it more as a method to teach students, and the second school used it more as a way for students to learn. Smith (2014) wrote an article about her journey with switching her classroom to a project-based learning focus while using technology to facilitate the learning happening in her room. She discusses that her reasoning for changing her approach was due in part to the excitement she observed in her students when they were discussing their use of technology outside of school. After doing research and before changing her class, Smith (2014) points out that "without directed and conscious change in pedagogy, employing technology alone will not result in any meaningful change in students' learning" (p. 42). So upon changing the format of her class, she knew that she would have to consider how she approaches the content of her class, and how she would pull in students' prior knowledge.

Her article revolves around a project she did during the year in which students had to present a historical person's biography. How the students presented the project was up to them. She points out that her classroom transformed over the course of this project as students put themselves into groups to work. She became more of a partner in the learning process in an effort to not impart knowledge and instead redirect and refine their knowledge. Upon her reflection at

the end of the project, she said the approach allowed her to differentiate the learning in her classroom. One of her takeaways was that "consideration needs to be given to how and why technology is being used, not just in literacy, but in other areas of learning and teaching" (Smith, 2014, p.47). So while she isn't teaching at a low-income school, she does point out the importance of having a purpose for using technology in the classroom to gain the benefits of it entirely. This aligns with the findings from the previous two studies as well in how the technology is used in the class impacts the students.

How Schools Can Help Bridge the Divide

So far, it was established that the part of the digital divide that was caused by access is no longer the primary concern. Much of the focus has now shifted to how technology is used. Teachers and educators have the potential to influence this divide in significant ways. Schools and school leaders must determine how to make the most substantial impact on upcoming learners. They need to look beyond usage at a basic level and look at how students are using technology in school, technology training for educators and families, and also both teacher and student's attitudes and beliefs on technology use. It is also of value to look at programs schools are putting in place to help bridge the divide and what kind of training teachers are getting that add value to the students' education on the digital front.

Program to Assist and Increase Usage

Analyzing technology use in the classroom is not the only thing to look at when looking at how schools can help close the divide. Another thing to look at are programs that schools have started or have in place that help get the technology out to the students and families and also help them utilize them in a way that will benefit all involved. By getting technology to be accessible

by families and also educating both students and parents on best practices, schools are putting students in a position to be successful.

One of the programs that is widely utilized by schools is a one-to-one program. A one-to-one program offers all students the ability to use a computer or device throughout the school day by providing enough devices for individual students to have their own. Some programs even allow students to bring home the device for use. One-to-one programs offer the "greatest potential of educational technologies to date in that they place the most power and versatility in students' hands" (Grimes & Warschauer, 2008, p. 306).

Grimes and Warschauer (2008) did a qualitative study on one of the largest one-to-one laptop implementations in California. The purpose of this study was to see how the implementation of such a program changed teaching and learning patterns in the schools to see what measurable impact a one-to-one program had on test scores and, lastly, to see how teachers and students evaluated the program. Their study covered a semi-urban school district with approximately 1,000 students participating in the program. They looked at three schools within the district featuring a wide range of age, SES, and student programs. One school was a junior high in a low socio-economic community. At that school, the program was launched to all 554 7th grade students. The second school was a K - 8 science and technology-focused school in a high socio-economic community. In this school, the laptop program was launched to all 3rd through 7th-grade students totaling 395 students. The last school was an elementary school in an economically diverse neighborhood. In this school, the laptop program was carried out in two gifted and talented classes. One class was at the 3/4 grade level, and the other was at the 5/6 grade level, totaling 62 students. Through the program, at the junior high school, the students

were provided laptops for the cost of insurance, while at the other two schools, parents were invited to purchase the laptop, and the school provided ones for low-income students. Grimes and Warschauer were given full access to the program as well as being able to observe classes and interview both teachers and students. The researchers utilized surveys and various documents and records to gather data with much of the data coming from the first year of the program (2004 - 2005). The researchers continued to look at test scores over the first two years (2004 - 2006). The researchers state that a limitation of the research was that they only used the initial implementation.

Grimes and Warschauer (2008) found that laptops were used regularly at all three schools, but the total use was lower in the junior high school. Key differences between the junior high and the other two schools was that the students in this school came from a low SES community and had less background and previous exposure to technology. The other schools were either focused on technology or the students were part of a gifted and talented program. The teachers at the other two schools were also trained to use technology in the classroom, whereas at the junior high, all the seventh-grade teachers were asked to implement use regardless of previous training.

In this study, researchers noted four positive changes in writing, information literacy, multimedia skills, and also autonomy. Writing and editing papers was one of the most observed uses of laptops in schools. While the amount of use and the approach of how the laptops were utilized during the writing process varied, "most teachers said their students were writing more" (Grimes & Warschauer, 2008, p. 316). In regard to information literacy, 63% of the students surveyed said they used their laptops to search the internet. Information literacy is a massive

component of 21st-century learning. This study suggests that introducing laptops has a positive impact on students' access to and use of information in instruction and research (Grimes & Warschauer, 2008). The last significant impact the researchers observed was greater student autonomy. When using laptops, students were more able to organize and maintain their school work independently. Grimes and Warschauer (2008) point out that having such a personalized learning experience is often an overlooked benefit of one-to-one programs.

Based on the research by Grimes an Warschauer (2008) the overall outcome of the program was positive. Teachers felt the laptop program assisted with learning and believed that it had a positive impact on all groups of students. When asked, students had the same positive response as the teachers, with 74% of students agreeing that school work was more interesting with the laptops (Grimes & Warschauer, 2008). When examining how implementing the program impacted test scores, there was no significant difference over the two years for ELA scores. Over the first year, the scores went down for students who were using a laptop but they went back up the second year. When looking at the math scores, they went up both years, in comparison to peers who were not using laptops; however, the researchers did not feel this was because of laptops since they were used the least in math classes. Final findings from the study suggest introducing a one-to-one program led to changes in content delivery in all classes but not to content being taught. Grimes and Warschauer (2008) do point out that implementation was harder in the low SES school than in the other two. Overall, the study suggests that "a one-to-one laptop program can have substantive effects on teaching and learning processes, facilitating the kinds of writing-intensive, information-rich, multimodal, and student-centered instruction that education reformers have long called for" (Grimes & Warschauer, 2008, p. 329).

A similar study on the implementation of one-to-one iPads was done by Howard and Howard (2017) in an urban high school in the southwestern part of the U.S. Researchers were looking at how the use of one-to-one programs could engage and motivate high school students. The research was done via observations, interviews, and surveys over the course of two years with six different teachers and 408 students. The majority of the students observed were ninth graders, but there were some older students seen as well.

During observations, Howard and Howard (2017) saw many instances of student motivation and engagement in relation to using the iPads in class. Students were using various apps to engage with content. In multiple classrooms, students worked collaboratively with both the content as well as peers. In a few cases, students participated in off-task behavior during class, which the researchers point out as one possible consequence of utilizing one-to-one technology.

When asked about learning and motivation in connection with the use of the iPads, all teachers expressed a belief that the use of iPads in their classes increased student learning as well as student motivation (Howard & Howard, 2017). Teachers shared positive thoughts on how utilizing iPads in their classrooms afforded students the ability to learn and practice skills at their own pace and to access outside resources. When asked about the use of iPads, "none of the teachers expressed concerns that the iPads might negatively affect learning in the classroom; but rather, all of the teachers believed that using them had a positive influence on student learning" (Howard & Howard, 2017, p.71). Surveyed students also shared the same positive feelings about the use of the iPads. A little over half of the students (61%) believed using an iPad in class helped them learn.

Howard and Howard (2017) conclude that the use of 1:1 iPads in the classroom had a positive impact on student engagement and motivation in this urban high school. This technology allows teachers to enhance their teaching and students to be more motivated to learn new content. They do note that when implementing a 1:1 program, a clear rationale, infrastructure, and support system for teachers must be considered to ensure success.

Family Programs

One-to-one programs are not the only programs that schools are utilizing to help close the divide, especially with students from low SES areas. As previously discussed, closing the digital divide is not just about making technology available to students; it is also about educating them and teaching them the skills to utilize that technology to its fullest. A program in Boston is doing just that.

Tech Goes Home is a citywide program in Boston that has helped provide computers to more than 5,000 low-income families that are a part of 43 Boston schools. Through the program, teachers educate parents and families on how to use computers to meet educational and life goals. After completing 25 hours of classes, families can purchase a laptop for $50. By allowing families to buy computers at an affordable price, students can have access that they may not have had previously.

DeGennaro (2010) highlights Lilla G. Frederick middle school and their use of this program. In this school, students help with the teaching of their parents by attending after school classes alongside them. The students in this school are made up of many different backgrounds and come from a neighborhood where the average household income is $22,700, which is 35% lower than the average Boston salary (DeGennaro, 2010). The background of the students doesn't

impede the school from teaching a rigorous curriculum to its students. The school grounds its curriculum in "inquiry, exploration, experiential learning, and the chance to make connections" (DeGennaro, 2010, p. 74). The use of digital technologies is an essential part of that, and teachers report that they utilize technology daily in the classroom. The school provides computers for students to use while in the building, but they do not allow them to bring them home. Many students did not have access at home, which was why the school decided to create this partnership and thus enable students to gain access at home. The school also works with families to gain internet access at an affordable rate.

The Tech Goes Home program does more than teach families how to utilize technology and make it available to them; the program also helps strengthen the home-school communication between parents and educators, along with introducing and educating parents to financial and career programs. During the classes, students sit with their parents and help teach them how to use programs so that the parents can be involved in what is happening at school as well as learn new skills. One of the final steps in these classes is to do a research project where the student and parent research something relating to personal goals or career exploration. The personalization of the project is thought to increase participation as well as help internalize new skills.

At the time of the article, the program had only been in place for three years but had already seen improvements in student achievement. In one year, the number of 6th graders failing math decreased by almost 50%, and the number of 7th graders failing Language Arts decreased by 20%. DeGennaro (2010) also notes that the mobility rate of the students in the school declined as well over this time.

Teacher Training

When looking at how technology is utilized to help bridge the digital divide, we can't overlook the influence of teachers. Teachers are going to be one of the most significant driving forces behind how technology is used in the classroom and the skills acquired through its use.. Teacher attitudes, beliefs, and training are all going to have an impact on closing the divide.

Teacher training has a significant impact on how teachers will use technology in their teaching and will, therefore, have a direct impact on student learning. Paul (2016) states that schools in White suburban communities are more inclined than schools serving low-income learners to use apps and programs that allow students to develop higher-order thinking skills. Not only is there a difference in programs they use when teaching, but also here is a difference between schools in the professional development the teachers receive concerning technology. Paul (2016) goes on to cite another study (Song & Owens, 2011) that states that "teachers of color in urban school contexts are twice as likely to possess inadequate technology and information literacy training, skills, and knowledge to work with technology in a classroom context that would benefit these students (as cited in Paul, 2016, p 412)." The fact that such a disparity exists means that schools, especially those serving low SES families, need to focus on teacher training to bridge the divide.

A case study out of Texas aimed to look at not only how teachers were using technology in their classes and how it impacted their classes, but also what was preventing teachers from using technology in their classrooms. Researchers Davidson, Richardson, and Jones (2014) collected data from eight ELA teachers working in grades 9 - 12. The teachers came from two

high schools, which had predominantly African American and Hispanic students from a low SES urban area. Within the two high schools, the way technology was used was very different. In one school, technology was mostly used for administrative purposes (teachers reported using it 90% of the time for this) while at the other school, the teachers reported using technology for instructional purposes about 80% of the time. The schools are in the same district, but they both have different technology goals in their building. At the first high school, the goal is to have technology written into the lesson plans, but there is no follow through with it. At the second high school, the goal was to integrate technology daily to enhance real-world connections (Davidson et al., 2014).

Since both schools have technology goals, the researchers sought to find out what prevented teachers from utilizing technology more in the classroom. Many of the participants stated that "lack of professional development for integrating technology and instruction" (Davidson et al., 2014, p. 13) as a barrier for not using it more. They said that, due to lack of training, they didn't feel comfortable using it or troubleshooting problems that may arise in their classroom. In general, all but one participant stated that they were comfortable using technology for instructional purposes. However, overall they felt they would use it more if they had gotten more training and support.

Davidson et al. (2014) conclude from their data that, while integrating technology can enhance teaching and learning, it will not do so without training and development. They suggest that effective professional development would include hands-on activities, self-reflection, and continuous long term learning. Without proper training and professional development, teachers cannot effectively close the digital divide.

The research and conclusion that teachers need proper training to be effective, by Davidson et al. (2014), supports the claims made by another group of researchers who found that teacher attitudes and participation in computer-based training have a positive effect on the quality of classroom integration. Coleman et al.(2016) did a study about the internal barriers that contribute to teacher technology use within the classroom. They looked at whether teachers' attitudes and anxiety toward computing correlate with their preparedness, whether training intensity improves preparedness, and whether the teacher's attitude and anxiety moderate training intensity.

The study by Coleman et al. (2016) was part of a five-year research project of a computer-based intervention designed to provide fourth and fifth-grade teachers with resources to integrate computers into their classroom as a primary tool. The study took place in an urban school district located in the Southeastern United States and included professional development, in-class support, and modeling of techniques for teachers. Teachers who participated got invited to a week-long course in the summer, in which they spent time learning programs, writing lesson plans, and modeling lessons for each other. During the school year, they participated in professional development and classroom integration of various programs with the support of team members.

Data was collected via surveys given to teachers at the start and end of the year and also through in-class observations. Coleman et al. (2016) used in-class observations to measure the preparedness of the teachers and the execution of the lesson. Preparedness and execution were both measured on a scale of 1 - 3. If teachers received a score of a three for preparedness, they were prepared with a plan when they came to the meeting. If they received a score of a three for

execution, they could carry out the lesson with minimal assistance. A flaw with this is that the execution of a lesson was left more open to the judgment of the rater and was prone to differences in opinion.

What the raters found concerning preparedness was that the only thing that made a difference was the teachers that attended the summer institute had a greater likelihood of receiving a higher preparedness rating. For the execution scores, the teachers that participated in the summer institute had higher scores in comparison to the teachers who did not attend. What had a higher significance, though, was teacher attitudes towards computers. Teachers who had a more positive attitude towards classroom computing appeared to have a positive effect on the likelihood of receiving a higher execution rating relative to those with more negative attitudes (Coleman et al., 2016). This is true in other studies as well. However, the study by Coleman et al. (2016) found that how teachers felt about computer use in the classroom contributed to how well they executed a lesson using computers. However, it did not impact how prepared they were for the lesson.

Overall, the researchers found that the teachers who attended the summer institute were more likely to have a higher rating in both execution and preparedness. This suggests that teachers who have both intensive training (summer institute), as well as continued training (professional development), are more prepared and more successful at integrating computers into the classroom than teachers who only receive professional development. Coleman et al. (2016) suggest that one possible explanation for this is that, since the teachers attended the summer institute when they were not currently teaching, they were better able to process the information and take time to make valuable lessons. When teachers are involved in professional development

that takes place during the school year, they are simultaneously teaching their classes and often unable to take time to make quality lessons involving new practices. Thus, they receive lower scores on the execution rating. So, while both are beneficial, teachers gained more from intensive training outside of the regular school year, as opposed to professional development during the school year.

A study out of Ohio by researchers Bannister and Fischer (2010) looked at a middle school that was the recipient of a federal grant. The school utilized the funds to provide teachers and students with increased opportunities to use technology for teaching and learning. The school, Ravine Junior High, has approximately 850 students that come from low SES and minority populations, and many of the students do not have home access to internet services. In addition, the students did not have a great deal of access at school, nor were they using computers at school due to the fact that the school had limited working devices. For the grant, after doing much research, the team determined that student access and use of technology were the most significant areas of need. Before this grant (GEAR - UP), the school had received a different grant that focused on getting the school infrastructure set up and allocated money to purchase new technologies. Prior to receiving the GEAR-UP grant, the researchers state, "if data on access had been collected at the Ravine site, it would have shown positive growth" (Banister & Fischer, 2010, pg.4). They say, however, that "lack of adequate tech support, because of strained budgets in city schools, kept the computer systems in a nonfunctional state" (Banister & Fischer, 2010, p. 4).

To combat this, and help close the divide, Ravine Junior High turned to deeply embedded professional development. This type of professional development requires

commitment over time and a "dedication to the transformation of teachers and reformers into significant partners/equals in the professional development process" (Banister & Fischer, 2010, p. 5). For professional development, the teachers had a say by bringing their needs and ideas to a professional development committee. Then that committee took those needs and concerns and worked on a plan for the next school year. At the start of the 2002/2003 school year, the school offered 20 spots for an after school module that focused on teacher tools. The module lasted for seven weeks, and participants met for two and a half hours one day after school per week. In the second-year, the school opened up a second session to allow more teachers to participate. They also created a second module that encouraged teachers to look beyond the tools they use in class and focus more on tools that students would use. They also encouraged the teacher to implement the ideas discussed in their classes and then had teachers share stories about what worked and what didn't. Over the next few years, the training pieces got more in-depth as teachers got introduced to new tools and ideas and how to use them in the classroom. At one point, Ravine Junior high brought in a specialist to help even further expand technology implementation. Teachers began to feel comfortable enough to help each other. The staff also began to identify students who could help with computer issues. "Access and use continued to increase, as communication about technology integration and comfort with the technologies spread" (Banister & Fischer, 2010, pg. 7).

As the GEAR - UP grant came to an end, the researchers reported that the efforts to make computer hardware accessible and functional was providing more opportunities and technology experiences for students. By using the deeply embedded professional development model, Ravine teachers were able to direct their professional growth in the use of technology for

teaching and learning. The outcome of this was that the students at Ravine were using computers in a way that "paralleled experiences shared by most non marginalized student populations" (Banister & Fischer, 2010, pg. 7).

Throughout these studies, it is suggested and shown that professional development can positively contribute to not only increased technology use but also more effective technology use by teachers in classrooms. However, it cannot just be professional development that makes this happen. Other things also need to be present to help close the divide. These things have been echoed in many of the studies already addressed. For professional development to be beneficial, technology needs to be present and functional (Banister & Fischer, 2010). If teachers and students become equipped with access to working hardware and teachers are provided adequate professional development, they can then go on to use technology in a way that will encourage more in-depth use and more content creation by students, thus helping to close the divide.

Teacher Attitude

While important, teacher training is not the only way to increase technology use in schools and help close the divide. Teacher attitudes and beliefs are also going to play a significant role in this endeavor. If a teacher does not feel comfortable using something or feels like they or their students can not be successful, they will be less willing to try it. In two of the previously mentioned studies, teacher attitudes got cited as a reason that technology was not utilized more in the schools.

In the study by Davidson et al. (2014), part of their research focused on barriers to integrating technology at two high schools. While many of the teachers at both schools said they were comfortable using technology, they were not comfortable troubleshooting problems with

technology that may arise during a class. One of the study participants stated that "a lack of professional development for integrating technology and instruction" (Davidson et al., 2014, p.13) is a barrier. He or she explained that they know they could transition to using it, but they need help. The participant wasn't comfortable yet with being able to integrate technology without help, so they limited use in their classroom. Another participant stated, "if I knew how to solve technology problems before I get to the middle of a lesson, it might be easier" (Davidson et al., 2014, p.13). While both of these comments connect back to a strong need for professional development, they also show that the teacher's beliefs in their abilities are holding them back.

Coleman et al. (2016) also looked at whether teachers' attitudes and anxiety correlated with their preparedness and how they execute a computer-based lesson. What the researchers found was that how teachers felt about using a computer in the classroom did not influence how prepared for a lesson they were, but it did affect how a teacher executed a lesson. If a teacher went into a lesson having some anxiety towards using a computer or teaching a computer-based lesson, it impacted how much support they relied upon from a team member during observations by the researchers. The researchers also found that teachers reported a decreased level of anxiety about using computers in the classroom after attending professional development focused on computer usage.

The studies by Davidson et al. (2014) and Coleman et al. (2016) show that teachers who have negative feelings about using computers in class will ultimately be less willing to use them and less willing to encourage students to use them. However, when those teachers receive quality professional development, it can ease their anxiety and allow them to not only teach using technology but also enable students to use it in a meaningful way within a class. Teachers that

have a positive attitude and belief about technology usage are more willing to push their students

in technology usage and are more comfortable incorporating programs into classroom content.

CHAPTER III: DISCUSSION AND SUMMARY

Summary of Literature

The digital divide contains three different levels that separate students by the access they have to technology; the ways in which they are using it, both in and out of the classroom; and finally how teachers modify the use of technology to meet students' needs (Wang, 2013). The digital divide has evolved over time and changed as technology has been increasingly more present in classrooms throughout the world. At this time, much of the research is focused on the first two levels of the divide.

The first level of the digital divide focuses on access to resources, both in school and out of school. The accessibility of technology varies for students based on different factors. One of those factors is the geographic location of a student. Wang (2013) found that students in rural schools have less access to resources than students in urban schools. The data from Wang focused on schools in Southern Taiwan, but the same is true of access within the United States. Harlan (2014) found that in rural areas, 65% of homes rely on wired internet. This is not sufficient access to run websites heavy with media that are needed for school or video-conferencing. Looking at geographic areas another way, both Wilhelm et al. (2002) and Morgan and VanLengen (2005) found that the south/southwest part of the country has the lowest rate of in-home internet access. Both studies also report that schools located in a suburban area have a higher percentage of access, as opposed to schools located in central areas. Wilhelm et al. (2002) combine their findings with the fact that the 10 states, in the southern region of the United States, that have the lowest percentage of in-home internet access are also the lowest-ranked for child well-being because of high poverty rates.

This aligns with the second major factor that impacts the first level of the digital divide, socio-economic status. Wilhlem et al. (2002) and Morgan and VanLengen (2005) both found that students from lower-income homes had less access to a computer or the internet than their counterparts from high-income homes. Wilehelm et al. (2002) report that 95% of students from homes where the annual income was $75,000 or higher had access to a computer outside of school, versus 33% of students coming from a home with an annual income of $15,000 or less. Morgan and VanLengen (2005) report that 52% of students who come from a household with less than $15,000 annual income access a computer outside of school. Schools play a big role in this for many students because as Wilhelm et al. (2002) pointed out, without school computer access, the gap between a high-income and a low-income student is significant, but schools reduce the gap by two-thirds.

Access to computers is an integral part of helping narrow the digital divide. Since schools can play a big factor in that, many are finding ways to provide computers and access to students who might otherwise not have it. Zucker (2009) reported on a school-based in Colorado that had great success implementing one-to-one laptops for their students. Similarly, Fairlie (2012) reported on a community college in Northern California who gave laptops to students chosen at random who applied for financial aid. They then followed their academic records to see if there was significance. They found that the randomly selected treatment group did better academically than the control group who did not receive computers (Fairlie, 2012).

Once students have access to technology, they tend to use it for academic or school-related purposes (Du et al.,2004; Greenhow et al., 2010; Hutchinson & Henry 2010). The research shows that the way students use technology differs, in that, students from higher SES

families tend to use technology for academics more at home, whereas students from a lower SES tend to use technology more in school than at home (Du et al.,2004; Hutchinson & Henry 2010). One thing that many researchers touched on was the disparity between the quality of instruction and how technology was used in schools due in part to the population coming from higher-income homes versus lower-income homes. Multiple studies found that use and instruction are driven by population. Schools with a higher population of low SES students tend to direct their focus of technology use on drills, practice, and remediation; whereas schools with populations of kids coming from higher SES areas focus on engaging with information and content creation (Du et al.,2004; Hutchinson & Henry 2010; Mouza, 2010; Reinhart et al., 2011). Students are using technology to access information and content, both in school and out of school. Teachers and educators must use these skills in the classroom and expand on them in an effort to narrow the digital divide.

Schools and teachers who are serving students that come from low SES areas have many options as to how they can help narrow the digital divide. One thing that research from both Henderson and Honan (2008) and Strawser and Apostle (2018) touched on was that teachers need to tie in and build upon students' background knowledge. Henderson and Honan (2008) point out that teachers in low socioeconomic schools don't always account for students' background in accessing and using computers or the internet, nor do they consider students' home use of digital technologies. When this happens, teachers tend to teach skills that students already know or they keep technology use at a surface level assuming students cannot handle it. This connects back to previous studies (Du et al.,2004; Hutchinson & Henry 2010; Mouza, 2010; Reinhart et al., 2011) that discussed how students in low SES areas tend to use technology for

surface-level learning. Another thing to take into account is students who may not have the background knowledge and allowing them more time to learn and use the technology tools presented.

To go beyond surface-level use, and better serve students from low SES areas, some schools adopt or implement programs to help narrow the divide by getting devices to students so they can use them outside of school. Some schools, like the one discussed by Howard and Howard (2017) and also the one discussed by Grimes and Warschauer (2008) start at the first level of the divide and provide access to technology for their students. Both of these schools implemented one-to-one devices for students in an effort to increase student success by ensuring all students had access to a device. Grimes and Warschauer (2008) concluded their research by stating that a one-to-one laptop program in schools can have positive effects on teaching and learning. However, a one-to-one program isn't the only option. Donna DeGennaro (2010) wrote about the impact of a city-wide program in Boston that helped educate parents on how to use technology at home and at the culmination of the program, attendees got to purchase a discounted computer for home use. The idea behind the program was to not only to get technology into the hands of families who might not have access to it otherwise, but also to educate them in computer literacy skills.

Another way that teachers and schools can better serve their students and provide technology-rich experiences is by becoming more thoroughly trained and having adequate technical support. Many of the studies (Banister &Fischer, 2010; Coleman et al., 2016; Davidson et al., 2014; Watson & Watson, 2011; Watulaket al., 2011) echoed similar conclusions that the effect of technology usage on students from low socioeconomic areas is partially dependent on

teacher training and support. Watulak et al. (2011) said that "in order to move toward technology integration that supports 21st-century skills,...teachers need to be supported to use new technologies, and learn how to incorporate them into their content" (p.13). The type of training and support can look different, as shown by the research by Coleman et al. (2016) and also Banister and Fischer (2010). Coleman et al. (2016) followed a school that immersed their staff in professional development during the summer and then held follow up training throughout the school year. The benefit to this method was that teachers had a head start on material for their classes. Alternatively, Banister and Fischer (2010) discussed after school professional development; at the conclusion of their research they stated that the digital divide can be narrowed as teachers integrate digital technologies into their classes and continually challenge themselves and their students to use these technologies.

Lastly, both Davidson et al. (2014) and Coleman et al. (2016) touch on teacher attitudes towards technology. If teachers are going to help narrow the digital divide and help ensure their students have the skills they need to be successful in this century, they have to believe in the mission. Teachers have to be willing to work to change how they are using technology in their classrooms, as well as what they are expecting students to do with the technology they have access to. This is particularly important when working with students who come from low socioeconomic backgrounds in order to ensure they can be successful in the world they will grow up in.

Limitations of the Research

There is a lot of literature that revolves around the digital divide, but less that focuses on how schools can help narrow the divide in low socioeconomic areas. Originally the majority of

the literature lends itself more to the first level of the divide and looking at demographics of people that have access to technology versus who does not. Also, when the first level of the divide started to narrow, and the researchers began to look more at the second and third levels of the divide, much of the research was older information and not as relevant. With technology changing at such a rapid pace, it is hard to find research that is timely since studies take time to perform and publish.

The data was harder to find when looking for specifics on the second level of the divide and also what is being done in schools and how they can help bridge the gap. There were many studies done about technology use in schools both in the United States as well as around the world; however, not all of these studies looked at the implications of different subgroups of students and instead just looked at overall school or district usage. These studies were broad and generalized their results focused on students or schools as a whole. In addition, several studies were specific in what they looked at in terms of school and student use. For example, there were studies that only looked at cell phone use in schools, or only looked at using technology for communication purposes.

There was a lot of information to sift through in order to find quality data focused on best practices and technology use specifically with a low-income student population. The research really had to be honed down in order to find meaningful data to help teachers and schools know how to reach this subgroup of students specifically. When going through the research, many studies had to be put aside because they did not focus on or even make mention of how programs affected students from low-income areas. There is more research based on the overall outcome of a program surrounding effective strategies when implementing computers

and devices in school that was unusable because it did not look at low-income students or schools who primarily serve low-income students.

Implications for Future Research

We know that the use of technology in school has indisputable benefits. More research needs to be done on how educators can ensure those benefits are reaching all students. Schools as a whole need to look at how to make technology use equitable for all students regardless of their background. This does not only apply to students coming from different socioeconomic backgrounds but also students with language barriers and learning disabilities. More research needs to be done about how to effectively implement technology into all classrooms on a deeper level.

Teacher training is another area more research could be focused on. If teachers are trained on techniques and practices in regard to technology usage, they are likely to feel more comfortable utilizing it in their classrooms. What that training looks like would likely be different based on the location of the school, but schools need to ensure that all students are given a fair chance to learn and utilize these skills that will drive their futures.

Lastly, more could be done to look at the broad impact of technology use on students. Many of the current studies only focused on one or two years. In order for a program to be implemented and given time to take effect, studies should last longer so that researchers can analyze the overall impact of technology use in schools. Following a group of students for multiple years could give insight as to how technology use in the classroom, teacher training, and implementation all tie together to either help or hinder students. It may also provide insight as to how schools had to alter programs to make them more usable and effective.

Implications for Professional Application

The research offers a lot of facts about how beneficial the use of technology is for students and almost every paper talked about the importance of teaching 21st-century skills. Much of the research also points out that the gap between students who have access to computers and the internet outside of school and those who do not is much smaller than it ever has been before. Educators need to look more closely at the second and third levels of the digital divide to prepare our students to move forward into the current technology-driven world.

In order to help bridge the digital divide, teachers need to pay attention to how they approach technology in the classroom, as well as how they are asking students to interact with it. They must go beyond just using it as a different way to complete a task that could similarly be done on paper. They need to make sure that students are given opportunities within each class and content area to utilize technology in a meaningful way. Students need to be taught how to interact with and use tools they may not be familiar with and also have the opportunity to learn new ways to approach a task using what they do know. Teachers cannot shy away from using technology in their classrooms because they are uncomfortable with it. They need to learn it and become comfortable with it in order to narrow the digital divide for students.

Teachers do not need to go on this journey alone. They can and should be utilizing the knowledge that their students bring to the table. Many students are more familiar and comfortable with technology than teachers realize. To not use this prior knowledge in the classroom is doing a disservice to students. I have been in classrooms where teachers have had students be the "teacher" for the lesson and I think this would be a great palace to utilize a similar strategy if the teacher had a student who was comfortable and able.

Lastly, I think that schools and school leaders should look at how to provide adequate training to teachers on best practices with technology, in association with low-income students. Teachers can benefit from training to further develop their ability to utilize technology in their classrooms. More training might help them feel more comfortable using technology in more in-depth ways as well. Many of the studies pointed to the lack of teacher training and its impact on the utilization of or lack thereof in classrooms. If schools focus on this, the effect would in turn impact students and help narrow the divide.

Conclusion

The digital divide is narrowing as students gain more access to technology, but there still remains a divide in how technology is utilized in classrooms across the world. There are many benefits to using technology not only in a classroom but also with students who come from a low socioeconomic background, but there is still work to do in order to continue to bridge the divide. Students from a low SES background need to learn in an environment with rich technology experiences that parallels that which is found in schools catering to a higher SES population. With adequate access to technology and focused training for educators, all students can receive equal opportunities for effective educational experiences. This is how educators can continue to bridge the digital divide.

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