Teacher Perception of Student Engagement in a One-to-One Computing Environment

By

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Teacher Perception of Student Engagement in a One-to-One Computing Environment

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Computers are ubiquitous in today’s society. The rapid development and wide availability of computers, post-PC devices, Wi-Fi, the Internet, and cloud-based apps and tools are altering all facets of the 21st century. The role and impact of technology in schools has been hotly debated for decades. Advances such as television, cable, and personal computers in the classroom have all shown tremendous potential to revolutionize schooling but have failed to do so. As Wi-Fi has become more commonplace and technology has become cheaper, more available, and more mobile, schools have increasingly sought to implement one-to-one student-to-computer ratios. The development of post-PC devices such as iPads, tablets, and Chromebooks has only driven this initiative further. Additionally, as smartphones become more and more commonplace, social pressures and habits are driving the push to make more devices available to students in schools, from preschools to colleges. As educators and educational institutions reposition themselves to prepare students for the 21st century and jobs that may not yet exist, they recognize that technology has redefined the paradigm of education.

The purpose of this study is to build on a wide body of research on one-to-one student-to-computer ratios. Specifically, the study is focused on understanding how teachers see the impact
of the one-to-one ratio on student engagement. Data for this survey were gathered via an
electronic survey distributed to teachers from three schools spanning Grades 3 through 12. The
data were analyzed and compared to the existing body of research on one-to-one computing
environments.

Teachers surveyed for this study indicated many positive effects of the implementation of
one-to-one programs. These included improved teacher technology skills, the ability to share
and organize resources and documents, the ability to assess and offer students feedback, and
savings in paper because there is no need for copies. Teachers also indicated using the devices
for a wide variety of uses. Although a great deal of research points to the positive impacts of a
one-to-one student-to-computer ratio on student engagement, the respondents did not agree. The
research indicates that many of the benefits associated with one-to-one programs manifest
themselves after the second year of implementation. Teachers indicated a number of negative
aspects of the one-to-one program. These included students being off task or disengaged,
increased plagiarism, decreased personal (student-to-student and student-to-teacher) interaction,
and underdevelopment of handwriting skills.
Dedications

This work would not have been possible without the support and assistance of my family and so many great colleagues and friends. First, the Monmouth County St. Peter’s University cohort: Not only did our sense of collegiality help me through this program but our conversations and interactions helped mold my views about educational leadership. Second, the boards of education, administration, and staff of the Neptune, Shore Regional, and West Long Branch school districts: The support, guidance, and opportunities they have provided me were invaluable in completing this process.

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Chapter One

Introduction

Societal shifts driven by technology have had a profound impact on educational infrastructure, resources, stakeholder relationships, and learners. Technology in schools in the 21st century includes interactive whiteboards, tablets, document cameras, Chromebooks, Apple TVs, 3-D content, cloud computing, Web 2.0 applications, mobile technology, video conferencing, OpenCourseWare, virtual schooling, and gaming (Sheniger, 2014). Even in developing countries, students have access to social networks through Facebook, instant communication through Twitter, and mobile technology through their smartphones. “Today’s kids are born digital—born into a media rich, networked world of infinite possibilities. But their digital lifestyle is about more than cool gadgets; it’s about engagement, self-directed learning, creativity, and empowerment” (“What Works in Education,” n.d.). Thus, students desire more varied forms of communication and more vibrant learning methods than in the past (Oblinger & Oblinger, 2005). Green, Facer, Rudd, Dillon, and Humphreys (2005) found, “By the age of 21 the average person will have spent 15,000 hours in formal education, 20,000 hours in front of the TV, and 50,000 hours in front of a computer screen.” The sheer volume of media that today’s students are exposed to has led many to think differently about how school should be structured.

These findings about education echo Dewey’s (1916) statement, “If we teach today as we taught yesterday we will rob our children of tomorrow.” To Dewey, education represents how the experience of the environment affects the learner and the interaction that takes place between the learner and his or her environment. In this paradigm, knowledge is based on active, dynamic,
and ever-evolving experience. Recognizing that we now live in a digital world, many schools have begun implementing a variety of programs and initiatives to incorporate technology throughout students’ learning experience. Some schools are allowing students to bring their own devices (“BYOD”) whereas others are moving to one-to-one computing environments (Sauers & Mcleod, 2012). Tablets and other one-to-one computing devices have become popular in contemporary classrooms (Cox & Hanson, 2009). In bringing in new devices and adopting more open technology policies, schools acknowledge that their mandates for educating learners in the 21st century go beyond reading, writing, and arithmetic (Wagner, 2008). One-to-one computing refers to the ratio of students to computers in the school. In addition to providing every student and staff member with a device, one-to-one schools also provide wireless Internet for use in school. Teachers have used laptops, tablets, and smartphones as a means to interact with the curriculum under the belief that these devices can be used to enhance students’ experience in the classroom (Enriquez, 2010). Some school districts have developed ways to extended wireless Internet into students’ homes and communities for students whose families cannot afford it (Zucker & Bonifaz, 2004).

**Statement of the Problem**

Student engagement is recognized as an important factor in student learning (Greenwood, Horton, & Utley, 2002; Slavin, 2003). Numerous studies of one-to-one computing environments have shown that one-to-one computing can increase student engagement (Dunleavy, Dexter, & Heinecke, 2007; Greaves, Hayes, Wilson, Gielnak, & Peterson, 2012; Grimes & Waschauer, 2008; Penuel, 2006; Zucker & McGhee 2005). However, although many studies point to the positive impact of one-to-one computing ratios on student engagement, there is little research exploring the phenomenon of student engagement in a one-to-one environment from the
perspective of teachers. This research looks to fill that gap in the research by seeking to better understand how teachers see one-to-one computing’s impact on student engagement and what teaching strategies, if any, lead to increases in student engagement in a one-to-one environment.

**Purpose of the Study**

The central phenomenon being studied in this research is one-to-one computing and student engagement. A wide body of research on one-to-one computing shows a positive impact on student engagement (Dunleavy et al., 2007; Greaves et al., 2012; Grimes & Waschauer, 2008; Penuel, 2006; Zucker & McGhee, 2005). The purpose of this qualitative study is to explore teacher perceptions of student engagement in the initial phase of the implementation of one-to-one programs in three schools. Third-grade teachers from a prekindergarten to third-grade school, Grades 4–8 teachers from a Grades 4–8 middle school, and Grades 9–12 teachers from a regional high school were included in this study. The research took place in a suburban regional district in central New Jersey. All of the students and staff in the grades included in the study received Google Chromebooks. All three campuses had wireless Internet available.

This research is a phenomenological study of one-to-one computing and student engagement. B. Johnson and Christensen (2012) described phenomenology as a form of qualitative research in which the researcher attempts to understand how one or more individuals experience a phenomenon. The key element to phenomenological research is the researcher attempts to understand how people experience a phenomenon from the perspective of each individual. In this case, the phenomenon being study is teachers’ perceptions of student engagement in one-to-one computing environments.
Research Questions

The research questions being examined in this study are as follows:

1. What are teachers’ perceptions of one-to-one computing programs?
2. Do teachers feel that the one-to-one initiative has impacted student engagement?
3. What are teachers’ perceptions of student engagement in a one-to-one environment?
4. Do teachers perceive any positive impacts of one-to-one initiatives? If so, what are these impacts?
5. Do teachers perceive any negative impacts of one-to-one initiatives? If so, what are these impacts?

Significance of the Study

One-to-one computing is one of the fastest-growing yet most controversial trends in school districts today (Lei & Zhao, 2008). Few educational reforms have been as widespread, dramatic, and costly as the modern implantation of computers and computer-based programs into classrooms (Bebell & Kay, 2010). The powerful and ubiquitous impact of technology will influence the next generations of students and workers. Educational institutions’ preparedness and ability to properly deal with access to technology will determine students’ success in school and in their careers. Although the use of mobile technologies in schools was originally met with resistance, that resistance has turned into rapidly increasing acceptance (Wong, 2014). Mobile technology now supports tools such as Socrative and Quizlet, which teachers can use to generate frequent formative assessments; Class Dojo, which is designed to improve classroom climate; and Explain Everything, which turns tablets into personal whiteboards.
In addition, students can wirelessly project and share content from their devices, and teachers now have the tools to produce and share “flipped lessons.” Flipped learning involves students having access to content (e.g., lectures) at home to allow more hands-on work, one-on-one work, and assessment in class (Picard, 2015). However, some feel that one-to-one computing is part of a long line of efforts to reform and change education that have met with limited or no success. These efforts include increasing accountability, fostering high-performing charter schools, comprehensively redesigning schools, using of high-stakes testing to improve schools, implementing professional development initiatives, and engaging in the standards movement (Weston & Bain, 2010).

Advances in technology, such as the Internet, have triggered a rapid expansion in the information available to today’s students and workforce. To be successful in the 21st century, students will need to quickly analyze, transform, and disseminate information. Communication and collaboration skills will become essential, as will critical thinking, problem solving, multitasking, and self-direction. Those who lack these 21st-century skills are faced with limited employment and income opportunities (Partnership for 21st Century Skills, 2004). Pink (2005) described the shift in the skills needed to be successful in a new economy. For most of the industrial era, knowledge was enough to guarantee a successful career. In other words, career success could be tied to the amount of specialized information an individual had.

With the wide availability of information due to technology, however, career success is now more closely tied to what workers can do with knowledge. The Internet to a large degree has leveled access to knowledge. Manual labor jobs at one time provided an opportunity for class shifts for non-college-educated workers. Today those types of jobs no longer provide a path to a better life. By the 1990s globalization had led to an increase in outsourcing of
manufacturing jobs to other countries. In the 21st century, this outsourcing grew to include a number of computer-based and service-based industries. As this shift continues, blue-collar jobs are less in demand and there is an increasing necessity for a technologically fluent workforce (Rousseau, 2007).

Prensky (2001) coined the term “digital natives.” This term is often used to describe today’s learners, who—as some would argue—have been fundamentally impacted by the interface between technology and students. Prensky noted, as many others have since, that the students of today are not the ones for whom the educational system was designed. Prensky (2006) asserted, “Schools are stuck in the 20th century. Students have rushed into the 21st.”

The call for increased technology in education to better meet the needs of a new generation is not unique to 2015. In 2001 the CEO Forum released the School Technology and Readiness Report, which found that technology could enhance student achievement in many ways. The impact of technology is greatest when technology is integrated into a curriculum that has clear measurable objectives, when assessments are not aligned to the curriculum or a means to measure 21st-century skills, and when strategies to measure and improve technology integration are few and far between.

Access to information is often cited as a reason for schools and school districts using a one-to-one strategy. The evolution of the World Wide Web to Web 2.0 created subtle and profound changes in how we access information, communicate, and learn. Web 2.0 allows users to more easily generate and publish content. Social networking technologies that have become the hallmark of Web 2.0 present a platform for discussion and interaction and the sharing of ideas, knowledge, and stories. As students use new technologies, they are not only exposed to
new information, but their perceptions of the communications process as a whole are altered. As they navigate the online tools, they are challenged to create their own zones of proximal development (Gunawardena et al., 2009). Vygotsky (1978) defined the zone of proximal development as “the distance between the actual developmental level as determined by independent problem solving under adult guidance or in collaboration with more capable peers.” Within the social context of Web 2.0 technologies, the zone of proximal development may be—and often is—scaffolded by tutorials and other help options to allow users to correctly navigate the interface (Gunawardena et al., 2009). Social networking technologies also provide a pathway to “active and engaged learning, where participants construct knowledge through social interaction and exploration” (Kamel Boulos, & Wheeler, 2007). This allows users to work at their own pace and supports student metacognition (Michalsky, Zion, & Mevarech, 2007). Early innovators, such as Papert, believed that computers had the power to support the constructivist pedagogy that Piaget championed (Warschauer, Cotton, & Ames, 2012). Singer and Reveson (1996) also saw a link between innovations in technology and the ability of schools to impart information to students and to allow students to discover information in a more constructivist manner. In this vein, the interactive nature of computer technology makes it superior to television and other noninteractive media.

Philosophically, many see the move to one-to-one computing as a way to change the traditional paradigm associated with schools. Although some still see little value behind the “hype” of one-to-one computing (Cuban, 2006, 2011; Hu, 2007), the larger emerging body of research shows that there are many positive impacts (Bebb, 2005; Dunleavy et al., 2007; Greaves et al., 2012; Grimes & Waschauer, 2008; Lei & Zhao, 2008; Penuel, 2006; Suhr, Hernandez, Grimes, & Warschauer, 2010; Zucker & Bonifaz, 2004; Zucker & McGhee, 2005).
New Jersey’s Core Content Curriculum State Standards emphasize the need for 21st-century learning. Many of the teaching and learning actions called for by the standards require access to and the use of computers or some other device. Specifically, Standards 6.3–Active Citizenship in the 21st Century and 8.1–Educational Technology show increasing emphasis on technology in education. Standard 8.1 calls on students “to use digital tools to access manage, evaluate, and synthesize information in order to solve problems individually and collaboratively to create and communicate knowledge.” To make cumulative progress under this standard, students must “participate in online discussions” (Grade 4), “participate in online communities” (Grade 8), and “develop an innovative solution to a complex global or local problem or issue in collaboration with peers and experts and present ideas for feedback in an online community” (Grades 12). Standard 8.2 requires all students to “develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, global society, and the environment.” Additionally, the standards cite the use of Google Earth; Google Maps; online communities such as Ning, Second Life, blogs, and wikis; web-based publications; digital tools; GPS; and virtual conferencing within the cumulative progress indicators. Standard 6.3 asks students to collaborate with students from other countries. None of these activities is possible without an abundance of educational technology.

The adoption of the Common Core State Standards has also pushed teachers and schools to adopt pedagogical methods and tools that aid students in developing a conceptual understanding and solving problems in and out of the classroom. Phillips and Wong (2012) argued, “The Common Core State Standards encourage teachers’ creativity in the classroom, honoring the creative tension in teaching, and provide ample guidance to ensure quality.” This call for a paradigm shift in education is supported by research that shows traditional instructor-
centered lectures are an ineffective means through which to reach students. Conversely, creating a classroom and school that encourage active participation, interactive learning, and collaboration are more effective” (Enriquez, 2010). The rapid adoption of one-to-one computing, the political pressure to develop 21st-century learning and schools tailored to digital learners, the philosophical orientation of many educators, and the varied opinions of researchers have created the need for more specialized research into the effects and impacts of one-to-one computing. This research looks to add to the current canon of knowledge.

**Definition of Terms**

- 21st-century skills—the Partnership for 21st Century Learning defined 21st-century skills as life and career skills; core subjects and 21st-century themes, information, media, and technology skills; and learning and innovation skills. Core subjects are defined as English, world languages, the arts, math, economics, science, geography, history, and civics. Within these core subjects are the interdisciplinary themes of global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; and environmental literacy. Learning and innovation skills are defined as critical thinking, communication, collaboration, and creativity (Partnership for 21st Century Learning, 2011).

- Apps—applications, or self-contained programs or pieces of software designed to fulfill a particular purpose. This term is used in particular for programs downloaded by a user onto a mobile device.

- BYOD (“Bring Your Own Device”)—in some models BYOD supplements one-to-one initiatives; in other models it is an alternative to one-to-one computing.
• Chrome—Google’s web browser; allows for app usage, cloud computing, and add-ons. Chromebooks access the Internet through the Chrome platform.

• Chromebooks—devices developed by Google that contain no operating system or hard drive; they are entirely Internet based. There are multiple manufacturers and they are generally much cheaper than laptops (Sheninger, 2014).

• Cloud computing—hosted services that can be accessed over the Internet (“virtual servers”; Scheninger, 2014).

• Digital literacy—Bulger (2006) defined digital literacy as reading, searching, assimilating, filtering, and assembling knowledge in an online environment.

• Google Apps for Education—applications for the Chrome Internet browser designed for educational purposes.

• Mobile OS—a computer operating system that is specifically designed to run on mobile devices such as mobile phones, smartphones, PDAs, tablet computers, and other handheld devices.

• One-to-one computing—a system in which students and faculty members receive a personal computing device (laptop, iPad, Chromebook, or tablet) to use for school and wireless Internet is provided at the school. Whether or not Internet access is also provided at home and whether students are allowed to keep their devices 24 hours a day, 7 days a week varies by specific program.

• Post-PC devices (PPDs)—the newest innovations in personal computing after the development of laptops and PCs (Murphy, 2011). Examples include iPads, Nexus tablets, and Chromebooks.

• Self-rating of Chromebook/Chrome skills
- Novice—still learning to use the device / little to no class use.
- Beginner—uses some apps and accesses the Internet.
- Intermediate—creates class materials and assigns some projects via technology; makes use of some apps.
- Advanced—regularly uses technology; can and has helped other staff with technology.
- Expert—ability to use technology for assessment and collaboration; makes use of multiple apps and platforms and can help teach others the technology.

- Student achievement—attendance, grades, credits earned, and scores on various standardized and local assessments (Meyer, 2007).
- Student engagement—students’ psychological investment in and effort directed toward schoolwork (Newmann, Wehlage, & Labron, 1992). Student engagement is a multifaceted term (Trowler & Trowler, 2010). Engagement includes student willingness to participate in routine school activities such as attending classes; submitting required work; following teachers’ directions in class; and feelings of belonging, enjoyment, and attachment. It is a behavioral, emotional, and cognitive, as well as a relational process (Chapman, 2003; Fredricks, Blumenfeld, & Paris 2004; Hamre & Pianta, 2001). Researchers define student engagement by a variety of metrics, including attendance, behavioral referrals, credits earned, grades, and performance on assessments (standardized tests, college admissions tests, school district, state, and national tests; Meyer, 2007).
- Web 2.0—a second generation of Web development that facilitates communication, secure information, sharing, interpersonability, and collaboration (Sheninger, 2014).
Chapter Two

A Historical Perspective on One-to-One Computing

The full history of computers in education is relatively brief. However, understanding that history is relevant to understanding the current usage of devices in one-to-one environments. For much of this history, views on the role and value of educational technology have been characterized by the debate between zealots on either side of the argument. Since the dawn of computing through the present era of instant and total connection, there have been those who swear by technology’s ability to fundamentally alter education and those who point to its inability to do so thus far (Picard, 2015).

The history of computers in education can be traced to the development of the MARK 1 in 1944 and ENIAC in 1946. These early computers were developed at Harvard and the University of Pennsylvania, respectively. The earliest applications for computers in education were in mathematics, science, and engineering as problem-solving tools that allowed students to deal with more complex math problems (Molnar, 1997).

A review of educational technology since the 1960s shows that the same rapid development seen in technology has not been seen in the pedagogical models used in schools today. Computers at the time were suitable for running simulations and tutorials as a productivity tool. They also could be used as tutees, as students could teach the computer by programming it. Even in light of the rapid advances in technology, these uses are still relevant (Thornburg, 2014). Kemeny and Hutz helped facilitate the transition of computers into education in 1963 when they developed a new, easier-to-use computer language called BASIC at
Dartmouth. BASIC served as a replacement for FORTRAN in coding some programs (Molnar, 1997).

The earliest application of computer technology in education can be traced back to Bolt, Beranek and Newman in 1967 when a group of programmers, influenced by Piaget, theorized that computers could help students learn by allowing students to construct their own knowledge and understanding by working firsthand with mathematical concepts. Their work led to the development of LOGO, an educational programming language (Thornburg, 2014). Seymour Papert, one of the lead LOGO programmers, extended his work with LOGO to Lego construction kits. The building of LOGO-driven Lego constructs represented the constructivist philosophy of many early educational computing pioneers. In the late 1960s, the National Science Foundation helped develop 30 regional computer networks to provide colleges and secondary with access to computers. By 1974 over 2 million students were using computers in school. In 1963 only 1% of secondary schools students used computers for instructional purposes. By 1975, 55% of schools had access to computers and 23% were using them primarily for instruction (Molnar, 1997).

In 1973 Xerox developed the Alto, the first personal computer. Led by Papert, Xerox developed Smalltalk, an object-oriented programming language designed to help students understand computer programming. That same year, the Minnesota Educational Computing Consortium, as part of the state’s educational technology push, developed computer simulations for students, such as Oregon Trail. Programs such as these focused on higher-order thinking skills.
The personal computing revolution was made possible by the advent of low-cost microcomputers (Molnar, 1997). During the 1970s, PCs such as the Commodore PET (1977), the Radio Shack TRS-80 (1977), and the Apple II (1977) began to appear in homes (Thornburg, 2014). The Apple II had the greatest impact on schools in part because of its use of floppy disks and graphic display. In the decades since the 1970s, the laptop has replaced the personal desktop computer in schools. In the current market, smartphones, tablets, and Chromebooks, to name a few, are rapidly crowding out laptops (Thornburg, 2014). Apple also led the way with one of the earliest one-to-one computer access programs in the 1980s with its Apple Classroom of Tomorrow Project (ACOT). As an early K–12 one-to-one initiative, ACOT sought to both examine the impact of technology on the classroom and change education in the classroom (Donovan, Hartley, & Strudler, 2007). In discussing the possible impact of computers on education, Papert (1993) called for professionals . . . [to] consciously break the habits we bring in thinking about the computer. Computation is in its infancy. It is hard to think about computers without projecting onto them the properties and limitations of those we think we know today. And nowhere is this more true than in imagining how computers can enter the world of education.

Computers in schools in the 1980s and 1990s primarily took the form of computer labs. This led to high student-to-computer ratios and logistical issues for teacher scheduling (Penuel, 2006). To a great degree, the full integration of computers in schools was limited by technology (e.g., their size) and by economics (their cost). Throughout the last decades of the 20th century, advances in computer technology made computers smaller and cheaper. The overall student-to-
computer ratio fell from 1:168 (1983) to 1:3.8 (2005; Grimes & Warschaur, 2008). Still, scheduling and allocating resources was problematic (Russell, Bebell, Cowan, & Corbelli, 2002).

The first one-to-one initiative noted by researchers started in 1989 at the Ladies’ Methodist College in Australia. Today these programs exist in the United States, France, Spain, North Ireland, and Germany (Bebell, 2005). Early one-to-one initiatives provided students with desktop computers for home use and laptops with limited or no access to the Internet (Penuel, 2006). The largest of the earliest initiatives in the United States took place Maine, where all 7th- and 8th-grade students in the state’s 239 middle schools and 25% of all of the state’s high schools received laptops. Additionally the state invested heavily in infrastructure to provide wireless access at school. The Maine Learning Technology Initiative began in 2002 and was expanded in 2009 (Waters, 2009). Whereas the state paid for most of the costs associated with the middle school program, the individual school districts bore many of the costs of the high school program. As a result, about 50% of the state’s schools participated in the MLTI in 2009–2010 (Ash, 2009). In 2013 Governor Paul LePage considered ending funding for the program but ultimately continued to fund it. Although he switched the program to Windows-based computers, he left the choice to keep Apple products to the individual districts. As of 2013, 90% of Maine’s districts continued to use Apple products (Woodard, 2013).

Microsoft’s Anytime Anywhere Learning program in the mid-1990s was one of the earliest pre–one-to-one programs in the United States. However, this program ended after a few years due to limited results and other problems (Grimes & Warschaur, 2008). An independent research team that evaluated the project reported increased enthusiasm for teaching and learning, improved writing skills across all grade levels, an increase in authentic uses of technology, and a shift to constructivist pedagogies (Donovan et al., 2007). Traditionally, desktops and laptops
were the standard for computers in education. As technology evolved, prices declined and the availability of a variety of technologies increased. This gave schools the opportunity to implement a greater amount and wider variety of technology (Scheninger, 2014).

Additional large-scale rollouts took place in Henrico County, Virginia (25,000 laptops); select struggling New Hampshire Schools in 2004 (Bebell, 2005); Texas and Cobb County Georgia (Penuel, 2006); post-Katrina New Orleans (Grimes & Warschauer, 2008); and Indiana through the TEACH-KNOW-BUILD Project in 2006 (Meyer, 2007). Large-scale global examples, although not completely one-to-one initiatives, include the nation of Malaysia and the province of Sao Palo, Brazil adopting Google Apps for education for the entire nation or province, respectively.

Culp, Honey, and Maninach (2003) reviewed two decades of major educational policy documents and asserted that policy makers believed technology could improve K–12 education in three areas: increasing the efficiency and effectiveness of teaching and managing schools, creating more constructivist and student-centered teaching environments, and maintaining economic competitiveness for the U.S. workforce. Proponents of increased technology in schools argue that technology can facilitate distance learning, collection and analysis of complex data, and foster more process-oriented communication skills. Many reports also show a desire to facilitate a pedagogical shift from traditional teacher-centered pedagogies to those that are more constructivist in nature, such as inquiry- and project-based learning. The result of many of these policies is a workforce that is better prepared to compete in a global economy.

In addition to the increase in one-to-one initiatives, high-speed Internet access has become the norm, and the market for other digital equipment is steadily on the rise (Grimes &
Warschaur, 2008). The average amount of time Americans spend online has gone from 2.7 hours per week in 2000 to almost 2.6 hours a day in 2010. Approximately 25% of all Internet-connected households in the world have Wi-Fi. “Online access . . . has become imbedded in the routines of our daily life” (Sheninger, 2014). Worldwide tablet sales grew about 70% from 2012 to 2013 and are projected to surpass desktop sales by 2015. More than one-third of U.S. teens own smartphones and 23% have tablets (National Survey on Mobile Technology for K-12 Education, 2013). By the end of 2011, there were 6 billion mobile subscriptions worldwide. In 2011, 11.1% more mobile devices were sold than in 2010. Smartphone sales reached 472 million in 2011. This represents 58% growth from 2010 (Mobile Thinking, 2012). In 2007, 55% of all American youths 12–17 used online social networking sites. That number had grown to 73% of youth by 2010, and 72% of adults were on social networking sites. This number includes 40% of adults 30 and older (Rodriguez, 2010). CoSN and the Metri group conducted a study of school administrators from across the nation in 2009 for the MacArthur Foundation. They found that schools were wary of venturing into the world of social media during school hours (Lemke, Coughlin, Garcia, Reifsneider, & Bass, 2009). The results of this survey are extremely troubling as the new generation of learners are comfortable and enthusiastic about using Web 2.0 technologies and participating in the World Wide Web as creators rather than consumers (Rosen & Nelson, 2008). All of these factors are converging to create digital learners and push schools to reevaluate their policies in regard to providing students with technology. Some schools have attempted to supplement their existing technology by adopting BYOD policies. Currently, 52% of BYOD participants use more than one device (Wong, 2014). The advent of cloud computing as a more efficient and cost-effective way of managing information is also pushing districts toward BYOD and one-to-one policies (Scheninger, 2014).
In 2013 the Digital Learning Council, created by former governors Jeb Bush and Bob Wise in 2010, began evaluating states on their progress in achieving the “10 Elements of High Quality Digital Learning.” These elements are student access, personalized learning, advancement, quality content, quality instruction, quality choices, assessment, accountability, funding, and delivery. According to the 2014 report, two states—Utah and Florida—received As, whereas 10 states received Bs and 14 states were given Fs. This was an improvement on the 20 states that had received Fs in the previous year. Overall, the report seemed to indicate improvement as measured by the group’s indicators; however that improvement was incremental. Florida was upgraded from a B to an A for using student data to close underperforming schools. Nevada rose from a D to a B for removing restrictions to distance education. Arkansas moved up to a D as a result of a law that mandated every student take at least one online class while in high school. Texas, which received a B, created an online course choice program using the state virtual school. California, which received an F, passed a law in January 2014 to expand student access to digital materials and force publishers to sell “unbundled content” (Pascopella, 2014).

Overall, the use of mobile technologies in schools is on the rise. A 2013 survey of more than 500 educators (National Survey on Mobile Technology for K–12 Education, 2013) revealed a surge in the growth of mobile technologies in schools that seems unlikely to slow any time soon. Although there were a few one-to-one initiatives (12.1% of those surveyed), cost, more than philosophy, seemed to be the prohibiting factor. Small classroom sets and carts with class sets of mobile devices seemed to be the most common method of making mobile devices available. Many districts that responded indicated they would like to institute a one-to-one ratio if their budgets allowed. The most common mobile devices employed in schools were iPads
(81.4%), followed by Google Chromebooks (31%). Other devices included mixed methods (BYOD; 23.7%), iPod touch (20%), Android tablets (16.9%), Kindle Fire tablets (15.3%), e-readers without Internet (10.6%), Nook tablets (10.2%), Google Nexus (6.1%), Microsoft Surface (5.9%), Intel tablets (3.1%), and Amplify tablets (1.2%). The most commonly expressed benefit from mobile technology was the potential to increase student engagement and personalize student learning. The applications most often listed as beneficial for student learning were digital textbooks (76.9%), student productivity tools (54.3%), and creation tools (51.6%).

Other uses included special education apps, research tools, online class pages, student polling/response systems, educational games, and simulation software (National Survey on Mobile Technology for K–12 Education, 2013). Challenges to implementing mobile technology in schools were identified as device management (configuring, monitoring, updating, securing, filtering, deploying apps, and erasing devices remotely; 26.6%), the need for teacher professional development (19.2%), infrastructure issues including Wi-Fi connectivity problems and bandwidth limitations (14%), breakage, theft, and security issues (10.3%). In all, 59.6% of respondents reported that mobile technology had been adopted in about 25% or more of the schools in their districts. Of the districts that indicated none of their schools had adopted mobile technology, 64.3% reported their districts were likely to adopt mobile technology in the near future with 28.7% stating they were very likely and 35.7% stating they were somewhat likely. Among respondents who reported that one or a few schools in their district employed mobile technology, 93.4% reported their districts were likely to expand their usage of mobile technology.

One-to-one initiatives make use of several devices. Some schools or districts may make use of multiple devices depending on grade level, academic discipline, or desired outcome. The
most common one-to-one devices include laptops, tablets, and Chromebooks. As smartphones continue to advance, they will play a role in this equation (Scheninger, 2014). Murphy (2011) coined the term “post-PC devices” (PPDs) to refer to the latest innovations in personal computing, such as the iPad. PPDs such as the iPad and Android OS devices such as the Samsung Galaxy, Sony Tablet 5, and Asus Nexus, as well as tablet-laptop hybrids made by Toshiba, Sony, Dell, Asus, and Lenovo, are all becoming players in one-to-one environments.

PPD one-to-one programs can be seen in the United States, Australia, Canada, New Zealand, Norway, South Korea, and the United Kingdom. The PPDs used in these programs share several general characteristics including a mobile OS, high-resolution touch screen, touch-driven interfaces, a broad range of apps, and wireless connectivity. Some schools are also making use of e-readers such as the Sony e-reader, Amazon’s Kindle, and the Nook. Each of these devices comes with benefits and limitations. Successful integration of these devices into schools has been based in large part on the stakeholders’ understanding of the devices’ specifics and the specific needs and goals of the schools’ programs (Clark & Luckin, 2013).

Chromebooks vary in form from other PPDs. Originally, Chromebooks had limited appeal due to their lack of hard drives and reliance on the Internet. By late 2012 Chromebooks had emerged as a serious contender to Apple’s educational market share (Akerman, 2013). Chromebooks are similar in form and function to a laptop. They run on Chrome OS and are designed to be used while connected to the Internet. The applications and data they use are cloud based (Vaughan-Nichols, 2012). Cloud storage, or cloud computing, makes use of groups of remote servers and software networks that allow centralized data storage and online access to computer services and/or resources (Hassan, 2011). Chromebooks are known as a “thin client”
because they provide a Web browser and rely on web applications for computing functionality. Some applications may store some data locally in offline mode (Vaughan-Nichols, 2012).

In 2013 Chromebooks soared past Apple’s MacBook line, driven mostly by sales in the educational sector. The comparatively low price of the devices coupled with their strong connection to Google and Google Apps such as Docs and Drive have been cited as reasons. Chromebooks accounted for 9.6% of the combined laptop and tablet market between January and November 2013, compared to 0.2% of the market during the same time span in 2012. In addition to price point and apps, the keyboards of the devices have been a strong selling point. Some argue that the iPad is excellent for consuming data but the lack of a keyboard hinders its ability to create content, particularly in an educational setting (Kelly, 2013).

The use of Chromebooks in one-to-one environments is varied. Writing, taking notes, completing homework, keeping organized, communicating with peers and teachers, and conducting research are the most commonly cited uses (Penuel, 2006). Many educators still find themselves in the adaptation stage, where they uses technology to do what they did before (e.g., take notes) but in a more high-tech way (Sandholtz, Ringstaff, & Dwyer, 1997). More innovative uses include promoting communication, collaboration, creativity, and global awareness through Web 2.0 applications, mobile technology, video conferencing, OpenCourseWare, massive open online courses (MOOCs), and gaming (Scheninger, 2014).

One-to-one computing initiatives have been rapidly spreading since the beginning of the 21st century. Large districts such as Henrico County Virginia and Cobb County Georgia, as well as states such as Maine and Texas, have invested in large one-to-one programs. Early programs relied on research that evaluated program outcomes (Penuel, 2006). Nevertheless, some schools
are falling behind, and a digital divide has emerged based largely on the quality of educational technology rather than simply access to the Internet (Education Week, 2011). As schools across the county adopt one-to-one programs, the question of the impact of one-to-one computing on student learning has yet to have a clear answer (Meyer, 2007). Additionally, outcome studies with rigorous designs are limited (Penuel, 2006).

**Literature Review**

Technology is ubiquitous at every level of society. The rapid advancement of technology has spread to every sector of society and has caused seismic changes in all facets of life. Education has not escaped this change, and over the last decades technology has created changes at every level of schooling. One-to-one programs have many stated goals including improving access to technology resources for all students (Penuel, 2006); preparing students for a global economy (Greaves et al., 2012.); creating global awareness; improving students’ critical thinking, problem-solving skills, technological literacy, and 21st-century skills (Grimes & Warschauer, 2008); preparing students for a digital world (Sauers & Mcleod, 2012); improving attendance and graduation rates; making learning fun; and allowing student ownership (http://googleforwork.blogspot.com/2014/02/sao-paulo-is-going-google-for-its-4.html)

In 1981, 18.2% of public schools had computers (U.S. Bureau of Census, 1985). The number of public schools that had computers had climbed to 85.1%. The number continued to climb throughout the 1990s with 98.5% of public schools having computers by 1992. The student to teacher ratio in the average public school in 1984 was 63.5 to 1. By 1992 the average student to computer ration in public schools was 1 to 12 (U.S. Bureau of Census, 1994). By 2003 the average student to computer ration in public schools had sunk to 4 to 1 (U.S. Bureau of
the Census, n.d.). Sharing resources (computers) has created issues related to availability, scheduling, inconvenience of access, the need to reteach computer skills due to the infrequency of use, the inability to assign computer work outside of class, and difficulty in engaging in in-depth projects. Lower student-to-computer ratios have increased teachers’ effective use of technology (Becker, 1994).

Researchers have found claims of improved learning, as evidenced by increases in test scores, to be largely unsubstantiated (Weston & Bain, 2010). For example, 15 months after Maine’s statewide one-to-one implementation, which cost $120 million, there was no change in 8th-grade scores on the Maine Educational Assessment. The Texas Technology Immersion Pilot (TIP) involved 22 schools and cost $14.5 million. At the 4-year evaluation there was no evidence linking one-to-one computing with self-directed learning or general satisfaction with schoolwork. In addition, there was no statistically significant effect on students’ Texas Assessment of Knowledge and Skills (TAKS) scores (Weston & Bain, 2010).

A 2001 review of one-to-one initiatives by SRI International and the U.S. Department of Education found “too little research-based evidence to determine whether such programs were effective, because the overall methodological quality of the studies was weak” (Penuel, 2006). The most common critique of one-to-one programs is the lack of results as demonstrated by standardized test scores (Silvernail, 2005). Large-scale infusions of technology have not achieved policy goals, and most technology use occurs in nonacademic areas (Grimes & Warschauer, 2008).

It is important to remember that technology in schools is a complex puzzle. The presence of computers in schools does not guarantee improved student achievement (Greaves et al., 2012).
Vendors such as Apple, Dell, HP, Lenovo, and Toshiba have produced a variety of whitepapers, websites, booklets, and brochures pushing one-to-one initiatives (Meyer, 2007). Other challenges include to one-to-one computing securing data securing network access, and network performance (Wong, 2014). Cuban (1986) documented how similar beliefs in the transformative power of film, radio, and television did very little to change education.

Bull, Bull, Garofolo, and Harris (2002) wrote, “The transition to pervasive computing has profound implications for education and may represent as great a paradigm shift as the invention of writing itself.” However, the belief in the transformational power of computers in schools is not universally shared. Critics of one-to-one programs point out the “outlandish claims” about “improved learning, better teaching, and students getting higher salaried jobs.” Some researchers liken one-to-one programs to many other technological advances over the last several decades that have failed to show a direct link to increased student test scores. Critics of one-to-one programs claim that many of the perceived increases in motivation come from the creation of more engaging lessons and the increased learning these lessons generate. Some argue that the impact of changes in pedagogy is often mistaken for the impact of one-to-one programs (Cuban, 2006).

One major criticism of one-to-one programs is that they are “oversold but underused” (Cuban, 2011), meaning devices are purchased and placed in classrooms but not used in a way to effect any real change. Cuban (2011) pointed to studies of technological innovations that show how innovations are often undermined by ineffective implementation and that this ineffective implementation hinders any chance for changes in academic outcomes. In regard to implementation, Desimone, Porter, Garet, Yoon, and Birman (2002) stressed the importance of measuring “the degree of implantation before assessing outcomes and attempting to attribute
them to a specific program.” It has also been shown that teachers’ philosophical and pedagogical beliefs toward educational technology can strongly shape how likely teachers will be to implement new technologies in school (Bebell & Kay, 2010; Bebell, Russell, & O’Dwyer, 2004).

A 2007 study of Indiana’s Teach-Know-Build Project found that as a result of the one-to-one program, teachers reported that students had greater engagement in their assigned work, showed increased motivation, had fewer behavioral referrals, and had higher attendance rates. Additionally, students felt the laptops they were given in the program helped them learn 21st-century skills. However, analysis of standardized test data showed few differences between students in the one-to-one environment and those in classes with a more traditional student-to-computer ratio (Rockman et al., 2007). Additional research by Rockman and Walker (1997, 1998, 2000) has shown that students in one-to-one computing classrooms have experienced strengthened ability to learn and easily transfer knowledge across disciplines. Interviews with teachers conducted by Rockman and Walker (1997) showed that student motivation increased and student behavior and attitude became more positive with the implantation of a one-to-one computing ratio. Teachers felt one-to-one laptop programs promoted and increased collaboration, enhanced independent learning, aided enthusiasm for school, and increased engagement in problem solving.

The Texas Technology Immersion Pilot (TTIP) was created by the Texas Legislature in 2003 with the idea that the use of technology in schools could be best achieved by immersion as opposed to a cyclical rollout (Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010). First-year analysis of the large-scale TTIP showed mixed results. Although schools in the program showed higher satisfaction and fewer disciplinary referrals than the control schools, there were no statistically significant differences between attendance rates and test scores between the
control and pilot groups (Shapley et al., 2006b). Observations of sixth-grade classes from 2003 show that teachers in one-to-one classes began to structure their classes differently than teachers in classrooms that had computers but did not have a one-to-one student to computer ratio. Teachers in the one-to-one classes began to move away from direct instruction to spending more time with students working in small groups or individually.

Both intellectual rigor and student engagement increased in the one-to-one classes (Shapley et al., 2006a). Using hierarchical modeling, Shapley et al. (2010) found that teacher-level components were inconsistently and not statistically significant predictors of student achievement. These predictors included immersion support and classroom immersion. However, student use of laptops outside of school for homework and learning games were the strongest predictors of student achievement in the TTIP. Additionally, researchers found that the quality of implementation varied across schools and individual classrooms. Less than a quarter of schools studied, 21 in total, reached substantial implementation. To achieve immersion, the Texas Education Agency (TEA) required schools to purchase immersion packages from vendors. The TEA selected Dell Computing, Apple, and Region 1 Education Service Center to provide these packages.

Fryer (2004) studied the effects implementing a one-to-one computing program in Floydada Junior High School in Floydada, Texas. Fryer found that during the study period, attendance rates actually decreased. Warschauer (2007) studied 10 schools in California and Maine that had one-to-one programs. His findings showed that students in one-to-one classes had more opportunities for just-in-time learning, individualized learning, and research/investigation. Although the research showed one-to-one environments were more conducive to research projects and in-depth learning than other environments, outcomes were not
even across all of the schools. Warschauer (2007) concluded that one-to-one computing cannot make bad schools good, but it can help make good schools better.

Henrico County, Virginia, provided iBook laptops to over 20,000 students as part of one of the largest one-to-one initiatives in the country in the early 2000s (Meyer, 2007). All of the county’s middle school and high school students and teachers received laptops. In order to increase access to the Internet outside of the school, Henrico County Schools offered families the option of signing up with an Internet service provider at a low cost (Zucker & Bonifaz, 2004). A 2004–2005 study showed that students at both levels did not feel the iBooks helped them do better in school but did feel that the computers made research easier and helped keep them organized (Davis, Garas, Hopstock, Kellum, & Stephenson, 2005). A 2005 study of the Henrico County program that focused primarily on math and science classrooms found that student learning included greater access to information, increased student motivation, increased student engagement, more self-directed learning, better student organization, and increased student interactions with teachers (Zucker & McGhee, 2005). Another study concluded that the one-to-one program in two Henrico County middle schools contributed to learning that was more student centered, collaborative, and easy to assess than conventional instruction (Dunleavy et al., 2007). Both of these studies relied primarily on interviews, observations, and focus groups but had no quantitative data or comparisons.

Many school districts that adopted one-to-one programs in the 1990s and 2000s ended those initiatives because of ongoing repairs and expenses, disruptions to the learning process, and a lack of evidence related to improvements in student learning (Hu, 2007). Even technology companies in the mid-2000s were hard-pressed to supply empirical evidence of the positive impact of one-to-one programs. Apple Computers Inc. (2005) stated that few studies have
presented research-based evidence of any kind that could illustrate how effective one-to-one initiatives are. In addition to the lack of evidence supporting the positive impact of one-to-one computing on student achievement, hardware and software affordability, and lack of high-quality staff development have hindered the expansion of one-to-one initiatives (“The Brutal Facts of 1 to 1 Computing,” 2006). These very real “budgeting realities” have kept most districts from implementing one-to-one programs (Brumfield, 2005).

Current research in some areas shows that the use of laptops may not be superior to pencil-and-paper practices. Mueller and Oppenheimer (2014) conducted a study of 65 college students comparing factual and conceptual recall in groups that took notes using laptops and pencil and paper. After watching one of five TED Talks, the subjects received three distractor tasks. Thirty minutes later they were given a recall test on the talk. Both groups performed equally well on the fact recall portion, but the laptop note takers performed worse on conceptual recall. Additionally, laptop note takers took more verbatim notes then pencil-and-paper note takers (Association for Psychological Science, 2014).

Research in regard to reading on electronic devices is also not favorable. Ming-der and Shih-chuan (2011) conducted research on graduate students use of and attitudes toward e-book reading. The results indicated that the students used e-books mainly for the purposes of study and research. Monographs were the type of e-book that students used most often, followed by textbooks and reference tools. Although students showed an appreciation for e-books, students mentioned several limitations of the technology. Students noted that the keyword search function was a positive feature. Often, graduate students browsed a few paragraphs or pages online and then printed out copies for further reading. They also borrowed the corresponding
paper versions of the e-books from the library. In certain respects, students’ use behavior was found to vary among disciplines.

Mangen, Walgermo, and Bronnick (2013) asked 72 tenth-grade students of similar reading ability to study one narrative text and one expository text. The texts were approximately 1,500 words in length. Half of the students read the texts on paper and half read them on computers. The students were given a posttest of reading comprehension. The test consisted of multiple-choice and short-answer questions. The students had access to the texts during the test. Students who read the paper-based texts slightly outperformed students who read the text electronically. Mangen et al. hypothesized that students who had access to the paper texts could more completely manipulate the text whereas the electronic reader group could only navigate between one section of the text at a time. “The ease with which you can find out the beginning, end and everything in-between and the constant connection to your path, your progress in the text, might be some way of making it less taxing cognitively, so you have more free capacity for comprehension” (Mangen et al., 2013). In addition, the results of a study comparing the plot recall of a group using e-readers and a group reading paper text showed that book readers could reconstruct events in a story better than Kindle readers could (Chandler, 2014).

Research conducted in Birmingham, Alabama, between 2008 and 2010 showed no positive impact from the districtwide one-to-one use of XO computers in Grades 1 through 5. The XO is an inexpensive computer with a unique operating system and applications that is produced by the One Laptop per Child (OLPC) group. OLPC provides XOs to low-income children around the world, mainly outside of the United States. The rollout of the 15,000 XOs in Birmingham was funded by the city council and not the school board, which led to much political infighting and may have hurt the program. Additionally, one of OLPC’s core beliefs is
that the technology itself is sufficient to revolutionize a child’s schooling, as little attention has been directed to infrastructure, staff training, or larger social programs. The researchers distributed surveys to a representative sample of children before and after they received their XOs. The information was supplemented by researcher observations and interviews.

Researchers found the XO broke down at a rapid rate, and without technology support, XOs were seldom used in classes. The study used a pre- and postassessment methodology with observations and interviews. Researchers found that teachers and schools had little interest in using XOs and that there was inadequate social and technical infrastructure. The most frequently used feature of the XO was the Memorize program for creating digital flash cards. The devices were also used for journaling, recording audio/video, chatting, organization, and word processing. The project was discontinued in 2010 as a result of its poor results and politically contentious nature. The device itself may have played a role in this as it was relatively inaccessible to teachers. The Sugar interface, which is unique to the XO, did not resemble the Windows or Macintosh operating systems. Because the XO was designed for children, it was difficult for most adults to use with its tiny keyboard and display. An additional issue in Birmingham was the lack of connectivity, which made sharing work nearly impossible. Teachers could only check what was on the students’ screens (Warschauer et al., 2012).

The technocentric approach of the OLPC program also hindered the Birmingham rollout. Papert and Negroponte were heavily influenced by Piaget’s constructivist approach. They believed the power of technology, along with students’ curiosity, would fundamentally change schooling, even with little staff development or social support. Ultimately, the research group concluded, “The XO was great as a research project. It has a lot of innovative features. But
there is a big gap between a great research project and large-scale production, distribution, and implementation in schools” (Warschauer et al., 2012).

As of the 2014–2015 school year, Hoboken, New Jersey, a small city outside of New York City abandoned its one-to-one program. The program, adopted and implemented in 2011, has proven unsustainable according to the superintendent. The district was unprepared for the amount of breakage associated with the devices, particularly cracked screens, dead batteries, and missing keys (Barshay, 2014). Additionally, theft and unanticipated difficulty in filtering the Internet were challenging. The district also cited cost of software, lack of teacher training, and the need to frequently update expensive hardware as factors in its decision.

A 2014 study conducted by digedu polled 620 K–12 teachers nationwide. The survey results showed that 88% of respondents used technology in their classes, but only 24% felt it had a strong positive effect on student achievement. Additionally, only 10% had used technology to flip their classroom and 32% had a one-to-one classroom. Of those surveyed, 62% wanted to use technology more than they currently do. More than half (51%) stated that their students used technology for content creation. However, 63% felt their students did not have enough hardware, 53% saw lack of Internet at home as a barrier, 46% did not feel they received adequate training, and 33% felt that monitoring students on their use of technology was an issue (Bolkan, 2014).

A profile of a failed one-to-one initiative took place in the Los Angeles Unified School District (LAUSD) from 2013 to 2014. An internal report obtained by the LA Times brought several criticisms of the more than $1 billion project in the nation’s second-largest school district. The 2013 rollout of devices to 47 schools suffered a series of setbacks, including
students learning to bypass the Web filters, which eventually led to the discontinuation of the program. Before discontinuing the program, LAUSD banned students from using their iPads outside school in response to the tampering with Web filters. The LAUSD report did not fault the program goals of increasing student engagement and equality of access to technology but did fault the bidding procedure. Specifically, the rules for awarding the contracts for the devices and curriculum, the changes to the original bidding specifications, and the past associations between LAUSD personnel and Apple and Pearson were heavily criticized. Both the specifics of the bid and key changes to the rules appeared to be tailored to Apple and Pearson products. Apple provided the hardware (iPads) and Pearson provided the curricular component. The Los Angeles County district attorney’s office reviewed the LAUSD report and determined no criminal charges were warranted.

Although the access to content that technology—specifically, a one-to-one computer ratio—could allow has been trumpeted as a reason to transition to one-to-one computing, not all of the evidence has been positive. A 2013 study from the Alliance for Higher Education & Democracy at the University of Pennsylvania Graduate School of Education showed some interesting statistics in regard to MOOCs. MOOCs are online classes aimed at unlimited enrollment. Many schools are implementing them into their programs of study. However, MOOC completion rates are low, averaging 4% across all courses. This number ranges from 2% to 14% based on the measurement of completion. Courses with a lower workload showed a higher completion rate (6% versus 2.5%). Across all of the courses studied, about half of those who registered viewed at least one lecture in their selected course. The number of individuals who registered for courses varied considerably across courses (“New Study Says MOOCs Have Few Active Users”).
In addition to concerns regarding student output and startup and maintenance costs, teachers often have concerns associated with the rollout of one-to-one computing initiatives. A study of the initial implementation of a one-to-one laptop program at an urban at-risk middle school in the southwestern United States showed teacher concerns at many levels. By implementing the Concerns-Based Adoption Model of Change, researchers were able to show teachers’ concerns at many levels including the personal stage and management stages. Teachers’ concerns in general revolved around themselves, but a small percentage was concerned with the best ways to implement the devices. Teachers also hesitated to be observed for the research, struggled with how to integrate the devices into their teaching, and admitted to not feeling comfortable with the instructional purposes of the devices (Donovan et al., 2007).

Higgins, Xiao, and Katsipataki (2012), in their review of meta-analyses of digital technology research, discussed what they dubbed the “contemporary myths and fallacies” surrounding educational technology, including the idea of a “net gen.” The researchers pointed out that there is no evidence that the human brain has changed in any way since 1980 and that students’ cognitive capacities remain unchanged. Additionally, the researchers stressed that “just because young people have grown up with technology it does not mean they are experts in its use for their own learning” and that “most young people are fluent in their use of some technologies, but none are expert at all of them.” The researchers speculated that the increases in student motivation due to technology incorporation may have more to do with the novelty of the technology than the technology itself. The researchers also pointed out that the ideas that we must use technology because it is there and that more technology is always better are fallacies. Further, they cautioned against the idea that the Internet has made memorizing and knowing
certain information obsolete. Specifically, they pointed to careers, such as medicine, that will always require “experience, understanding, and expertise.”

Russell et al. (2002) used classroom observations, student interviews, teacher interviews, and student drawings to study how the classroom experience of fourth graders changed when the device ratio went from three-to-one to one-to-one. In this study, each student received an AlphaSmart, a personal, portable writing device. The device was capable of basic word processing; copying, cutting, and pasting text; printing; and spell-checking. The researchers found that there was a clear increase in the frequency of device use, changes in the way teachers regarded the technology, improvement in the quality of student work, and a greater sense of student empowerment after the one-to-one ratio was initiated. They found that the results varied by classroom depending on how the technology was utilized.

Penuel (2006) synthesized the findings of 245 studies for methodological rigor. Articles meeting specific criteria in regard to studying one-to-one initiatives were identified. Of the 245 studies, 30 were selected for inclusion. Although studies with rigorous research designs were few, those that did measure outcomes showed positive effects on technology use, technology literacy, and writing skills. Half of these studies (15) reported a positive impact on student engagement and motivation. The studies showed that giving students more access to technology increased students’ practice in using it. In comparison to other technology initiatives, students in one-to-one environments were more likely to use productivity and design tools as part of a larger class context, which led to increased technological literacy.

The increased use of word processing software provides practice for and increases in students’ writing skills. What researchers have failed to illuminate is the impact of one-to-one
programs on student achievement in core subjects such as math and language arts. Few studies have reported on the impact of specific math and language arts software on measurable outcomes (standardized test scores). Penuel (2006) looked specifically at the impact of teacher perceptions of and beliefs about technology.

Case studies of teachers in laptop programs have shown that teachers’ beliefs about students, the potential role of technology in learning, and the availability of high quality digital content influence the degree to which they use laptops with students . . . Teachers who believe that students are capable of completing complex assignments on their own in collaboration with peers may be more likely to assign extended projects that require laptop use and allow students to choose topics for their own research projects. Teachers who view technology as a tool with a wide variety of potential applications are more likely to use laptops often with students . . . Third, those teachers who believe that there are adequate software and internet-based resources available to help teachers in their particular content area may use laptops with students more often than teachers who believe that there is simply not enough high-quality material available . . . Conversely, those teachers who are concerned that students will use their laptops for unauthorized purposes, such as playing games or searching the internet for recreational purposes during class time, are likely to report implementing laptops less often with students in class.

Case studies (Dunleavy et al., 2007; Grimes & Waschauer, 2008; Zucker & McGhee, 2005) report greater access to online information, increased student engagement, and greater self-paced learning. Interviews, observations, surveys, and analysis of student work conducted in laptop programs in three California schools showed that the one-to-one program had significant benefits. Specifically, researchers found the program helped facilitate writing-intensive, information-rich, multimodal, student-centered instruction. However, gains in language arts and math test scores among students with laptops lagged behind those without laptops in the first year. However, students with laptops showed strong gains in the second year (Grimes & Waschauer, 2008).
Although the goals and scales of one-to-one programs vary widely, there is a common need for effective implementation. There is a growing consensus that a systematic approach to implementation is essential. This approach includes leadership and planning, supportive school culture, training and professional development, robust infrastructure, and technical support. Specifically, researchers have associated effective leadership in demonstrating the role of devices in teaching and learning with stronger implementation (Zucker, 2005; Zucker & McGhee, 2005). In addition to effective leadership, teachers’ attitudes and beliefs about technology can also impact the implementation of a one-to-one program (Penuel, 2006).

Zucker and Bonifaz (2004) analyzed data from early laptop programs, including those in Indiana, Michigan, New Hampshire, New Mexico, Texas, and Vermont, and developed several “lessons learned.” These lessons were grouped into five categories: planning, training and professional development, hardware and software, managing change, and monitoring and evaluating. Elements in the planning stage include focusing on key goals for student success, aligning technology policies and supports with goals, building strong leadership, considering long-term funding, planning for logistics, and developing partnerships both inside and outside of the school. The researchers identified the following training and professional development elements: focusing professional development on integrating technology into the curriculum, using a variety of professional development formats, assessing the professional development needs of the staff, partnering with local universities and other institutions, training parents on basic technical skills and information, and creating a parent resource center. Elements in the hardware/software area included purchasing or licensing digital tools, creating e-learning curricula, identifying software needs and restrictions, assessing the infrastructure of schools, making technology support available, and maintaining the networks. Elements to consider
within the domain of managing change include allowing sufficient time for change to take place and planning to maintain stakeholder participation. Elements to consider within the area of monitoring and evaluating change include making monitoring ongoing and conducting evaluation studies.

Research on elementary literacy found a reduction in the “fourth-grade slump” when using laptops (Suhr et al., 2010). The so-called “fourth-grade slump” refers to the deceleration in reading skill development that occurs as students transition from lower to upper elementary school. Parallel to this reading slump is a deceleration in writing skills. The transition between lower and upper elementary can be characterized as a transition from “learning to read to reading to learn.” This manifests itself as readers transition from high-frequency words to more abstract, less familiar language. This slump is especially prevalent among low socioeconomic status (SES) students, who have the greatest difficulty making this transition (Chall, Jacobs, & Baldwin, 1990).

Suhr et al. (2010) utilized a quasi-experimental research design to analyze the effects of a one-to-one laptop program on third- through fifth-grade students English/language arts scores on the California Standards Test(CST) assessment in California. Data from the students’ third-grade (pretest) and fifth-grade (posttest) performance were analyzed using analysis of variance (ANOVA), multivariate analysis (MANOVA), and multiple regressions. Additionally, students and teachers from the same district were surveyed. The teachers reported a high level of student engagement in the laptop classrooms. The majority of students (83.3%) from the treatment group indicated that they preferred to learn with laptops, 79.9% said they felt schoolwork became more interesting once they received the laptops, and 71.5% said they revised or edited their work more after they received their laptops. The results of the ANOVA and MANOVA
showed that after Year 2, students with laptops significantly outperformed students without laptops on literary response and analysis ($p < .01$) and writing strategies ($p < .05$). It is worth noting that the difference between the two groups was much more observable after Year 2. Both groups showed a drop in reading comprehension scores; however the group with laptops showed less of a drop.

Additional research on literacy in a digital context shows, on average, that students performed better on computer-based assessments of literacy than they did on paper-and-pencil assessments. A cross-tab analysis of the students showed significant differences between students’ quartile scores on text literacy and digital literacy (Eno, 2011). There is growing research on the interface between digital communication technology and formal education. Bauerlein (2008/2009) held that these technologies are affecting student processing and fundamentally impacting communication between students. Also, the ubiquitous nature of these technologies is impacting reading habits. More time spent with devices equates to less time reading paper-based texts.

With the growth of technology and computer-based assessments, the need for digital literacy is greater than ever before. Bulger (2006) defined digital literacy as reading, searching, assimilating, filtering, and assembling knowledge in an online environment. The need for improved digital literacy becomes more significant as more schools move toward blended learning and online learning environments (Gomez, 2007).

Lei and Zhao (2008) investigated students’ use of one-to-one laptops for various activities and the impact of one-to-one computing on student culture and student learning. Their research was conducted at an upper-class middle school in the northwestern United States.
Students, teachers, and parents were surveyed and interviewed in regard to laptop use in school. Additionally, students’ grade point average (GPA) and technology proficiency were analyzed. Overall, students’, teachers’, and parents’ perceptions of the program were positive: 87.5% of students indicated their laptops were important to them, 83.6% felt laptops helped with homework, and 83.6% felt laptops helped with their technology skills. Nearly three-quarters (72.7%) of parents felt that the laptops were important to their child’s education. All teachers (100%) felt the laptops were important to both staff and students, and 96.4% felt that the laptops helped with parent communication. A majority of students (99.3%) reported using their laptops more than 1 hour a day. Of those students, 24.6% reported using their devices 1–2 hours a day, 30.8% reported using them 2–3 hours a day, and 36.9% reported using them more than 3 hours a day. The majority of students reported using the laptops for their homework (81.4%) and to search for information (71.4%). However, 65.8% reported using the laptops for “online fun,” chatting (51.1%), or to play games (48.1%). Only 11.3% reported using their device to make their own website.

Lei and Zhao (2008) also found significant gains in students’ technological proficiency after the first year in a one-to-one program as measured by a technology proficiency scale (premean score = 7.42, postmean score = 7.94, $t = 2.26$, $p < 0.05$). Middle school students’ GPA in one-to-one environments showed a marginally significant increase ($t = 1.97$, $p = 0.051$). The researchers urged caution when interpreting these findings, as numerous factors besides technology could have had an impact on student GPA. Gulek and Demirtas (2005) also explored the impact of one-to-one computing on students’ GPA. They found that students who participated in a one-to-one program showed gains in GPA, English/language arts, and math, and significant gains in writing.
An evaluation of Canada’s Peace River North School District’s Wireless Writing Program showed students who participated in the one-to-one iBook program improved substantially in terms of both writing skills and attitudes toward writing (Jeroski, 2005). Research has also shown that students who participate in one-to-one computing programs show gains in terms of the source, process, and products of literacy (Warschauer, 2006).

Teachers have reported that student engagement has a positive impact (Bebell, 2005). Bebell’s research from the first 9 months of New Hampshire’s one-to-one program implementation showed a positive impact on student engagement. New Hampshire’s Technology Promoting Student Excellence (TPSE) program was inspired by Maine’s program. The stated objective of the TPSE was to decrease student absences and tardiness, decrease discipline issues, and increase student learning and skill building. In addition to increased student engagement, Bebell found increased student and teacher use of technology, teacher reports of increased student retention of material and achievement, and improved student teacher interactions. Michigan’s experience with one-to-one initiatives, which began in 2004, also showed that one-to-one schools reported higher student engagement and increased attendance (Lemke & Martin, 2004).

Project Hiller was a 3-year one-to-one laptop program that took place at Union Hill High School in Union Hill, New Jersey. The project did not involve a random sample of the school’s population; rather the sample consisted of students who volunteered and met certain criteria. Fifty percent of the students involved in the pilot were in the school’s honors program. The stated goal of the program was to “increase student performance and outcomes.” Students involved in the program had to maintain good attendance and grades, and attend before- and after-school meetings, in addition to other requirements. At the end of the 3-year program,
researchers found that the students who participated in the program had better standardized test scores than their peers (Light, McDermott, & Honey, 2002).

Goldberg, Russell, and Cook (2003) conducted a meta-analysis of 26 studies of one-to-one programs from 1992 to 2002. Meta-analysis is a method of quantitatively combining the results of multiple studies (Glass, 1976). Since meta-analysis was first developed by Gene Glass and his colleges, it has been used extensively in the fields of education, psychology, and medicine. Given the large sample size meta-analysis provides, this technique helps mitigate the influence of uncontrolled errors on findings (J. Marzano, Marzano, & Pickering, 2003). The focus of the analysis was the effect of computer and paper-and-pencil environments on K–12 student writing. Effect size represents the standardized difference between two groups on a given measure. Mathematically, it represents the mean difference between groups expressed in standard deviation units.

Overall, the meta-analysis suggested that students who used computers in the writing process produced work of greater length and quality. Significant mean effect sizes were found in favor of computers in terms of quality of writing ($d = .41, n = 15$) and quantity of writing ($d = .50, n = 14$). Articles collected for the meta-analysis that did not meet researchers’ statistical criteria ($n = 35$) indicated that the writing process was more social, collaborative, and iterative in computer classrooms. Additionally, students in one-to-one environments showed greater engagement and motivation. On average, the effects were greater at the high school and middle school levels than at the elementary level. The researchers also found a statistically significant relationship between grade level and quality of writing; as school level increased, the magnitude of the effect size increased.
A study of a 3-year laptop immersion program in Pleasanton, California, looked at the impact of laptops on students’ GPA, end-of-course grades, writing, and standardized test scores. A review of the research showed that students with laptops had higher GPAs, higher grades on the end-of-course exams, and higher grades on standardized tests than the control group, which did not have laptops. The laptop group also showed greater improvement in writing scores (Gulek & Demitras, 2005).

During the initial implementation of Maine’s one-to-one program, all seventh- and eighth-grade students and teachers received laptops. Students reported using the devices most frequently to find and organize information and to take notes. Teachers reported students were more engaged in their work and provided better-quality work. Students in ninth grade (who no longer had laptops) reported that they got less schoolwork done without their laptops and that they felt the quality of their schoolwork had declined (Silvernail & Lane, 2004).

One of the demonstration schools for the Maine Learning Technology Initiative, Piscataquis Community High School, gave all of its students and teachers laptops to use at home and at school. A 2004 study related to student learning showed that most students agreed that the laptops made them more motivated and engaged. Teacher respondents also agreed. Teachers and students also agreed that the overall level of student work improved after the implementation of the one-to-one program. The daily attendance rate at the school increased from 91% to 98% during the implementation (One-to-One Laptops in a High School Environment, 2004). Like many early one-to-one studies, the early research on Maine’s program did not produce any quantitative data to verify the results (Meyer, 2007).
Maine experienced significant improvement in students’ writing scores on statewide tests. There was a correlation between how extensively students used the laptops and their writing scores (Silvernail & Gritter, 2007). A 2011 report commissioned by the Maine State Legislature showed that the laptop program “had a significant impact on curriculum, instruction, and learning in Maine’s middle schools” (Silvernail, 2011). The report also highlighted uneven implementation across the state. In his report, Silvernail stated, “So many things are going on in schools, it’s difficult to classify what makes the difference. The laptop is a tool.” In surveying 1,690 middle school teachers involved in the MLTI program (approximately 38% of all middle school teachers in Maine), Silvernail found that 80%–90% of teachers reported using their laptops a few times a week or more frequently to develop instructional materials and conduct research for lesson development. Three-quarters (75%) reported using the laptops just as frequently while providing instruction. However, only 53% of teachers reported using laptops to provide differentiated instruction. Whereas 60% of teachers reported using the laptops for some form of summative assessment, only 53% of teachers self-reported using the laptops for formative assessment. Approximately 75%–80% of teachers said they used laptops a few times a week or more to record and manage student information. Whereas 90% of teachers reported using their laptops to communicate with colleagues, 75% reported using their devices to communicate with parents and students.

Throughout the years in which data were tracked for the study (2003–2010), teachers reported using their laptops more and more for tasks (Silvernail, 2011). Surveys of students revealed that the laptops were used least frequently for mathematics (for which 46% reported they used devices 0 hours per week), art/music (for which 51% reported they used devices 0 hours per week), and health/physical education (for which 59% reported they used devices 0 hours per
week). The devices were used most frequently in language arts/English (for which 51% reported using the laptops 1–3 hours per week and 43% reported using them 4 or more hours per week in class), social studies (for which 50% reported using the laptops 1–3 hours a week and 40% reported using them 4 or more hours per week in class), and science classes (for which 53% reported using the laptops 1–3 hours a week and 38% reported using them 4 or more hours per week in class). When using the laptops in class, students reported using technology to research information (69% indicated this occurred a few times a week or more), edit papers (44% indicated this occurred a few times a week or more), take notes (42% indicated this occurred a few times a week or more), and organize information (38% indicated this occurred a few times a week or more), which represent traditional uses.

The most common examples of 21st-century skills that students indicated they used a few times a week or more were gathering data from multiple sources to solve problems (36%), learning things from more than one subject at once (30%), and evaluating information obtained on the Internet (26%). Critically analyzing data or graphs from media (17%); visually representing or investigating concepts (18%); solving complex problems by analyzing and evaluating information (19%); and creating graphs, tables, and charts to explain a point of view (19%) were least often cited. Use of applications for 21st-century skills lagged way behind. Additionally, 80% of teachers reported that they felt that laptops helped them explore and teach in greater depth in a wider variety of content. Over three-quarters (76%) of staff felt that laptops helped them better differentiate the curriculum, though this opinion ran counter to earlier evidence. Further, two-thirds (66%) of teachers stated they felt laptops helped them better teach critical thinking. Overall, almost three-quarters (74%) of the teachers reported that laptops were an important teaching tool (Silvernail, 2011).
In regard to student engagement, 80% of staff felt students were more actively involved in their own learning when using the laptops. The same percentage of teachers (80%) stated that students were more engaged when using laptops, and 78% of student respondents indicated they were more interested in school when they used their laptops. In addition, 72% of teachers felt laptops made it easier for students to demonstrate their learning, 70% felt that students were able to express ideas more effectively, and 61% felt that students learned content faster when using laptops. Further, 88% of students reported that they were more likely to edit their work when they used a laptop. In addition, they stated they were better organized (87%), their work quality improved (82%), they did more work (80%), and they were better able to understand their work (76%) as a result of using the laptops (Silvernail, 2011).

In looking at evidence of achievement, Silvernail analyzed math, reading, and science. In math, an analysis of covariance (ANCOVA) revealed that students whose teachers participated in sustained technology-infused professional development for 20 months or more increased their own content knowledge and outscored peers in a control group. In regard to writing scores, researchers found a statistically significant difference between writing scores before and after the implementation of the MLTI. An ANOVA suggested that the more extensively students used their laptops, the greater the improvement in their writing. The data also revealed that student improvement in writing was not just seen in writing with laptops but in writing regardless of the test medium. Pre- and postassessments were developed in science to measure the impact of presenting instruction using laptops on retention. Students were taught the content in the same way, but the content was presented to the experimental group in this study using computer animation. The academic growth of the experimental group exceeded the growth of the control group. Statewide evidence from the National Assessment of Educational Progress data showed
the percentage of eighth-grade students scoring proficient and above proficient in math rose from 30% in 2000 to 39% in 2011. However, this trend mirrors the larger national trend for the same period (Silvernail, 2011).

The percentage of Maine eighth graders scoring proficient or above on NAEP for reading went from 38% in 2002 to 39% in 2011 (Morell, 2012). Specific research from Piscataquis Community High School showed 79% of students felt laptops made schoolwork more interesting and 60% of students felt more motivated to do schoolwork. More than 70% of teachers reported that the laptop program helped improve student interaction with staff and that it improved interaction among students typically classified as at risk. Teachers reported that laptops improved at-risk students’ ability to work in groups (One-to-One, 2004).

Bebell and Kay (2010) examined the Berkshire Wireless Learning Initiative (BWLI) in western Maine. The BWLI provided technology access to students and teachers in five public and private schools. The researchers used a pre/post comparative design study to explore the impact of specific programs over 3 years. The overall goal of the BWLI was to determine the efficacy of a one-to-one program in transforming teaching and learning in a traditional middle school setting. The specific outcomes included improving student achievement and engagement, improving school discipline, and improving students’ ability to work independently. The 633 seventh-grade students involved in the study \((n = 633)\) received Apple iBook G4 laptops in the first year (2006). The rollout continued over 3 years to include all sixth-, seventh-, and eighth-grade students \((n = 1,700)\). Data were collected via teacher and student surveys, student drawings, selected teacher interviews, an analysis of student records and achievement scores, and classroom observations.
One of the most universal findings of Bebell and Kay’s (2010) study was that the implementation and outcomes of the programs varied widely between the five schools. The study showed a dramatic increase in the use of technology across the curriculum within the first months of the program. Teachers reported the adoption of new approaches to the curriculum that were subsequently reported by teachers and administrators to increase student engagement. To a lesser extent, teachers reported increased academic performance. Most of the teachers found a wide variety of uses for the technology, including record keeping, communication, creation and management of web pages, and accessing educational resources. Although there was substantial variation between and among teachers with usage, most of the teachers altered their practices with the introduction of laptops. Both student usage of technology and teacher computer skills increased during the pilot program. Increased teacher comfort with technology was manifest in both instructional and noninstructional practices. Even though the majority of teachers said that going one-to-one had changed their teaching, almost all expressed that they were still learning how to teach in a one-to-one setting after 3 years.

In addition, students in the BWLI were found to have used technology across a wide variety of applications at a much higher rate than students at comparison schools (p < .0005). Across all the teacher respondents, 44% student interaction from their traditional students, 42% for their at-risk and low-achieving students, and 39% for their high-achieving students. Triangulation of classroom observations, surveys, and interviews demonstrated improved student engagement through the pilot program. Overall, 83% of teachers felt that engagement had increased for traditional students, compared to 84% for at-risk and low-achieving students, and 71% for high-achieving students. These results were mirrored by student motivation: 73% of teachers reported student motivation improved for their traditional students, 76% felt that
motivation had increased for their at-risk students, and 59% felt it had increased for high-achieving students. Conversely, less than 2% of teachers felt the one-to-one program had a negative impact on student engagement or motivation. These results were supported by both principal interviews and classroom observations. Interviews and observations also supported the idea that student engagement increased when teachers used technology as part of their presentation of the curriculum.

Warschauer (2005) synthesized research from a team of researchers at the University of California-Irvine over the course of 2 years. Their work encompassed 10 one-to-one laptop programs: three were in Maine and seven were located in California. The study included more than 1,000 students in Grades 3–12 in suburban, urban, and rural districts. Warschauer found laptop programs did not have any appreciable effect on student test scores. He also found that laptop programs did not show an effect on reforming troubled schools. In fact, Warschauer maintained that issues of student behavior management and unfocused instruction laptops can magnify those problems. There was also no evidence that laptops could reduce the achievement gap. In fact, Warschauer found it could magnify the “Sesame Street Effect,” by which an innovation designed to help at-risk learners instead benefits affluent children to a much higher degree (Attwell & Battle, 1999). The research team found that “laptops facilitate the kinds of learning, thinking, and analysis that today’s world demands” (21st Century Learning Skills). They found that greater access to multimedia led to greater student engagement, greater ease of integration of technology into instruction, and deeper learning. Additionally, they found the volume and quality of student writing increased in one-to-one environments.

Sloss and Potts (2006) studied the impact of laptops on college students’ academic performance. The researchers studied students at Carnegie Mellon University’s School of
Design. As with many studies, they found mixed results. Students with laptops spent more time on their work, worked for longer periods, were more likely to work from home, and were more likely to work alone. However, students with laptops did not produce higher-quality work; sometimes they went off task and other times they worked in isolation.

The supposed ability of one-to-one programs to reduce the achievement gap is an often-cited reason for districts making the decision to transition to one-to-one computing. Rousseau (2007) looked at the implementation of one-to-one computing programs in socioeconomically diverse schools to analyze this claim. Rousseau used a mixed-methods design to examine the difference in implementation and usage of laptops in high- and low-SES schools in Maine and California. Both the low- and high-SES schools included in this study implemented programs that were designed to provide equal access to technology and professional development to the staff. Rousseau found high-SES schools were able to smoothly integrate the laptops into their curricula by focusing the use of the laptops primarily on research and analytic skills. However, low-SES schools struggled with how to implement the technology. Additionally teachers in high-SES schools were better trained to manage the changes in their classes brought about by one-to-one computing.

Rousseau (2007) found that the existing inequalities between schools were not remediated by the one-to-one initiatives. Computer fluency improved for both groups, but it improved at a greater rate for high-SES students. Additionally, issues that are more pervasive in low-SES schools, such as school discipline problems, were more common in the low-SES schools in the study. In some cases the technology amplified disciplinary problems in low-SES schools. The vision for the use of the technology was also less focused on low-SES schools.

Rousseau stated that measurement of one-to-one programs’ impact was difficult to measure in a
quantitative manner, as standardized testing does not measure or reflect on many of the skills gained by the use of technology. Low-SES schools were shown to focus their instruction on basic computer literacy skills, including saving files, opening applications, closing files, and printing. There was also time spent on creating basic products using standard software, word processing, spreadsheets, videos, and presentations. This was juxtaposed with high-SES schools, which can focus on enhancing analytical skills and academic performance. Rousseau found few examples of actual autonomy or meaningful collaboration at low-SES schools. However, it was difficult for Rousseau to make any long-term evaluations as all the programs were still in their early stages.

Meyer (2007) evaluated one-to-one computing environments in three Midwestern schools and the changes in teaching and student learning as perceived by the school administrators. Data were gathered through teacher and administrator interviews. Meyer found that increased student motivation was the top change in student learning reported by respondents. Increased active participation, improved research skills, improved overall academic achievement, increased student responsibility, and increased interaction and communication with other students, teachers, and parents were the next most frequently cited effects.

In addition to demonstrating improved writing scores in one-to-one schools, studies showed improved problem-solving skills; improvements in science, literacy, and exam scores; improved GPAs; increased student engagement; improved attendance and behavior; and improved teacher practice. Although many teachers and parents worry about the distractions that come with one-to-one computing, academic engagement has shown to be one of the most commonly cited benefits of one-to-one programs (Sauers & Mcleod, 2012). Many studies support the positive relationship between one-to-one programs and student engagement (Bebell,
Improvements became more pronounced in Years 2 and 3 of program implementation (Sauers & McLeod, 2012). After 2 years, students in one-to-one programs score significantly better than their peers in all subject areas (Light et al., 2002).

In 2008, the Friday Institute for Educational Innovation began a 3-year evaluation of North Carolina’s one-to-one program, the NC 1:1 Technology Initiative. Specifically, the evaluation looked at leadership’s role in implementing a one-to-one program (Corn, 2010). Corn (2010) built on the existing research on school leadership (R. Marzano, Waters, & McNulty, 2005) and leadership for effectiveness in technology-enhanced schools (Anderson & Dexter, 2000; Flanagan & Jacobsen, 2003) to develop models for technology leadership with six and five elements, respectively. The evaluation encompassed eight early-college high schools and ten comprehensive high schools comprising 9,500 total students. The 18 schools studied were located in regions across North Carolina. The rollout of the program was staggered so researchers grouped schools into cohorts. The rollout to staff and students took place between March 2007 and November 2009. Data were collected from the 18 one-to-one schools in the form of site visits, classroom observations, surveys, interviews (administration, teachers, and students), and focus groups. Archival data, including attendance, discipline reports, dropout data, and achievement scores, were also analyzed.

Corn (2010) found that leadership struggles in all schools included staff learning to use the technology, students downloading inappropriate content, cheating/plagiarism, and missing devices. Two variables explained significant variance in principals’ overall leadership scores: school type (early-college or traditional) and length of implementation. Teachers in early-college high schools were also shown to have a significantly more positive attitude toward
learning with laptops. On average, all of the principals in one-to-one schools showed effective leadership behaviors. Of all the leadership behaviors examined by Corn, principal behaviors associated with advocacy and vision contributed most to teachers’ attitudes toward the program. Teachers’ use of technology and their comfort with technology were not influenced by the principal’s leadership.

In a study of 997 schools in 49 states, the International Society for Technology in Education (ISTE) (Greaves et al., 2012) found that a one-to-one student computer ratio has a greater impact on student outcomes. These findings mirror other results when comparing one-to-one, two-to-one, three-to-one, and four-to-one environments (Apple Computers Inc., 2005; Penuel, 2006). Their data showed that two-to-one schools more closely mirrored the results of three-to-one schools than one-to-one schools in the areas of reduction in disciplinary referrals, high-stakes test scores, reduction in the dropout rate, and increased graduation rates. This finding was measured through 11 categories of educational success that encompassed 22 independent variables. These indicators were as follows:

- Disciplinary action rate
- Dropout rate
- High-stakes test scores
- Copy expenses related to paper
- Teacher attendance
- Advanced Placement course enrollment
- College attendance plans
- Course completion rates
• Dual college enrollment
• Graduation rates

The researchers conducted a comparison of their findings disaggregated by one-to-one, two, two-to-one, and three-to-one student to computer ratios. Additionally, student demographic data were collected and correlated to survey results. Researchers identified nine implementation strategies that when properly implemented were linked to student success. They were as follows:

• Integration into intervention classes
• School leadership providing time for teacher professional learning
• Student use of technology for daily online collaboration
• Technology integrated into core classes weekly or more often
• Online formative assessments done weekly
• Lower student-to-computer ratios
• Virtual field trips done at least monthly
• Use of search engines daily
• Principals trained in and modeling best practices

The ISTE researchers maintained that when these guidelines are followed, one-to-one computing not only can increase student achievement but also can be revenue positive by reducing consumable costs and by reducing the dropout rate through higher student engagement. Researchers also found that daily use of technology produced the best return on investment and was strongly correlated to various educational success measures including
better discipline in schools, improved attendance, and increased college attendance ((Greaves et al., 2012).  

Of the one-to-one schools studied, 40% reported that students do not use the technology on a daily basis. Teachers indicated that top-down implementation of the program, lack of staff buy-in, overreliance on and concern with hardware, and use of laptops for less transformative activities as some of the boundaries to usage. The research emphasized the role of the principal as a critical part of a successful one-to-one program. Principals must not only model effective practices but also provide the proper amount of professional development and generate staff and stakeholder buy-in. Online collaboration has been shown to be an important factor in increasing student engagement and productivity (Greaves et al., 2012).  

Collaboration and interaction among students have longed been viewed as important factors in improving student achievement. Student participation in study groups is a good predictor of success in college. Access to a one-to-one environment allows for more interaction through technology, whether through social media or other media. Students in one-to-one environments have been shown to participate in study groups more often than students in other environments. Delivering the curriculum electronically becomes easier in a one-to-one environment. The dissemination of information electronically allows more time for one-on-one teacher-student interaction. This can be especially helpful in classes comprising struggling learners (Greaves et al., 2012).  

One case study specifically cited in the research was the Sunnyside Unified District in Tucson, Arizona. Sunnyside Unified, a district of 17,800 K–12 students, began their “Project Graduation” in 2007. The district was primarily minority students (87.7% Hispanic), one-third
English language learners, and 86% free and reduced-price lunch students. Over the course of 4 years, their one-to-one program encompassed 2,481 students. Among the improvements in the district were reduction in school disciplinary action, increased student engagement, and improved student attendance (Greaves et al., 2012).

Heinrich (2012) studied a one-to-one iPad initiative in Longfield Academy in Kent, United Kingdom. A survey given to staff, students, and parents at the end of the first year of the one-to-one program showed that students used their iPads in almost all subjects for researching topics online, brainstorming, and developing presentations. Students indicated that they would like to use their devices more often to replace paper-and-pen tasks and books. The tasks that students indicated were possible after the one-to-one initiative but were not possible prior to the initiative included easy Internet access, use of iBooks, access to translation tools, easy access to educational games and apps for learning, self-reflection tools, and annotating text. Heinrich’s research suggested that the use of iPads allowed students to augment and enhance their learning in ways that were not previously possible. Teachers also reported that the multiple communication features on the tablets made home school communications easier.

Henderson and Yeow (2012) studied a one-to-one program in a New Zealand primary school. They cited the ease with which the tablets in the program allowed for students to transition between formal, informal, personal, and social contexts as an example of how iPads helped students take control of their learning. Additionally, the tablet’s features allowed for better student collaboration.
Kyanka-Maggart (2013) investigated the use of tablet technology in the classroom. Specifically, her study focused on the relationship between the use of iPad technology and teachers’ perceptions of student motivation, students’ perceived motivation and self-efficacy, and students’ time spent on task in the classroom while engaging with mathematics concepts and skills practice. The study population comprised students from Grades 5 and 6 at a rural Kansas K–12 school. The total population for this study was 22 students. The sample size was 21 students. The researcher used a mixed-methods design and a variety of instruments to investigate the research questions. In order to measure student motivation as perceived by teachers, the researcher conducted semistructured individual interviews with each 5th- and 6th-grade teacher. To gather data on the effect of tablet technology on students’ perceptions of self-efficacy and motivation, the researcher developed a self-efficacy survey. Observations of classes were also conducted, with the researcher measuring time spent on task by using two grids that organized information about the observations.

The results of the study showed that iPad use in mathematics made a statistically significant difference in students’ perceptions of their own motivation and self-efficacy (Kyanka-Maggart, 2013). However, there was no statistically significant difference between using iPads and paper and pencil in terms of time spent on task in mathematics. A qualitative analysis of the teachers’ perceptions of student motivation demonstrated that teachers believed the iPads engaged students and increased their motivation in school. A qualitative analysis of students’ perceptions of the use of iPads showed that the majority of students enjoyed the ability to organize and check their work, the use of different applications in order to learn, and the ability to have fun.
An emerging area of research is the integration of technology’s impact on special education students. O’Malley et al. (2013) investigated the use of iPads in a curriculum for students with disabilities and examined the effect of the use of a basic math skill application on basic math fluency. Basic math fluency refers to the accuracy and speed with which a student can solve simple computations such as addition, subtraction, multiplication, and division (Poncy, Skinner, & O’Mara, 2006). Previous research has shown that iPads can be used as a form of assistive technology for students with communication disorders (Flores et al., 2012) or visual impairments (Shah, 2011). The functionality of the iPad offers opportunities for instructional interventions and differentiation of instruction. O’Malley et al. conducted the study with 10 students with moderate to severe cognitive disabilities enrolled in a special education school as a whole-class intervention. This 4-week study employed a single-case reversal design, or ABAB design with a baseline phase, followed by an intervention phase, followed by another baseline phase, followed by another intervention phase. The ABAB design demonstrates the effect across additional participants increases external validity and strengthens conclusions about the causal relationship (Horner et al., 2005). The data were assessed using both visual and statistical analysis (O’Malley et al., 2013). The researchers identified four major trends, two of which related to one-to-one computing. Overall, the intervention had a positive effect on math fluency, and teachers perceived the iPads had a positive effect on student engagement.

Blankenship, Ayres, and Langone (2005) found students diagnosed with emotional disturbance (ED) had increased independence, increased content retention, and higher instructional engagement when using iPad technology. Haydon et al. (2012) also studied the impact of iPad usage on students who were classified has having ED. The researchers studied
an urban Midwestern alternative school. They compared the effects of worksheets and iPads on student engagement and the accuracy of math work. Three students were studied over 5-week period. The researchers observed student engagement and behavior as students completed math worksheets for a period ranging from 26 to 40 min and on iPads for a time period ranging from 26 to 40 min. Results showed that all students received a higher number of correct responses when completing math work on an iPad. Lei and Zhao cited studies by Harris and Smith and by Conway in regard to one-to-one computing and special education students.

Another area of studies is the impact of one-to-one computing on students with special needs. For example Harris and Smith (2004) studied the use of laptops by seventh grade students with disabilities in the Maine Learning Technology Initiative project. They found that the laptops helped the students with disabilities to improve their engagement in learning, increase their motivation and ability to work independently, and improve their class participation and interaction with others. Similarly, Conway (2005) reported positive impact of one-to-one laptop program on students with dyslexia and other reading or writing difficulties.

Interactive whiteboards are one form of technology commonly used in K–12 classrooms. Whitepapers produced by technology companies make several claims about how technology affects learning. These include raising the level of student engagement, motivating students, and promoting enthusiasm for learning. It has also been suggested that interactive whiteboards support many different learning styles and have been successfully employed in learning environments serving visually and hearing impaired students (SMART Technologies Inc., 2004). However, interactive whiteboards, like many forms of classroom technology (desktops, projectors), are large, stationary pieces of equipment.

The movement of technology in the 21st century is to smaller, more personal mobile computing devices (Barbour, 2012). Many of these were limited by the opposite problem—
that they were too small to be practical for school use. The iPad was one of the first devices to provide the processing potential and screen size to be of use to schools. Barbour (2012) studied the use of iPads and iPod Touches by a small group of high school science teachers who were awarded the devices as part of a grant from the College of Education at Wayne State University. The researcher’s initial analysis of the data showed that the teachers all felt that the iPad could be of great use in the classroom, but all felt extremely limited by the fact that they only had one iPad per teacher and there was not a one-to-one student to device ratio. The teachers tended to use the device more for personal uses, such as professional development, than as a teaching resource.

Manuguerra and Petcoz (2011) looked at the impact of iPads in particular on higher education (college). They argued that to facilitate a cultural change for teachers toward the ubiquitous use of technology, a new generation of devices and software that are easy to use without a steep learning curve is necessary. They further argued that iPads and other tablets offer this possibility. Other research specific to tablets in education shows increased retention and performance in math for students using tablet PCs (Romney, 2009), increased student convenience and flexibility (Hall & Smith, 2011), and positive feedback and optimism of students in regard to classes in which iPads were used (Kinash, Brand, Mathew, & Kordyban, 2011). Although no improvements in learning outcomes were noted (Hall & Smith, 2011), students believed their learning had improved as a result of using the devices (Kinash et al., 2011).

Higgins et al. (2012) conducted a review and summary of 48 meta-analyses of digital learning initiatives to identify the effects of technology on learning. Studies conducted in the United States showed only a slight relationship between computer use in schools and
improvements in student test scores. In the studies reviewed from the United Kingdom, there were statistically significant findings between student technology use and school achievement. However, the typical overall effect size for technology use (between 0.3 and 0.4) was slightly below average for the researched interventions in education.

The research also points to increased student engagement and motivation. The caveat is that technology only has a positive effect when effectively aligned to learning outcomes. Specifically, the researchers pointed to six trends in the research:

- Collaborative use of technology is generally more effective than individual use.
- Regular, short, focused use of technology is most effective for improving learning.
- Technology can be very effective for remedial skill building, including for students with special needs and for students from low-SES backgrounds.
- Test gains attributed to technology use tended to be greater in math and science. In literacy the impact was greater in writing than in reading or spelling.
- Sufficient training and support were needed for effective implementation of technology.

Much of the research on one-to-one schools points to improved student engagement as a benefit of the implementation of a one-to-one student to computer ratio (Dunleavy et al., 2007; Greaves et al., 2012; Grimes & Waschauer, 2008; Penuel, 2006; Zucker & McGhee, 2005). Schlecty (1994) wrote that students who are engaged exhibit three characteristics: They are attached to their work, they persist in their work despite challenges and obstacles, and they take visible delight in accomplishing their work. Newmann et al. (1992) defined engagement in
academic work as “students’ psychological investment and effort directed towards learning, understanding, or mastering the knowledge, skills, or crafts the academic work is intended to promote.”

Whereas Newmann et al. (1992) noted the lack of correlation between student engagement and student achievement, Kuh (2007) noted that college students who are engaged in their learning generally get better grades, are more satisfied with their college experience, and are more likely to get a degree. Skinner, Furrer, Marchand, and Kindermann (2008) highlighted the research in regard to the impact and importance of student engagement on students’ education.

Over the past 10 years, research has converged on the construct of academic engagement as a key contributor to children’s school success . . . In the short term, engagement predicts students’ learning, grades, and achievement test scores; over the long term, it predicts patterns of attendance, retention, graduation, and academic resilience . . . Studies have also suggested that academic engagement serves as a protective factor against risky activities . . . such as substance abuse, risky sexual behavior, and delinquency.

Educators and parents often wonder what factors motivate a child to learn. They value motivation in school for its own sake and for its long-term contribution to children's learning and self-esteem. Skinner and Belmont (1993) stated,

Highly motivated children are easy to identify: They are enthusiastic, interested, involved, and curious; they try hard and persist; and they actively cope with challenges and setbacks. These are the children who should stay in school longer, learn more, feel better about themselves, and continue their education after high school.

Although motivated students may be easy to recognize, research shows that they may be hard to find as students’ intrinsic motivation decreases as they move from preschool through high school (Harter, 1981). As this occurs, students tend to feel increasingly alienated from their learning.
Chapman (2003) noted that student engagement has a hodgepodge of definitions, including student willingness to participate in routine school activities such as attending classes, submitting required work, and following teachers’ directions in class. Researchers have incorporated emotional or affective aspects into the conceptual understanding of engagement (Finn, 1993). Attached to the construct of engagement are feelings of belonging, enjoyment, and attachment. In reviewing the literature, Fredricks et al. (2004) proposed that student engagement has multiple dimensions: behavioral, emotional, and cognitive. Behavioral engagement is based on the concept of student participation and includes involvement in academic, extracurricular, and social activities. Behavioral engagement is the easiest to observe and therefore the most studied type of engagement. Behavioral engagement can be observed when students contribute to class discussions, attend to academic tasks, and demonstrate they are listening to teacher instruction. Emotional engagement focuses on positive and negative reactions to teachers, classmates, school, and academics (Connell & Wellborn, 1991; Finn, 1993). Cognitive aspects of engagement include student investment in learning, perseverance in the face of challenges, and the use of deep, rather than superficial, strategies. Student engagement has been shown to correlate positively with achievement and negatively with the likelihood of dropping out of school. Yet, the subtypes are likely interrelated (Fredricks et al., 2004). Decades of psychological research have demonstrated that behaviors, emotions, and cognitions can be mutually reinforcing (Beck, 1976).

In classrooms, when students actively participate in assignments, their cognitive exertion and positive emotional responses to teachers may increase. Engaged students are also more likely to earn better grades in school and score higher on standardized tests (Fredricks et al., 2004). In a nationwide study of ninth-grade students, Finn (1993) found that behavioral
engagement predicted performance on standardized achievement tests. The process of engaging students in their own learning has been—and continues to be—one of the biggest challenges educators face. Research on student engagement shows students become more disengaged from school as they progress through school (Marks, 2000). By high school, as many as 40% to 60% of students become chronically disengaged (Sedlak, Wheeler, Pullin, & Cusick, 1996). Marks (2000) described engagement as “a psychological process, specifically, the attention, interest, investment, and effort students expend in the work of learning . . . students' involvement with school [a sense of belonging and an acceptance of the goals of schooling].”

Connell and Welborn (1994) and examined the causes and consequences of student engagement. They defined two forms of engagement: ongoing engagement and reaction to challenge. The definition of ongoing engagement mirrors other definitions of engagement. Ongoing engagement refers to student behavior, emotions, and thought processes during the school day (Connell & Wellborn, 1994; Skinner, 1995; Skinner, Ztnmer-Gembeck, & Connell, 1996). Students’ reaction to challenge is a much less frequently cited aspect of engagement. It includes “coping strategies for dealing with a challenge, particularly whether [students] engage or withdraw when faced with perceived failure in school” (Connell & Wellborn, 1991). Students’ reaction to challenge also encompasses the skills they use when they perceive in-school situations to be challenging but persevere through those situations. In this situation, they often make use of certain sets of mental skills such as effort, strategic thinking, problem solving, information seeking, and experimentation. This optimistic attitude stands in opposition to the attitudes of students who feel threatened by a situation and react to a perceived failure by escaping the situation mentally or physically, and by avoiding or delaying the activity as long as
possible. These behaviors are accompanied by emotions such as anger, blame, denial, anxiety, and hopelessness.

Engagement is often linked to the concept of motivation. Motivation can be either extrinsic (generated by outside forces) or intrinsic (internally driven). Kohn (1993) laid out the prevailing argument against extrinsic rewards (grades, gold stars, and other rewards). He maintained that reliance on external factors rarely produces any deep, long-lasting commitment to learning. Pink’s (2010) synthesis of research outlined three factors that motivate and create engagement: autonomy, mastery, and purpose. These factors have been shown to create the sort of self-directed work educators often envision when they discuss engagement. A review of the existing research conducted by Skinner and Belmont (1993) showed,

Psychological research has focused on individual intrapsychic influences on motivation, such as attributions (Weiner, 1986), self-efficacy (Schunk, 1991), perceived ability (Mclver, Stipek, & Daniels, 1991), perceived control and competence (Chapman, Skinner, & Baltes, 1990; Weisz & Cameron, 1985), self-concept (Wigfield & Karpathian, 1991), intrinsic motivation (Corno & Rohrkemper, 1985; Deci & Ryan, 1985), interest (Schiefele, 1991), learning strategies (Pintrich & De Groot, 1990), and goal orientations (Ames & Ames, 1984; Dweck & Elliot, 1983; Nicholls, 1984).

Weiner (1990) reviewed the history of motivational research in education. He summarized motivational theories by stating “the main theories today are based on the interrelated cognitions of causal ascriptions, efficacy and control beliefs, helplessness, and thoughts about the goals for which one is striving.”

Although motivation is closely related to the concept of engagement, these concepts are not interchangeable. There is a body of empirical evidence that shows engagement may be an important component within motivation (Skinner et al., 2008). Engagement interacts with other motivation variables to result in outcomes, academic or otherwise, as products of engagement. However, motivation and engagement are separate phenomena that are statistically independent.
Students may be motivated to perform an academic task but not actively engaged in it (Connell & Wellborn, 1991; Skinner & Belmont, 1993). Additional research supports the connection between engagement, school behaviors, and achievement across socioeconomic lines (Klem & Connell, 2004). Linnenbrink and Pintrich (2002) built on the work of Bandura (1997) and Pintrich and Schunk (2002) to demonstrate that motivation is a contextual and stable trait. This indicates that motivation is not a constant but a situational variable. Although this construct may make assessing and researching motivation difficult, it implies that student motivation can be improved in the correct situation.

Along with motivation, student self-efficacy has been associated with increased persistence related to student engagement. Research has also suggested that self-efficacy is associated with a great variety of positive educational outcomes including choice, persistence, cognitive engagement, and use of self-regulation strategies. Akey (2006) suggested that student engagement hinges on students’ sense of self-efficacy. Akey stated that as students develop a sense of confidence in their ability to succeed academically, their engagement also increases. Conversely, students are less likely to attempt academic endeavors in which they do not feel confident, leading to disengagement. Linnenbrink and Pintich (2002) explored the inverse relationship between student self-efficacy and engagement, and learned helplessness. Learned helplessness, like self-efficacy, is related to one’s perceptions of his or her own abilities. Students who exhibit learned helplessness show lower levels of self-efficacy, task persistence, and academic achievement.

Engagement in schoolwork involves both behaviors and emotions. Engagement is more than motivation or “paying attention.” Students can show motivation without making academic progress. Activities that engage students’ enthusiasm and interest in school have been shown to
have the following characteristics: emphasis on higher-order thinking, active participation, variety, collaboration, meaningful connection to student culture, and outside lives. Academic achievement, attendance, and behavior can all be indicators of student engagement (Committee on Increasing High School Students’ Engagement and Motivation to Learn, Board on Children Youth and Families, and Division of Behavioral and Social Sciences and Education, 2004). A 2007 survey of over 81,000 students across 26 states and 110 schools showed lecture to be the least engaging method for delivering instruction. Overall, students were most engaged by teaching methods that allowed them to participate in learning, such as discussion and debate, group projects, presentation, role-playing, and art/drama activities (Voices of Student on Engagement, 2007). Educational research has focused on teacher behaviors that should be effective in promoting student motivation. Brophy (1986) described guidance; modeling; enthusiasm; provision of choice; sincere praise; reinforcement; and curiosity-, dissonance-, and interest-induction as teacher behaviors that are correlated with increased student motivation.

Although all teachers and educators understand the value of student engagement, student engagement is not a prerequisite for all learning. Most of what students learn (more than 90%) is acquired unconsciously (Gazzaniga, 2001). It is even possible to learn complex patterns unconsciously (Nissen & Bullemer, 1987). However, for a typical school classroom, greater focused attention (engagement) is preferable (Jensen, 2005). When discussing student engagement, educators frequently speak in terms of “paying attention.” Engagement requires that students orient, engage, and maintain the appropriate neural networks while simultaneously excluding and/or suppressing distractors, which requires both mental discipline and the proper chemical balance (Wang, Zhong, Gu, & Yan, 2003). Brain imaging studies demonstrate that engaged students showed increased neurological activity in the prefrontal and posterior parietal
lobes, the thalamus, and the anterior cingulate (LaBerg, 1995). Kilgard and Merzenich (1998) found that engagement required the visual and auditory systems to lock in on the work at hand. Specifically, student engagement increases when students choose relevant, meaningful learning; hear the teacher above all else; get adequate sleep and avoid drugs; and do not have processing disorders (Jensen, 2005).

Although engagement may not be a prerequisite for learning, disengagement has had documented negative impacts. Lehr, Sinclair, and Christenson (2004) described how a prolonged period of disengagement can result in students dropping out of school once they reach high school. Alienation, a poor sense of belonging, and a general dislike of school compound the problem. For their study, the researchers defined academic engagement as work completion and accuracy, class participation, eagerness to learn, and persistence.

The research on student engagement has primarily focused upon increasing student achievement, positive behaviors, and a sense of belonging in students. However, more recent studies have been built around the goal of enhancing students’ abilities to learn how to learn. Due to this, student engagement has become both a strategic process for learning and an outcome all to itself. Several types of engagement have been classified in the literature: academic, cognitive, intellectual, institutional, emotional, behavioral, social, and psychological. These have been measured by a number of quantitative data such as attendance, test scores, and graduation and truancy rates. Many educators consider engaging disengaged students to be one of the greatest challenges facing schools.

As the students of today interact with the world around them in different ways than their parents did, their concept of engagement may be different as well. In large part, this is a result of
radical changes in technology since the 1990s (Taylor & Parsons, 2011). Gilbert (2007) called for major shifts in curriculum, pedagogy, and assessment to properly engage today’s learners and to prepare them for the “Knowledge Society” in which they will live. Barnes, Marateo, and Ferris (2007) described how “Net Gen” learners need self-directed learning activities, interactive environments, multiple forms of feedback, and assignment choice to create personally meaningful learning experiences. Some critics do not believe that the technological advances of recent decades have created students who need special educational and engagement considerations. Instead, they believe shifts in pedagogy are actually dumbing down a generation. These critics claim that educators get to mold how students learn and that the changes in learners have more to do with a lack in student mental discipline than technological shifts (Carlson, 2005).

Greenwood et al. (2002) and Slavin (2003) have concluded that engaged time is the most important influence on academic achievement. Greenwood et al. further showed student academic engagement, as measured by “engaged time,” increases through second grade and levels off after second grade. Engaged time, also referred to as time on task, is the amount of time spent learning in school (Slavin, 2003). It includes behaviors such as writing, participating in tasks, reading aloud, reading silently, and asking questions. Additionally, students who are engaged are attentive, interested, and invested in their learning. Engagement is more than a behavioral concept. It is the sum total of an emotional commitment to academics (VanDeWeghe, 2006).

Time on task is often cited as an essential component of engagement (Greenwood et al., 2002; Kuh, 2009; Trowler & Trowler, 2010). In a synthesis of time-on-task research Karweit (1984) stated that time is a necessary but not sufficient condition for learning. She further found
that studies show a positive association between time and learning. Many studies find a statically significant effect of engaged time on learning. However, research points to the fact that only a portion of the time in school is used for instruction. There is a wide variation in the amount of time students are exposed to learning activities. The allocations of time for learning can vary markedly between classrooms within the same schools. These variations in the way available time is used cannot be completely controlled. Karweit pointed out a positive association between time and learning but differences in student achievement are not consistently explained by different variations in instructional time.

When studying student engagement in college, Kuh (2009) defined engagement as the time and effort students invest in educational activities linked to desired college outcomes, including interactions with other students and faculty. Although engagement requires the agency of the individual student, it also requires certain institutional inputs. Kuh (2008) identified certain high-impact educational practices at the college level that could maximize student engagement. Among these were service learning, study abroad, participation in learning communities, and culminating projects. He recommended that students engage in at least two of these practices over the course of their undergraduate education. Coates (2005) described the process of engagement as being “based on the constructivist assumption that learning is influenced by how individuals participate in educationally purposeful activities . . . learning is seen as a joint proposition.” Gunawardena et al. (2009) found that student engagement and learning were enhanced by Web 2.0 collaboration. Junco, Elavsky, and Heiberger (2012) studied the use of Twitter as a tool to increase student engagement in college classes. They found that when students were required to use Twitter for a course and when faculty engaged with them
regularly, there was an increase in both students’ grades and engagement. Specifically, faculty engaged more on the platform with their students and saw improved academic outcomes.

Trowler and Trowler (2010) pointed to the diversity of understanding of the term “student engagement.” They pointed out that a substantial body of evidence exists to support the notion that improved student engagement leads to improved educational outcomes. While reviewing the literature on student engagement, they determined several key statements that could be made with a reasonable degree of confidence about engagement. These statements can be categorized into three categories: student engagement in individual student learning, student engagement with process and structure, and student engagement with identity. Among these statements are the following:

- Student engagement improves outcomes.
- Specific features of engagement improve outcomes.
- Engagement improves specific desirable outcomes.
- Responsibility for engagement is shared.
- Engagement benefits all students, but some more than others.

A body of evidence that has been built since the 1980s has established a correlation between student investment of time, effort, and interest in a range of educationally oriented activities and favorable outcomes such as increased performance, persistence, and student satisfaction. Specific aspects of engagement, such as involvement, time on task, and quality of effort, have repeatedly been linked to positive outcomes. Specific desirable outcomes include

- General abilities and critical thinking
- Practice competence and transferable skills
• Cognitive development
• Self-esteem
• Moral and ethical development
• Satisfaction
• Accrual of social capital
• Improved grades
• Persistence

However, researchers have pointed out that these statements are confined by the context of the situation. Kuh (2009) warned that given the diversity of student bodies, it is unreasonable to presume that what will work in one setting will work in a different setting with different students. Konings, Brand-Gruwel, vanMerrienboer, and Broers (2008) claimed that the expectations of students themselves have an impact on motivation, engagement, and investment of effort in school. Kuh, Cruce, Shoup, Kinzie, and Gonyea (2008) warned that “simply offering [engaging] programs and practices does not guarantee that they will have the intended effects on student success . . . practices must be of high quality, customized to meet the needs of the students they are intended to reach” (p. 556). Chickering and Gamson (1987) summarized the evidence on undergraduate college teaching and learning into seven effective practices:

• Student-staff contact
• Active learning
• Prompt feedback
• Time on task
• High expectations
Respect for diverse learning styles

Cooperation among students

Windham (2005) recommended interaction, exploration, relevancy, multimedia, and instruction as the means to engage learners. Taylor and Parsons (2011) expanded on the existing research to include authentic assessment as an element of engaging learners. The National Assessment of Student Engagement (NASE; 2014), a survey of undergraduate students at schools in the American Association of State Colleges and Universities (AASCU), many patterns relate to student engagement in schools. Institutions that are similar in size, student body demographics, and programming showed great variation in student engagement. Although many differences can account for this variation in like schools, the NASE showed institutional cultural differences were an important factor. Using the federal graduation metric, the AASCU schools were divided into 12 groups. Among these groups is a wide variation in student graduation rates. Further investigation of the schools in each group with the highest graduation rates showed the importance of school culture in student engagement. When a similar study was conducted with Hispanic students, the results were similar.

The survey identified four themes that encompass high-impact practices for improving student engagement. These themes are academic challenge, learning with peers, experiences with faculty, and campus environment. These themes are further explained by 10 engagement indicators:

- Higher-order learning
- Reflective and integrative learning
- Learning strategies
• Quantitative reasoning
• Collaborative learning
• Discussion with diverse others
• Student-faculty interaction
• Effective teaching practices
• Quality of interactions
• Supportive environment

Among other findings in the study were that schools of engineering showed the highest levels of collaborative learning across institutions. Also, it was noted that as faculty indicated they spend more time trying to improve their teaching, they tended to use lectures less often and engage students in discussion, small group activities, experiments, and presentations instead. Overall, they tended to interact with their students more.

Engagement is a relational process that depends on teachers’ ability to meet students’ developmental needs (Hamre & Pianta, 2010). Due to this, it can be concluded that improving teachers’ developmentally appropriate interactions with their students has the potential to increase their behavioral engagement. Through their interactions with students, teachers challenge and interest students; afford rich learning opportunities; and provide appropriate support to scaffold student participation (Gregory, Allen, Mikami, Hafen, & Pianta, 2013).

Multimedia and technology both have been cited as ways to engage students (Barnes et al., 2007; Project Tomorrow, 2010; Taylor & Parsons, 2011; Windham, 2005). By incorporating technology, teachers can reach students through varied channels of communication (Lamb & Johnson, 2012). Technology has the potential to make learning accessible and relevant to
students while also bringing them in contact with experts in a way that was not possible even a
decade ago. Both students and researchers have called for new tools in the classroom toolbox.
This list of tools can include WebQuests, blogs, wikis, YouTube video, smart boards,
smartphones, video editing software, and gaming software. These technologies have proven
helpful in engaging students in learning about subjects, exploring ways to present their learning,
and allowing students to control their learning (Barnes et al., 2007; Dunleavy & Milton, 2009;
Project Tomorrow, 2010). Project Tomorrow (2010) reported that teachers perceived that the
use of technology increased student engagement in several areas, including cognitive, affective,
behavioral, academic, and social dimensions.

Teachers also reported that students were more motivated to learn (51%), apply their
knowledge to practical problems (30%), and take ownership of their own learning (23%).
Teachers also reported an increase in students’ 21st-century skills as a result of incorporating
technology into instruction. Specifically, creativity (39%), collaboration (30%), and problem
solving / critical thinking (27%). Finally, teachers reported having more time to differentiate
instruction (31%) and that they had more information on how students were doing academically
(29%). Technology also helps create “rich learning environments” that provide for student
engagement (Parsons, McRae, & Taylor, 2006). Technology has also been seen as a way to
move teachers to a more constructivist philosophy, which may have positive impacts on student
engagement. Constructivist educators seek to create an environment that allows students to
explore and collaborate, resulting in a deep understanding of the subject.

Self-determination theory states that competence, autonomy, and relatedness enhance
intrinsic motivation (Ryan & Deci, 2000). Many hope that one-to-one environments can tap into
intrinsic motivation in the constructivist classroom. Projects in these classrooms are designed to
encourage mindful, authentic problem solving and inquiry. Students in constructivist classrooms use computers to access information, communicate, collaborate, and express themselves in a variety of ways (Becker, 2001; Rousseau, 2007). Constructivist pedagogical beliefs and frequency of computer use in the classroom have been shown to be correlated (Becker, 2001). Students who are presented a curriculum with which they can interact are more likely to be motivated to learn; therefore their performance will improve (Amelink, Scales, & Tront, 2012).

Morris and Parker (2014) looked at the impact of educational technology and its correlation to student engagement. Given that students increasingly expect technology to be a part of their school experience, Morris and Parker framed their research around the question, does student use of technology improve student outcomes? This line of thinking is particularly important and timely given the emphasis on technology-centered pedagogy education. If the proponents and manufacturers of the new technology are to be believed, usage alone should supplement the learning process in a way that makes the classroom experience student centered, engaging, and more structured for deeper learning and higher performance.

Morris and Parker (2014) investigated the use of a tool designed with the specific purpose of student engagement in a large classroom. The tool allowed students to post to a community-based discussion similar to a Twitter feed. The tool was part of a package that won an award at the 2012 Campus Technology Innovators Awards under the category of teaching and learning. Specifically, the tool allowed for an interface permitted integration with Facebook and Twitter, text messaging capabilities, real-time discussion, and use of hash tags. The platform also allowed back-channel communication during lectures. Students were surveyed using the Classroom Experience Questionnaire (CEQ). Student engagement was measured using a Likert scale (from 1 = strongly disagree to 3 = undecided to 5 = strongly agree). CEQ items were
transformed into factor regression scores. Results came from a single section of an introductory Political Science course. The course was primarily made up of first- and second-year students. The course roster had 187 students. A total of 74 students (40%) volunteered and completed surveys. Of those 74, 11 did not complete the survey after opening it on the website. Those 11 surveys were dropped, leaving 63 valid cases available for the study. As usage of the platform increased students’ sense of community, learning went down. In other words, students’ posting was negatively correlated with their sense of engagement as measured by the CEQ. Although the researchers used a small sample size, these findings seemed to indicate that usage of technology is not enough to improve student engagement.

Diemer, Fernandez, and Streeply (2012) looked at the use of iPads in undergraduate college courses. With the rapid development of tablet technology, many colleges and universities have launched iPad initiatives in an effort to enhance student learning. As with many technology initiatives discussed thus far, the rapid adoption of iPads and their relationship to increasing student engagement and achievement is not clear. Diemer et al. explored student perceptions of engagement and learning using iPads. Data were collected using a survey asking them to rate their learning and engagement using a 5-point Likert scale. Their responses were grouped into themes.

Students who reported a high level of engagement while using iPads also reported a high level of learning (Diemer et al., 2012). A moderate positive correlation was found between reported levels of engagement and reported levels of learning using iPads, $r(192) = .684, p < .001$. Spearman rank correlations showed a positive relationship between students’ e-learning preference and their perceived learning, $r(170) = 0.30, p < 0.0001$, as well as between students’ e-learning preference and perceived engagement, $r (180) = 0.32, p < 0.0001$). Students who
preferred extensive use of e-learning technology also reported more perceived learning and engagement. For those students with no e-learning preference, significant main effects for e-learning on perceived learning, \( F(3,182) = 6.87, p = 0.0002 \), and perceived engagement, \( F(3,195) = 6.21, p = 0.0005 \), did not lead to discovery of significant differences between the group with no preference and the groups who expressed the extent of their preference for e-learning.

One-way ANOVAs comparing perceived learning and perceived engagement in a number of iPad activities showed significant differences for perceived learning, \( F(4,187) = 2.85, p < .05 \) (Diemer et al., 2012). The researchers used Tukey’s HSD to determine the nature of the differences. The students who used iPads seven or more times per week reported higher levels of learning (\( M = 4.26, SD = .563 \)) than those who used iPads once (\( M = 3.86, SD = .776 \)). Parker, Bianchi, and Cheah (2008) explained that a link between use of instructional technology and increased student engagement is strongly supported in the literature. However, they cited a lack of data showing that increased student engagement resulted in higher grades or higher exam scores. No effects due to age, gender, or language were found. An ANOVA was used to compare perceived learning and perceived engagement among the three factors. No main effects were significant (\( p > .05 \)).

Age, gender, and the use of English as a first language had little influence on students’ perceptions of learning and engagement (Diemer et al., 2012). This finding is supported by other research. Data collected by the Pew Internet Research Project (Jones & Fox, 2009) showed no dramatic difference in Internet usage between users in their 20s compared to older generations. Githens’s (2007) examination of existing research shows that older employees in an industrial setting were in fact more willing to adapt to instructional technology for training programs than
younger employees were. Students who characterized themselves as comfortable with modes of e-learning reported much greater perceptions engagement. Additionally, students who reported being comfortable iPads and e-learning were more likely to use iPads for learning in future course work.

**Summary of Research**

The history of computers in education is relatively short. However, in the last two decades, personal computers and PPDs, along with the expansion of wireless Internet, have had a profound impact on society and education. However, there are mixed results in regard to one-to-one computing’s impact on academic achievement, particularly when measured by standardized testing. In regard to improvements in writing, Jeroski (2005) found improvements in both writing quality and student attitudes toward writing. Worschauer (2006) found gains in the process and products of literacy. Goldberg et al. (2003) found significant improvement in the quality and quantity of students’ writing. Silvernail and Gritter (2007) found a correlation between how often students used their computers and their writing scores on standardized tests. Overall, a wide body of research on one-to-one computing shows a positive impact on student engagement (Dunleavy et al., 2007; Greaves et al., 2012; Grimes & Waschauer, 2008; Penuel, 2006; Zucker & McGhee, 2005)
Chapter 3 Methods

This qualitative study examines teacher perceptions of student engagement in a one-to-one computing environment. Qualitative research is a type of social science research that depends on broad general questions and relies on the views of participants. Qualitative data are collected mainly in the form of the words of the participants. The data are then analyzed for themes. As with all research, the line of inquiry should be conducted in a subjective and unbiased manner.

Qualitative research was developed in the late 1800s and early 1900s in fields other than education. The earliest qualitative studies took place in the fields of sociology and anthropology (Creswell, 2008). The use of qualitative research in the field of education has been most prevalent over the last 30 years. Although qualitative research is relatively new, it presents an alternative to quantitative methods (Bogdan & Biklen, 1998). Although quantitative and qualitative research represent distinct methodologies, only in rare situations is research purely quantitative or qualitative (Firestone, 1987). At one time, researchers believed that qualitative and quantitative research methodologies could not be mixed. The problem with this “incompatibility thesis” was that it does not acknowledge that the mixing of assumptions, ideas, and methods can be helpful in offering another paradigm through which to view an issue (B. Johnson & Christensen, 2012).

Educational research in general exists on a continuum from quantitative to qualitative (Reichardt & Cook, 1979). Qualitative research in education emerged in the 1960s amid a call from education philosophers for an alternative to the traditional approach. Early proponents of qualitative research felt traditional quantitative methods relied too much on the researcher’s view
of education and did not adequately incorporate the participants’ views. Early qualitative researchers aimed to examine phenomena within the context of the situation. The advent and development of qualitative research led to the recognition of three characteristics of qualitative research:

- The belief that researchers need to listen to the viewpoints of participants in studies
- Asking general, open-ended questions and collecting data in places where people live and work
- The belief that the researcher has a role in advocating for the improvement of individuals’ lives

Qualitative researchers tend to explore research problems about which little is known and to focus on a central phenomenon. The literature review often plays a minor role in suggesting the research question, though it helps justify the importance of the research problem. The data collected for qualitative research often are elicited by asking questions that permit the participants to generate their own responses, which can include both words and images. The data are usually collected from a small number of individual sites in a broad and general manner in order to better understand participants’ experience. Unlike quantitative researchers, qualitative researchers do not choose participants through random sampling. Instead, researchers look for sites that can best help them understand the issue being studied. Qualitative research also varies from quantitative research in terms of reporting and evaluating the findings. The research reports from this type of research use a flexible structure and tend to take a more reflexive approach to the subject. Reflexivity means the researchers reflect on their own biases, values, assumptions, and experiences. However, the qualitative reflection needs to be an accurate and credible account of the phenomena being studied (Creswell, 2008).
Qualitative researchers work within the concept that reality is socially constructed (Guba & Lincoln, 1989). Specifically, qualitative researchers view the impact of socially constructed norms and language on how a group views and understands a given topic. The idea that people see and understand the world through their local language is referred to as the linguistic relativity hypothesis. Qualitative research emphasizes a “bottom-up” approach to generating or constructing knowledge. Unlike quantitative research, qualitative research creates a place for relativism and group justification of varying standards. Both the research and findings in qualitative research are heavily contextualized and situation when compared to quantitative data. The work presented by qualitative researchers is often used to understand particular groups and inform local policy. The four most common approaches to qualitative research are: phenomenology, ethnography, case study, and the grounded theory approach. In qualitative data analysis the researcher may alternate between data collection and data analysis during a research study. This cyclical process is called interim analysis. This process is employed in qualitative research because qualitative researchers use each round of data collection to guide the succeeding rounds of data collection. This process continues until the researcher is satisfied with their understanding of the topic or the data pools are exhausted. Grounded theorists refer to this point as theoretical saturation (B. Johnson & Christensen, 2012).

**Context or the Study**

The research was conducted at three schools located in West Long Branch, New Jersey: Betty McElmon School (BME), Frank Antonides School (FAS), and Shore Regional High School (SRHS). West Long Branch is located in Monmouth County. BME is a prekindergarten through Grade 3 school. FAS is a Grades 4 through 8 school. SRHS is a regional Grades 9 through 12 high school.
The West Long Branch School District is a small K–8 district that, along with Oceanport, Sea Bright, and Monmouth Beach, New Jersey, sends its high school students to Shore Regional High School. Sea Bright has no schools and sends its students to the Oceanport K–8 district. Oceanport, West Long Branch, and Shore Regional share a superintendent, business administrator, and director of curriculum and instruction. Their business administrator and director of curriculum and instruction are also shared with Monmouth Beach. When the state of New Jersey divided school districts by district factor groups (DFGs), West Long Branch was labeled an FG. Shore Regional, as a separate school district, was a GH. DFGs were developed in 1975 to help compare students’ performance on statewide assessments across demographically similar school districts. DFGs were updated every 10 years with the most recent census data. Following the Abbot v. Burke rulings, DFGs were also used to define and target the group of school districts that would receive a parity remedy. The DFGs represented an approximate measure of a community’s relative SES. Six variables are closely related to SES:

- Percentage of adults with no high school diploma
- Percentage of adults with some college education
- Occupational status
- Unemployment rate
- Percentage of individuals in poverty
- Median family income

Nonoperating school districts do not receive a DFG classification (New Jersey Department of Education, n.d.a). Although the state of New Jersey no longer classifies districts by DFGs, the
researcher believes they are useful in providing a socioeconomic context through which to view this research. Additionally, DFGs provide a lens through which to compare this research with other similar research.

At BME the third-grade students were all issued Chromebooks for the 2014–2015 school year. Students kept the device throughout the day, and wireless Internet was provided throughout the campus, which is connected to FAS via three shared hallways. Tables 1 and 2 present demographic information about the students for the 2014–2015 school year.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>33</td>
<td>30</td>
<td>63</td>
</tr>
</tbody>
</table>

Table 1 Student Count by Gender for the 2014–2015 School Year at BME

<table>
<thead>
<tr>
<th>Grade</th>
<th>White</th>
<th>Black</th>
<th>Hispanic</th>
<th>Asian</th>
<th>Multiple ethnicities</th>
<th>Special education (all)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>53</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 2 Ethnicity and special education count by grade level for the 2014–2015 school at FAS year at BME

An analysis of BME NJASK scores from the 2013–2014 school year provides an overview of students’ general academic achievement (see Table 3).

<table>
<thead>
<tr>
<th>Grade</th>
<th>ELA general education</th>
<th>ELA special education</th>
<th>Math general education</th>
<th>Math special education</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>78</td>
<td>33</td>
<td>87</td>
<td>42</td>
</tr>
</tbody>
</table>

Table 3 NJASK 2014 Pass Percentages

At FAS there were 341 students at the start of the 2014–2015 school year, all of whom were issued Chromebooks. Prior to the 2014–2015 school year, some teachers had access to class sets of Chromebooks and received training in the various Google Applications for Education. The district’s e-mail is serviced by Google Mail. Wireless Internet is available
throughout the campus. Students have access to their devices throughout the entire school day but do not bring their devices home with them. The students pick up the devices during homeroom and returned to their homeroom prior to leaving school for the day. Tables 4 and 5 show the gender, ethnic, and special education composition for FAS students.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>27</td>
<td>35</td>
<td>62</td>
</tr>
<tr>
<td>5</td>
<td>33</td>
<td>31</td>
<td>64</td>
</tr>
<tr>
<td>6</td>
<td>33</td>
<td>29</td>
<td>62</td>
</tr>
<tr>
<td>7</td>
<td>39</td>
<td>41</td>
<td>80</td>
</tr>
<tr>
<td>8</td>
<td>34</td>
<td>39</td>
<td>73</td>
</tr>
</tbody>
</table>

Table 4 Student Count by Grade Level and Gender for the 2014–2015 School Year at FAS

<table>
<thead>
<tr>
<th>Grade</th>
<th>White</th>
<th>Black</th>
<th>Hispanic</th>
<th>Asian</th>
<th>Multiple ethnicities</th>
<th>Special education (all)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>54</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>58</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>48</td>
<td>1</td>
<td>9</td>
<td>3</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>71</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 5 Ethnicity and Special Education Count by Grade Level for the 2014–2015 School Year at FAS

An analysis of FAS students’ NJASK scores from the 2013–2014 school year provides a snapshot of the students’ general level of academic performance. Although using NJASK scores to paint a broad picture of a district is a drastic oversimplification, it can be instructive as a piece of an overall narrative.

<table>
<thead>
<tr>
<th>Grade</th>
<th>ELA general education</th>
<th>ELA special education</th>
<th>Math general education</th>
<th>Math special education</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>80</td>
<td>50</td>
<td>82.4</td>
<td>75</td>
</tr>
<tr>
<td>5</td>
<td>68.1</td>
<td>47</td>
<td>85.4</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>82.1</td>
<td>25</td>
<td>94.1</td>
<td>88</td>
</tr>
<tr>
<td>7</td>
<td>72.7</td>
<td>6</td>
<td>81.8</td>
<td>25</td>
</tr>
<tr>
<td>8</td>
<td>96.7</td>
<td>75</td>
<td>93.4</td>
<td>39.5</td>
</tr>
</tbody>
</table>
Table 6 NJASK 2014 Pass Percentages

During the 2014–2015 school year, SRHS was in the second year of its one-to-one program. Prior to the 2013–2014 school year, SRHS had several Chromebooks available on carts. Many teachers made use of various Google Apps for Education. The district’s e-mail is serviced by Google Mail. Wireless Internet is available throughout the school. Students took their devices home with them. Students also had the option to keep the devices with them over the summer. The district had a self-insurance program to deal with breakage issues. All students were provided with carrying cases for their devices midway through the 2013–2014 school year to help minimize breakage issues.

<table>
<thead>
<tr>
<th></th>
<th>Advanced proficient</th>
<th>Proficient</th>
<th>Partially proficient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Math</strong></td>
<td>35%</td>
<td>52.8%</td>
<td>12.2%</td>
</tr>
<tr>
<td><strong>Math general education</strong></td>
<td>39.25%</td>
<td>55.5%</td>
<td>5.2%</td>
</tr>
<tr>
<td><strong>Math special education</strong></td>
<td>9%</td>
<td>36.3%</td>
<td>54.5%</td>
</tr>
<tr>
<td><strong>Language arts</strong></td>
<td>43.9%</td>
<td>55.7%</td>
<td>1.27%</td>
</tr>
<tr>
<td><strong>Language arts general education</strong></td>
<td>48%</td>
<td>52%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Language arts special education</strong></td>
<td>18%</td>
<td>72.7%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Table 7 Shore Regional 2014 HSPA Scores

<table>
<thead>
<tr>
<th>Grade</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>79</td>
<td>70</td>
<td>149</td>
</tr>
<tr>
<td>10</td>
<td>73</td>
<td>87</td>
<td>160</td>
</tr>
<tr>
<td>11</td>
<td>86</td>
<td>74</td>
<td>160</td>
</tr>
<tr>
<td>12</td>
<td>76</td>
<td>81</td>
<td>157</td>
</tr>
</tbody>
</table>

Table 8 Student Count by Grade Level and Gender for the 2014–2015 School Year at SRHS
<table>
<thead>
<tr>
<th>Grade</th>
<th>White</th>
<th>Black</th>
<th>Hispanic</th>
<th>Asian</th>
<th>Multiple ethnicities</th>
<th>Special education (all)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>133</td>
<td>1</td>
<td>8</td>
<td>2</td>
<td>5</td>
<td>32</td>
</tr>
<tr>
<td>10</td>
<td>151</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>31</td>
</tr>
<tr>
<td>11</td>
<td>150</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>12</td>
<td>147</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>17</td>
</tr>
</tbody>
</table>

Table 9 Ethnicity and Special Education Count by Grade Level for the 2014–2015 School Year at SRHS

**Research Questions**

The research questions examined in this study are as follows:

1. What are teachers’ perceptions of one-to-one computing programs?
2. Do teachers feel that the one-to-one initiative has impacted student engagement?
3. What are teachers’ perceptions of student engagement in a one-to-one environment?
4. Do teachers perceive any positive impacts of one-to-one initiatives? If so, what are they?
5. Do teachers perceive any negative impacts of one-to-one initiatives? If so, what are they?

**Data Collection**

Data for this research were collected by surveying staff at BME, FAS, and SRHS. The survey, data collection, and analysis all followed IRB protocol. Letters of solicitation were included with the survey. The survey was administered using via proxy by Google Forms. Forms is a program available within Google Drive, a free, cloud-based app that allows users to save and share files. Other programs available through Drive include Google Docs, a web-based word processor; Google Sheets, a spreadsheet program; and Google Slides, a presentation
program. This suite of programs is tightly integrated, and all alterations made to files in these programs are automatically saved in Drive. Accessing these programs can be done through the Internet or applications for both the iOS and Android platforms. All programs within Drive allow for multiple users and real-time edits and collaboration. Forms allows users to create custom forms for surveys and questionnaires within Drive. Forms automatically populates a spreadsheet in Drive with the data collected from the surveys. This allows the data to be analyzed in Sheets. Questions in Google forms can be entered using multiple choice, text, paragraph text, check boxes, date, time, scales, or graphs. The survey can be shared with respondents by sharing a Web link via e-mail or social media (e.g., Facebook, Twitter, Google+; Create a Survey Using Google Forms, n.d.).

The link to the survey was shared with the entire staff of FAS and SRHS, as well as the third-grade teachers at BME. The form was shared by a proxy of the Department of Education at St. Peter’s University. Teachers’ grade level was not included in the survey. These steps were taken in order to create separation between the research and data collection, as well as to guarantee the surveys were anonymous. For additional separation, the form’s settings were set up for anonymous responses. As the purpose of the study was to further understand teacher perceptions of student engagement in a one-to-one environment administration, technology coordinators, counselors, and other nonteachers were not included in the survey.

The survey was a modified version of a survey developed by the Mitchell Institute and used in several studies. Specifically, this survey was used in the One-to-One Laptops in a High School Environment Final Report for the Piscataquis Community High School Study from February 2004. The survey developer gave permission to use the survey in this study. Teachers had 2 weeks to complete the survey, which was administered in April 2015. The teacher survey
focused on how the Chromebooks were used in the classroom, the frequency of use, and the teachers’ perceptions of how the Chromebooks impact student achievement. There were also open-ended questions asking for the teachers’ overall feedback on the one-to-one initiative.

Data Analysis

Data for this research were gathered over 2 weeks in April 2015. A survey was shared electronically by proxy to staff at BME, FAS, and SRHS. Teachers from Grades 3–12 responded. The responses were analyzed in two ways. First, the responses were calculated, totaled, and charted to provide a numeric description and context for the teachers’ responses. The descriptive statistics provided both information on the responders and their opinions of teaching and learning in the one-to-one environment. Second, the open-ended question responses were coded to look for themes in staff answers.

Limitations

The major limitation of this study was that it focused on teacher perceptions on a very small scale. As the study was phenomenological, it focused on how an extremely small group of teachers perceived the phenomenon of student engagement. This study made no use of various measures of student achievement nor did it make any attempt to measure the degree to which the adoption had been implemented. The researcher is the principal at FAS. That role in the school may have influenced the staff and/or biased the information they provided. In order to further ensure staff anonymity, teachers’ grade level was not included in the survey. Although it was important to avoid collecting any information that could identify staff, this created a gap in analyzing possible relationships between grade level and perceptions of student engagement. Additionally, all researchers had their own bias, which could impact the validity of the data. The
researcher’s previous experiences with educational technology, working in a one-to-one school, and supervising technology all could create undue bias. One of the largest limitations to the study is the complex nature of student engagement itself. As the literature shows, student engagement is a difficult concept to explain. As such, any understanding the study sheds on engagement in one-to-one environments is limited to what researchers understand about the concept of engagement. This survey also did not attempt to delve into what types of engagement were impacted by the adoption of a one-to-one computing ratio.
Chapter 4 Research Findings

The importance of student engagement to learning has long been recognized (Greenwood et al., 2002; Slavin, 2003). Numerous studies of one-to-one computing environments have shown that one-to-one computing can increase student engagement (Dunleavy et al., 2007; Greaves et al., 2012; Grimes & Waschauer, 2008; Penuel, 2006; Zucker & McGhee, 2005). Research has shown mixed results in regard to one-to-one computing’s impact on academic achievement, particularly when measured by standardized testing. Jeroski (2005) and Worschauer (2006) found improvements in writing quality, student attitudes’ toward writing, and gains in the process and products of literacy. Goldberg et al. (2003) found significant improvement in the quality and quantity of students’ writing. Silvernail and Gritter (2007) found a correlation between how often students used their computers and their writing scores on standardized tests.

There is little research exploring the phenomena of student engagement in a one-to-one environment from the perspective of teachers. The goal of this research was to supplement previous research by exploring the construct of student engagement in a one-to-one environment from the teachers’ point of view. The research was conducted at three schools located in Monmouth County. Data for this research were collected by surveying staff via Google Forms.

This chapter reports on the analysis of the data gathered from the survey. The study sought to better understand how teachers see the phenomena of student engagement in a one-to-one computing environment. Teachers from three different schools in Grades 3 through 12 were surveyed for this research. There were 48 responses to the survey. Although 48 teachers responded, not all of the respondents answered all of the questions. As such, the results in all of
the categories did not always total 48. Teacher respondents came from a variety of content areas (see Table 10) and years of experience (see Table 11). Although the teacher respondents represent a wide variety of content areas, the great majority self-identified as content area specialists (e.g., in math or social studies) and not as generalists of special education. This is to be expected, however, due to the fact most of the teachers included in this survey were middle or high school teachers.

The teachers’ perceptions of the one-to-one program’s impact on writing, discussed later, may be especially telling, given that 19 of the 48 respondents indicated they taught content that was traditionally considered to emphasize writing (e.g., language arts, social studies, math, and science). Only 13% of respondents had been teaching 3 years or less. The same proportion (13%) had been teaching for 4–7 years, whereas 16% of the teachers who responded to the survey had been teaching between 7 and 9 years. Slightly less (14%) indicated they had been teaching 10–12 years, whereas 25% fell into the 13–19 years of teaching experience range. Finally, 19% of the staff included in the survey had been teaching 20 years or more.

The majority of teachers who responded could be considered veteran staff (7 years or more of teaching experience). However, the sample provides enough breadth to encompass a wide variety of teaching experience. In order to guarantee teacher anonymity, teachers’ grade level was not collected as part of the survey. Due to this fact, it was not possible to characterize or group responses by grade level, which created another limitation for the study, as it would be useful to determine patterns that could be identified based on grade level.
<table>
<thead>
<tr>
<th>Content Area</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>All content areas</td>
<td>1</td>
</tr>
<tr>
<td>Art/music</td>
<td>4</td>
</tr>
<tr>
<td>Business and technology</td>
<td>2</td>
</tr>
<tr>
<td>Foreign language</td>
<td>4</td>
</tr>
<tr>
<td>Industrial arts</td>
<td>1</td>
</tr>
<tr>
<td>Language arts, math, science, and social studies</td>
<td>2</td>
</tr>
<tr>
<td>Language arts</td>
<td>8</td>
</tr>
<tr>
<td>Math</td>
<td>7</td>
</tr>
<tr>
<td>Science</td>
<td>9</td>
</tr>
<tr>
<td>Social studies</td>
<td>8</td>
</tr>
<tr>
<td>Special education</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
</tr>
</tbody>
</table>

Table 10 Respondent Breakdown by Content Area

<table>
<thead>
<tr>
<th>Years Teaching</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 years or fewer</td>
<td>6</td>
</tr>
<tr>
<td>4–6 years</td>
<td>6</td>
</tr>
<tr>
<td>7–9 years</td>
<td>8</td>
</tr>
<tr>
<td>10–12 years</td>
<td>7</td>
</tr>
<tr>
<td>13–19 years</td>
<td>12</td>
</tr>
<tr>
<td>20 or more years</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
</tr>
</tbody>
</table>

Table 11 Respondent Breakdown by Years Teaching

Teachers were asked to self-evaluate their overall skills with Chromebooks and the Chrome platform prior to the start of the one-to-one initiative and after the implementation of the initiative (see Table 12). The survey coincided with the end of the second year of the SRHS...
initiative and the first year of the BME and FAS initiatives. One important theme that came out of the survey was that teachers reported increased skill with both the Chrome platform and the Chromebooks themselves (see Table 12). This seems to mirror the findings of Bebell and Kay (2010), Meyer (2007), and Sauers and Mcleod (2012), who found that increased student and teacher skills with technology were positively impacted by one-to-one programs. Five teachers self-reported that they had the lowest skill level (novice) prior to the start of the one-to-one initiative. None self-reported in this category at the time of the survey.

Prior to the implementation of the one-to-one program, most considered themselves beginners (42%) or intermediate (31%). Post implementation, most teachers felt they were either at the intermediate (48%) or advanced level (29%). No teachers felt they were experts before the one-to-one ratio was implemented. After the one-to-one rollout, 15% self-reported being experts. Teachers’ improved confidence no doubt has a positive impact on their efficacy in regard to using educational technology, which represents an important data point.

<table>
<thead>
<tr>
<th>Skill level</th>
<th>Pre one-to-one initiative</th>
<th>Post one-to-one initiative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novice</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Beginner</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>Intermediate</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>Advanced</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Expert</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>48</td>
</tr>
</tbody>
</table>

Table 12 Respondents’ self-reported Chromebook / Chrome skills pre and post one-to-one initiative
A majority of the research on one-to-one computing points to increased student engagement as a positive impact of the programs (Bebell, 2005; Dunleavy et al., 2007; Greaves et al., 2012; Grimes & Waschauer, 2008; Penuel, 2006; Silvernail & Lane, 2004; Suhr et al., 2010; Zucker & McGhee, 2005). Teachers’ perceptions in this study did not mirror the trends from the research (see Table 13). Teachers were asked what impact they felt the one-to-one program had on the engagement of at-risk, traditional, and high-achieving students. Whereas 34.7% of teachers indicated they felt the one-to-one initiative improved student engagement among at-risk students, 32.6% indicated they felt that at-risk student engagement had declined. Another 32.6% of teachers felt the level of engagement was unchanged. This pattern was also seen with traditional students, as 40.4% of teachers saw student engagement increase but 29.7% felt it decreased. The same percentage (29.7%) felt there was no effect on student engagement.

By contrast, most teachers (51.1%) felt the one-to-one initiative had no impact on high-achieving students’ engagement. One-third (33.3%) of teachers felt the Chromebooks had a positive impact on high-achieving student engagement, and 15.5% felt Chromebooks had a negative impact on student engagement. Given the literature on student engagement, these results led the researcher to question the teaching practices in the classrooms as much as the impact of one-to-one computing. Additionally, as discussed later, the findings were likely influenced by the fact that the implementations were still in the early stages.
<table>
<thead>
<tr>
<th>Effect</th>
<th>At-risk / low-achieving students</th>
<th>Traditional students</th>
<th>High-achieving students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declined</td>
<td>15</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Improved</td>
<td>16</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>No effect</td>
<td>15</td>
<td>14</td>
<td>23</td>
</tr>
</tbody>
</table>

Table 13 Teachers’ Perceptions of One-to-One Computing’s Impact of Student Engagement

When given several choices regarding the positive impacts of one-to-one computing, only 4% (2 out of 47) indicated perceiving increased student engagement as a positive outcome (see Table 14). The same percentage of teachers responded that there were no positive impacts of the one-to-one program. The researcher predicted the percentage of teachers selecting increased student engagement would have been higher had teachers been allowed to choose multiple answers. This was not allowed in order to determine what teachers felt was the greatest positive impact of the program. The most frequently identified positive impact was student computer literacy, which was identified by 34% of respondents (16 of 47). If the goals for one-to-one programs are to improve students’ technological literacy and 21st-century skills (Grimes & Warschauer, 2008), then this is a promising finding.

Educators are well aware that they are preparing students for jobs that do not yet exist. Whatever these jobs may be, they will include a heavy reliance on digital literacy. Improved student digital literacy is not a given result of adding computers to school. Although technology is omnipresent in young people’s lives, this does not guarantee that students know how to use it for effective educational and professional means. In order for their digital literacy to improve, students must consistently use the devices for academic tasks.
Improved teacher access to educational resources was also seen as a major positive impact of the program by 23% of the teachers (11 of 47). Again, this is an important finding given the sheer wealth of information available for educators online. Connected educators make use of Twitter and other social media sites to share ideas and best practices. Many teachers have taken to creating and personal learning networks (PLNs), which are driven by the individual. These may include Twitter, Google +, webinars, blogs, and curation sites such as Diigo to create and share professional content for professional development (Edublogs Teacher Challenges, n.d.). The researcher theorized that teachers using their devices to become comfortable with and make use of all of the information available on the Internet is a very positive step for both them and their schools.

No teachers cited improvement in the quantity or quality of what students learn in school or the rigor of curriculum as a positive impact of the one-to-one program. One teacher who took the survey did not answer this question. Additionally, two staff members answered “none” in regard to positive impact. Personalized learning activities were the second-most selected option, with 25% of respondents (12 of 47) selecting it.
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Student computer literacy</td>
<td>16</td>
</tr>
<tr>
<td>Quantity and quality of what students learn in school</td>
<td>0</td>
</tr>
<tr>
<td>Personalized learning opportunities for each student</td>
<td>12</td>
</tr>
<tr>
<td>Rigor of curriculum</td>
<td>0</td>
</tr>
<tr>
<td>Reliable assessment of student progress</td>
<td>4</td>
</tr>
<tr>
<td>Teacher access to educational resources</td>
<td>11</td>
</tr>
<tr>
<td>Student engagement</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
</tr>
</tbody>
</table>

Table 14 Teachers’ Perceptions of the Positive Impacts of One-to-One Computing
Table 15 Teacher Usage of Chromebooks

As part of the staff survey, teachers received a list of common teacher activities (see Table 15). These activities were conduct research for lesson plans, develop instructional materials for presentations, produce homework assignments, assess students, manage student information, communicate with students or parents, and communicate with colleagues. Teachers were asked to indicate how frequently they used Chromebooks to complete these activities (never, less than monthly, monthly, weekly, or daily). In all, 4 teachers indicated that they never used the Chromebooks to plan lessons, 3 indicated they used them less than monthly, 7 said they used them monthly, 21 said they used them weekly for lesson plans, and 12 said they used them
daily for planning and preparation. In regard to developing instructional materials or presentations, 3 teachers said they never used the devices, 4 said they used them less than monthly, 6 said they used them monthly, 18 said they used the devices weekly, and 13 said they used the devices daily for developing materials. For producing homework assignments, 7 teachers said they never made use of the devices, 3 said they used the Chromebooks less than monthly for this purposes, 8 said they made use of Chromebooks monthly, 14 said they made use of the devices weekly, and 15 said they used them daily.

In addition, 5 teachers responded that they never used Chromebooks to assess students, 3 said they used the devices less than monthly for assessment, 9 said they used them monthly, 13 stated they used them weekly, and 18 said they used the devices daily for assessment. Regarding student information, 8 teachers said they never used the devices to manage student information, 2 indicated they used them less than monthly, 8 said they used them monthly, 11 indicated they used them weekly, and 18 said they used them daily. For communicating with students and/or parents, 7 teachers said they never made use of Chromebooks, 3 said they used them less than monthly, 7 said they used them monthly, 13 said they used them weekly, and 17 claimed to use them daily. For communication with colleagues, 3 teachers said they never used Chromebooks, 3 said they used them less than monthly, 8 indicated they used the devices monthly, 9 claimed to use the devices weekly, and 24 indicated them daily.

The action for which the most teachers \( (n = 8) \) selected \textit{never} was managing student information. Lesson planning, producing homework, assessing students, communicating with students and parents, and communicating with colleagues were the tasks most frequently cited as occurring less than monthly \( (n = 3) \). Assessment of students \( (n = 9) \) was the activity that most teachers selected as occurring monthly. Conducting research for lesson plans was most
frequently \((n = 21)\) indicated as occurring weekly. Communicating with colleagues was the task that was most frequently selected as occurring daily. In general, most staff indicated that the various activities occurred weekly or daily as opposed to less frequently (i.e., never, less than monthly, or monthly).

With all of the available options, the number of teachers who indicated they used Chromebooks daily far exceeded the number of teachers who indicated they never used them. In all categories but two, daily use was more common than weekly use. Also, in all categories, the combined number of teachers who reported daily or weekly use was greater than the combined number who reported monthly use, less than monthly use, or never. This points to a certain level of integration of the devices into the teachers’ daily routine. While this points to frequent use, especially for communication, assessment, and managing student data, it does not reveal the quality of the work put into these activities. Specifically, it does not shed light on how engaging the assessments, homework, or instructional materials developed may be.

The teacher survey included two open-ended questions: “Do you think the Chromebook program has had any negative impacts? If yes, please describe?” and “Are there positive impacts to the Chromebook program that you have not already indicated in this survey? If yes, please describe.” During the analysis of teacher responses, several themes emerged in each category, including positive and negative impacts.

The themes associated with negative impacts of the one-to-one Chromebook program were as follows:

- Students being off task / disengaged
- Increased plagiarism
- Decreased personal (student-to-student and student-to-teacher) interaction
- Students’ lack of handwriting skills

By far the concern most frequently expressed was improving students’ access to media, communication tools, and games. Staff expressed concern that it would be easier for students to engage in things other than their classwork. They also expressed concern over a perceived lack of control over what students were doing on their devices. Not only was there an expression of concern that students were off task or disengaged with learning, but some respondents also expressed concern that students could be engaged in inappropriate activities.

The themes associated with perceived positive impacts were as follows:

- The ability to share and organize resources/documents
- The ability to assess students and offer feedback
- Savings in paper / no need for copies

It is interesting to note that no teachers indicated increased student engagement or motivation as one of the positive impacts of the one-to-one initiative. The ability to assess students and offer feedback is of particular importance as students nationwide are engaging in either the PARCC or Smarter Balanced computer-based assessments.

Teachers were also asked to look at a list of classroom practices and indicate whether these practices occurred less often, more often, or about as often as they had prior to the implementation of the one-to-one initiative (see Table 16). These 18 practices were as follows:

- Students teach other students.
- Students teach the teacher.
- Students select their own research area.
- Students work in groups and review/edit their own work.
• Students engage in multiple learning activities during class.
• Students do different assignments in one class.
• Students write more than one page.
• A textbook is the primary guide.
• Student interest influences the lesson.
• Teachers use direct instruction
• Teachers give quizzes and tests
• Teachers evaluate student work.
• Students evaluate other students’ work.
• Students evaluate their own work.
• Curriculum connects to other disciplines.
• Students are off task.
• Students are engaged in their work.

In all, 11% of teachers reported that students teaching other students happened less often after going one-to-one computing, 73% indicated this practice remained unchanged, and 16% indicated it happened more often. With regard to students teaching the teacher, 15% indicated this happened less often, 64% said it occurred about the same amount, and 21% said it occurred more often. With respect to students selecting their own research topics, 9% of respondents said this occurred less often after the one-to-one program began, 47% said it happened about as often, and 44% said it happened more often. With respect to students working in groups, 6% of teachers said this occurred less often, 62% said it happens about as often as before, and 32% said it occurred more often.
When asked about students reviewing and editing their work, 6% of teachers said this occurred less often than before one-to-one computing was implemented, 47% felt it occurred at about the same rate, and 47% said it happened more often. In regard to students engaging in multiple learning activities during class, 4% of teachers indicated it happened less often, 43% indicated it happened about the same amount, and 53% stated it happened more often after the implementation of one-to-one computing. Similarly, 2% of respondents said their students did different assignments in the same class, whereas 47% said this occurred about as often as it had previously, and 51% said it happened more often. In addition, 20% of teachers said that students wrote more than one page less often after the implementation of Chromebooks, whereas 70% said it happened about as often and 10% said it occurred more often.

Moreover, 51% of teachers said that the use of a textbook as the primary guide occurred less often, whereas 47% felt it occurred at about the same rate and 2% indicated it happened more often. Next, 11% of staff felt that student interests influenced the lesson less after the introduction of one-to-one computing, whereas 66% said it occurred about as often, and 23% said it occurred more often. On the topic of direct instruction, 11% felt it occurred less often, 66% felt it occurred about as often, and 23% felt student interests now influenced the lesson. In addition, 13% of respondents indicated direct instruction occurred less often after the introduction of one-to-one computing, whereas 77% felt it occurred about as often and 10% stated it happened more often.

With respect to administration of quizzes and tests, 15% of teacher respondents stated that this occurred less frequently after the introduction of Chromebooks into the classroom, whereas 62% stated that there was no change and 23% stated that it happened more often. In addition, 2% of teachers stated they evaluated student work less often than previously, 74% felt
there was no change in their behavior, and 24% felt it occurred more often now. Related to evaluation of work, 17% of teachers stated that students evaluated other students’ work less often, 63% stated that it happened about the same amount, and 20% stated that it occurred more often. In addition, 4% of respondents felt students evaluated their own work less often after the one-to-one rollout, 62% felt it happened about as often, and 34% felt it occurred more often. Finally, 2% of staff stated that the curriculum connected to other disciplines less frequently than it had before the introduction of one-to-one computing, 60% stated it happened at about the same rate, and 38% stated it now happened more often.

In many ways, the respondents in this survey mirrored some of the patterns seen in larger-scale surveys. The National Survey on Mobile Technology for K-12 Education (2013) demonstrated that teachers most often identified the following as beneficial to student learning: the use of digital textbooks (76.9%), student productivity tools (54.3%), and creation tools (51.6%). Two important responses emerged from the survey in regard to student engagement. The first was that 19% respondents felt students were off task less often than previously, 30% felt that students remained on task about as frequently, and 51% felt it happened more frequently. Second, 21% of teachers reported that students were engaged in their work less often than prior to the one-to-one program, 47% felt students were engaged about as often, and 32% reported that students were more engaged than they were prior to the program. Much of the research shows that both teachers and parents worried about the distractions that could come with one-to-one devices. While these concerns are common, they are not reflected in the research as a whole (Sauers & Mcleod, 2012).

In all categories, more teachers perceived no change (about as often) than any change (less or more frequently). This seems to fit within the larger context of many teachers perceiving
little impact on their overall practices. However, in all but three of the categories (direct instruction, textbook as the primary guide, and students write more than one page), more teachers felt the actions were happening more frequently now than those who felt the actions were happening less frequently. It is important to note that direct instruction and students writing more than one page were more of a function of teacher planning then they are a function of the one-to-one devices. The choice to lecture is a choice entertained as part of the planning process, but given the fact that one-to-one computing gives students access to unlimited information, it is a choice that does not seem to be necessary.

The length of student writing is also directly related to teacher choice. Teachers themselves have the ability to decide the level of rigor in their classes and what length assignments should be. Given that a one-to-one environment makes research much quicker and easier and that shared documents allow for real-time collaboration and editing, it is interesting that any teachers would indicate students are writing less. In fact, one could make a very sound argument that transitioning away from direct instruction and requiring more student writing are both much easier to accomplish in a one-to-one environment. Again, there is not a strong perception of improved student engagement as a result of the one-to-one initiative. In all, 21% of teachers felt their students were engaged in their work less often after the initiative began, whereas 32% felt they were engaged in their work more often. More respondents saw no change (47%) than saw either more or less engagement. Overall, more respondents perceived change (53%) than did not (47%). The concerns about decreased student engagement are likely tied to concerns of students’ off-task behaviors. In all, 19% of the respondents indicated that students were off task less often after the transition to one-to-one computing, whereas 30% felt students were off task about as frequently as before the transition. The most concerning statistic was that
51% of teachers felt their students were off task more often after the initiative began. Although the responses in regard to student engagement and student off-task behavior are troubling, other positive outcomes were indicated, such as teachers using the textbook as their primary guide less often, students reviewing/editing their own work more, students engaging in multiple learning activities during class more often, and students doing different assignments in the same class more frequently.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Less often</th>
<th>About as often</th>
<th>More often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students teach other students</td>
<td>5</td>
<td>33</td>
<td>7</td>
</tr>
<tr>
<td>Students teach the teacher</td>
<td>7</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Students select their own research area</td>
<td>4</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>Students work in groups</td>
<td>3</td>
<td>29</td>
<td>15</td>
</tr>
<tr>
<td>Students review/edit their own work</td>
<td>3</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Students engage in multiple learning activities during class</td>
<td>2</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>Students do different assignments in one class</td>
<td>1</td>
<td>22</td>
<td>24</td>
</tr>
<tr>
<td>Students write more than one page</td>
<td>9</td>
<td>32</td>
<td>5</td>
</tr>
<tr>
<td>A textbook is the primary guide</td>
<td>24</td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>Student interests influence the lesson</td>
<td>5</td>
<td>31</td>
<td>11</td>
</tr>
<tr>
<td>Direct instruction</td>
<td>6</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>Quizzes and tests</td>
<td>7</td>
<td>29</td>
<td>11</td>
</tr>
<tr>
<td>Teacher evaluates student work</td>
<td>1</td>
<td>34</td>
<td>11</td>
</tr>
<tr>
<td>Students evaluate other students’ work</td>
<td>8</td>
<td>29</td>
<td>9</td>
</tr>
<tr>
<td>Students evaluate their own work</td>
<td>2</td>
<td>29</td>
<td>16</td>
</tr>
<tr>
<td>Curriculum connects to other disciplines</td>
<td>1</td>
<td>28</td>
<td>18</td>
</tr>
<tr>
<td>Students are off task</td>
<td>9</td>
<td>14</td>
<td>24</td>
</tr>
<tr>
<td>Students are engaged in their work</td>
<td>10</td>
<td>22</td>
<td>15</td>
</tr>
</tbody>
</table>
Chapter 5 Conclusions and Recommendations

Given the growing prevalence of one-to-one programs and technology in education as a whole, it is important to understand how teachers perceive certain aspects of one-to-one programs. School districts invest large sums of time and money into these types of programs. This study examined teachers’ perceptions of student engagement before and after the initial implantation of a one-to-one Chromebook initiative in three schools. In all, 48 teachers from three central New Jersey schools participated in the study. The survey was administered to teachers in the Spring of 2015 through Google Forms. This research examines teacher perceptions of student engagement in a one-to-one computing environment. The results were analyzed in the preceding chapter.

Conclusions

There are several patterns and lessons that emerged from the review of the literature and this study that are important for educational leaders. In general, policy makers should note that more than half (51%) of respondents felt they no longer used textbooks as their primary guide after the transition to a one-to-one computing environment. Additionally, 53% and 51% of the teachers who responded indicated that students engaged in multiple learning activities during class and that students did different assignments during class more often after the one-to-one rollout. Both of these represent sound pedagogical practice and should be considered positive.

The literature indicates that one-to-one programs have improved the product and process of literacy (Worschauer, 2006), as well as the quality and quantity of students’ writing (Goldberg et al., 2003), and that these programs were correlated to improvements in both writing quality and students’ attitudes toward writing (Jeroski, 2005). However, 20% of teachers included in
this study felt that students did not write more than one page as often as they did before the implementation of Chromebooks. A majority (70%) felt it happened about as often, and only 10% of the respondents felt writing more than one page occurred more often after implementation.

A great deal of the research and literature on one-to-one computing indicates a positive impact on student engagement (Dunleavy et al., 2007; Greaves et al., 2012; Grimes & Waschauer, 2008; Penuel, 2006; Zucker & McGhee, 2005). These findings were not conclusively mirrored by this research. When asked to evaluate how often specific student behaviors occurred in their classroom pre and post implementation of one-to-one computing, 51% indicated they felt students were off task more often after the one-to-one initiative began. Additionally, only 21% of respondents indicated students were engaged in their work more often after the Chromebook adoption. Just under half felt students were off task less often (19%) or about as often (30%) since transitioning to one-to-one computing. A majority (51%) of respondents felt students were off task more often after the implementation of the one-to-one program.

Additionally, 21% of teachers reported that students were engaged in their work less often after the one-to-one program implementation, 47% felt students were engaged about as often, and 32% reported students were more engaged. When given several choices of the positive impacts of one-to-one computing ratios, only 4% of teacher respondents indicated increased student engagement as a positive outcome. When asked separately about the impact of the Chromebook program on the engagement of various groups of students, about one-third indicated student engagement had improved (34.7% for at-risk students, 40.4% for traditional students, and 33.3% for high-achieving students). However, nearly two-thirds of the staff
indicated that engagement was static or had declined. More teachers felt the one-to-one initiative had a positive impact on traditional students than on any other group (40.4%), whereas 29.7% of staff answered that it either remained the same or was negatively impacted. More than half (51.1%) felt as if the one-to-one program had no impact on high-achieving students’ motivation, and 15.5% felt the computers had a negative impact. In regard to at-risk students, 32.6% felt student engagement remained static, and the same percentage felt it had decreased. The observer cannot account for why staff answered the two questions differently.

One must be careful about reasoning the specific results of this study to the broader context of the literature. Nevertheless, the results can provide useful guidance as schools attempt to understand how to incorporate technology. It should also be noted that during this research the programs at BME and FAS were still in their first year. Light et al. (2002) found that after 2 years, students in one-to-one programs scored significantly better than their peers in all content areas on standardized assessments. Sauers and Mcleod (2012) echoed this finding, reporting that positive results in one-to-one programs were more obvious in Years 2 and 3 of the program. It is also important to note the role of teachers’ beliefs and how they shape teachers’ perceptions. Penuel’s (2006) meta-analysis shows teachers’ beliefs about technology can also impact the implementation of one-to-one programs. As with anything, the total immersion of students and teachers into a one-to-one classroom takes time to become an effective practice. In many ways to be done in an effective manner, the integration of one-to-one technology has to replace the traditional classroom paradigm with a different one. Sandholtz et al. (1997) pointed out that many educators still find themselves in the adaptation stage. Writing, taking notes, completing homework, keeping organized, communicating with peers and teachers, and researching are all common activities in the adaptation stage (Penuel, 2006). Time and high-quality professional
development are needed to help teachers move beyond this stage. Higgins et al. (2012) noted that sufficient training and support were needed for effective implementation of technology. The National Survey on Mobile Technology for K–12 Education (2013) found that the need for teacher professional development was articulated by nearly one-fifth of the teachers surveyed (19.2%).

Although instant and constant access to the Internet provides a host of opportunities, it also creates many challenges. Much of the data collect from teachers showed that they are still concerned with these challenges and dealing with them. Concerns over keeping students on task and controlling what they have access to are a large part of what teachers in one-to-one classes need to prepare for. Also, it is important to note that simply having devices in their hands does not improve student achievement or engagement. Warschauer (2007) concluded that one-to-one computing cannot make bad schools or classrooms better. It will not be possible to keep students on task when they are using their devices if procedures and lessons are not designed and put in place to keep students on task in general. Further, traditional lessons that simply use technology in the substitution phase do not automatically become more engaging. Technology can only have an impact on student engagement when it transforms what is happening in the classroom in the modification and redefinition stages. Using technology to modify and redefine classroom practices helps move teaching and learning to the higher levels of Bloom’s taxonomy. Studies suggest that over the long term, as computers are used more routinely, changes may take place not only in instruction but also in assessment systems, instructional materials, management systems, and communications (Meyer, 2007).

There are numerous calls for major shifts in the paradigms of education in the 21st century (Gilbert, 2007). Barnes et al. (2007) echoed the need for today’s learners to have self-
directed learning activities, interactive environments, multiple forms of feedback, and assignment choices to create personally meaningful learning experiences. However, it takes time to radically alter classroom practices in order to skillfully integrate new pedagogies, such as engaging inquiry-based teaching that makes use of students’ devices, into classrooms. Again, the research supports the idea that paradigm shifts take time. As all of the schools involved in this study had been transitioning to one-to-one computing for less than 1 year, it is reasonable to assume that the full impact of these programs had not yet been realized. In this regard, it is important to realize that two of the three schools had not yet completed the first year of the initiative and were still in the learning phase. The teachers and staff of SRHS had twice as long to share ideas and learn from their mistakes. With that experience came management lessons, such as purchasing software to monitor student device usage and location schoolwide, and opportunities for peer-to-peer professional development in which teachers share what strategies have worked best for them. These types of experiences can only be gained through time.

**Recommendations**

As discussed above, there is no substitute for time and experience when implementing a major change to instructional practice. This experience can be supplemented and enhanced by high-quality professional development. Ruben Puentedura developed the SAMR model for understanding the levels of technology integration in the classroom. The SAMR model breaks teacher use of technology into two categories: enhancement and transformation. Enhancement builds on traditional teaching and learning practices whereas transformation allows for significant task redesign and the creation of new tasks. The enhancement level is divided between substitution and augmentation. Substitution occurs when technology is directly substituted for a previous practice. Augmentation acts as a substitution for and improvement
over a nontechnological activity. The transformation level is divided into modification and redefinition. Modification allows for task redesign and redefinition allows for the creation of new tasks (Puente-Dura, 2014).

Puente-Dura (2014) created a crosswalk between the SAMR model and Bloom’s taxonomy. Encouraging critical thinking, problem-solving skills, and 21st-century skills, and moving teaching and learning practice to the higher levels of Bloom’s taxonomy are all stated purposes of one-to-one initiatives (Grimes & Warschauer, 2008). Puente-Dura (2014) correlated specific learning activities with the steps on the SAMR model, using e-books as examples of the substitution stage, which best correlates to the remember stage of Bloom’s Taxonomy. The use of bookmark aggregation services (e.g., Diigo and Delicious) is also an example of the substitution stage, which is better compared to the understanding level of Bloom’s taxonomy. An activity such as using visualization tools like GeoGebra as a means of better exploring and understanding concepts is linked to the augmentation level of the SAMR model and the application level of Bloom’s taxonomy.

Using digital tools to solve questions raised by digital research and to critique research (e.g., writing a blog post) would be examples of the modification stage associated with the analyze and evaluate stages of Bloom’s, respectively. Students who develop their critique into a digital video project would be operating at the redefinition and creation stages. The researcher recommends follow-up research that makes use of observation to determine if teachers who operate primarily in the modification and redefinition stages report higher levels of student engagement. The researcher questioned whether the level of technology use, or lack of use, in some classes may have hindered the student engagement. One-to-one computing is much like using stations in a classroom. If the stations themselves are not high quality, then the strategy of
stations becomes ineffective. If the activities the teachers use the one-to-one devices for are not high quality and engaging, then the students will not be engaged. As such, the researcher recommends an emphasis on professional development and student-centered lessons. As Chromebooks are a tool, they are limited by the skill of the user. As the skills of the teacher to create engaging lessons are developed, the Chromebooks will become more useful. This would be the researcher’s primary recommendation as it gets to the heart of both the one-to-one initiative and sound teaching as a whole.

A good portion of teachers’ professional development should be built around the sharing and discussion of best practices in a one-to-one environment. These sessions should focus on activities on the higher end of the SAMR model. This professional development should be supported and supplemented with continued training at various levels of technology proficiency in order to ensure all staff have a common level of knowledge. This is important to ensure that they have the ability to implement best practices and student-centered lessons at a minimum level of proficiency. Although this type of “how to” professional development is important, it all too often becomes the end in staff training as opposed to being a means to an end. The research is clear that high-quality professional development is a prerequisite to successful implementation of one-to-one programs (Higgins et al., 2012; National Survey on Mobile Technology for K-12 Education, 2013; Penuel, 2006).

Additionally, numerous studies emphasize the importance of supportive leadership and planning as vital to a successful one-to-one initiative. Specifically, effective leadership in regard to the devices’ role in teaching and learning has been associated with stronger implementation (Penuel, 2006; Zucker, 2005; Zucker & McGhee, 2005). It is important that in building
leadership, principals in particular must support teachers moving away from the traditional models of teaching and learning to more constructivist, inquiry-based models.

A specific area of need would be to look deeper into teachers’ perception that students were off task and disengaged more often than before the implementation of the Chromebook program. In many ways this concern may be linked to the need for professional development on planning designing and rigorous lessons that make use of the technology. As with other areas of teaching, planning lessons that account for various learning styles and require students to do most of the cognitive work will lesson disengaged behaviors. Also, an area of further research should be to investigate and understand what specific behaviors and concerns lead teachers to perceive their students to be more disengaged since the implementation of the Chromebook initiative.

It is important to note that teachers’ concern about off-task behaviors or “misbehaviors” is not solely confined to one-to-one environments. These concerns echo larger teacher concerns in regard to their classes in totality. The results of a 2004 study by J. Johnson (2004) showed that 97% of teachers felt that good discipline was essential to a successful school and teachers were concerned instruction sometimes became “minimal” compared to the amount of time they spent dealing with disciplinary issues. Therefore, it is important to separate teachers’ concerns regarding to off-task behavior as a whole from their concerns germane to the use of the Chromebooks.

As a whole, schools should look to deal with distractions and off-task behavior through policy and technology. By enforcing policies and educating students, parents, and staff about the school’s acceptable use policy and the consequences of violating it, the administration and
teachers can reduce off-task behaviors. Education regarding the appropriate use of devices is vitally important. If one-to-one initiatives are to prepare students for employment in the 21st century, digital citizenship and responsible use are key tenets of any program. Education regarding what constitutes off-task behavior is important. One must keep in mind that the concepts of off-task, disruptive, and disengaged behavior are highly contextualized norms. Many students may not have access to or fully understand these norms as staff do (Cole & Varrus, 2002). At the logistical end, the schools should continually look to incorporate management tools and filters and firewalls (e.g., Hapara, Google Classroom, Smoothwall) to help teachers keep students away from content that is not school related. Maintaining and updating web-filtering software, while not explicitly pedagogical, is a part of the complex whole that is the use of devices in a one-to-one environment.

Multimedia and technology both have been cited as ways to engage students (Barnes et al., 2007, Project Tomorrow, 2010; Taylor & Parsons, 2011; Windham, 2005). Specifically, the research continually highlights improved student engagement as a positive impact of one-to-one program engagement (Dunleavy et al., 2007; Greaves et al., 2012; Grimes & Waschauer, 2008; Penuel, 2006; Zucker & McGhee, 2005). Given the existing research, as well as the research presented here, the researcher believes that the districts studied should continue the one-to-one program and frequently reevaluate all sources of data on the program to continue to revise and improve it.

**Suggestions for Further Research**

This research, by design, was qualitative. It aimed to understand specific phenomena from the standpoint of teachers in a one-to-one environment. As such, it should be noted that the
data presented reflect teachers’ opinions but were in no way statistically analyzed for correlations or to control for any variables. However, any of the survey questions, or the survey as a whole, could be used to conduct a quantitative study.

The survey could also be made more open-ended by allowing teachers to select multiple answers to the questions. The teachers would not be limited to the answers that they felt they had observed most or that they felt occurred most. The researcher believes that using the same survey from this research but allowing teachers to select all of the answers they felt were applicable would create a more detailed picture of the staff’s perceptions. Specifically, the researcher theorized the percentage of teachers selecting increased student engagement would have been higher if the teachers had been given several choices regarding the positive impacts of one-to-one computing ratios. Had the teachers been allowed to choose multiple answers, this finding would have been closer to the findings of the larger body of research. However, in order to determine what the teachers felt was the greatest positive impact of the program, they were not allowed to choose multiple answers. Allowing for multiple results may also have yielded different results as the percentages in certain categories would have been altered. This may have allowed for a better understanding of the phenomenon being studied from the teachers’ point of view.

This study does not provide a complete picture of how teachers see the phenomenon of student engagement in a one-to-one environment. Recreating this study using teacher focus groups to create context and give deeper meaning to the survey results is also a recommendation. Focus groups can be used to collect a shared understanding of a phenomenon from a group. Focus groups involve collecting data through group interviews. A typical focus group is between four and six participants (Creswell, 2008), though focus groups can be as large as
twelve (B. Johnson & Christensen, 2012). One benefit to focus groups is that the interaction between group members often yields better information than interviews would (Creswell, 2008). Additionally focus groups are especially useful when complementing other methods of data collection as they provide in-depth information in a short amount of time (B. Johnson & Christensen, 2012). A focus group of teachers could be built around the following questions:

1. What is your role at ______________?
2. How comfortable are you with using technology, both at work and personally?
3. What is your overall opinion of the one-to-one program?
4. How can you tell if students are engaged in their work / your lesson?
5. Have you seen an impact on student engagement because of the one-to-one program?
   If so, please explain.
6. How has the one-to-one initiative affected your teaching?
7. What impact, if any, have you seen the one-to-one program have on students?

It has been shown that teachers’ philosophical beliefs about technology shape teachers’ use of new technology (Bebell & Kay, 2010; Bebell et al., 2004; McFarlane, Hoffman, & Green, 1997). In some studies, teachers expressed feeling uncomfortable with the technology being implemented (Donovan et al., 2007). Understanding teachers’ beliefs and attitudes about technology is important for understanding and interpreting response data. The researcher suggested surveying staff prior to the implementation of a one-to-one initiative in order to better understand the teachers’ philosophical orientation. The data could then be used to correlate staff proficiency in technology with perceptions of student engagement. This would help demonstrate how teachers’ level of comfort with technology impacts their perceptions of the benefits of one-to-one programs. This research could be recreated while accounting for not only teachers’ level
of comfort with technology but also their personal attitudes about technology and on-to-one computing.

The Technology Attitude Survey (TAS) was developed as a tool to assess teachers’ attitudes toward the use of educational technology. The reliability and validity of the TAS were investigated in a small pilot study, which showed high reliability (McFarlane et al., 1997). The TAS consists of a series of statements about educational technology. Staff are asked to rank the statements in regard to how true they are of the teacher (1 = not all true of me / 7 = very much true of me). The following questions included in the TAS, while not all encompassing, would help researchers establish an understanding of teachers’ perceptions, attitudes, and opinions toward technology:

- I like using technology.
- I feel confident with my ability to learn about technology.
- Working with technology makes me nervous.
- I like using technology in my work.
- I’m not the type to do well with technology.
- I feel uncomfortable using most technology.
- Learning about technology is a worthwhile and necessary subject for all prospective teachers.
- It is important to know how to use technology in order to get a teaching position.
- I think using technology will be difficult for me.
- Technology makes me feel uneasy and confused.
- Once I start using technology, I will find it hard to stop.

The information gleaned from these questions can provide insight into teachers’ attitudes in a qualitative study. In a quantitative study, the data produced from a prequestionnaire using questions such as these could be correlated to teachers’ answers in the perception study in order to further inform the results.
The region used in this study had a small administrative team. The three schools each had a principal. BME and FAS also had a shared director of special education. In addition to a principal, SRHS had an assistant principal, an athletic director, and a director of pupil personal services. The three schools also shared a superintendent and a director of curriculum and instruction. This made for a relatively small sample size for study. As survey data from administrators can be used with data from teachers, this research could also be conducted in a significantly larger district with a larger administrative staff. The views of district administrators would serve as an additional way to understand the role of technology in increasing engagement. In addition to recreating this study with an administrative team, researchers could replicate the study in a larger district to allow for a larger sample size in regard to teachers and administrators.

To expand the understanding of student engagement beyond what is perceived by teachers, this survey could be modified and shared with students to determine how they see the one-to-one initiative impacting their engagement. A student survey could also be administered in concert with a staff survey to look for correlations and areas of commonality. Research could also be done to triangulate the perceptions of teachers, students, and administrators. These data could reveal not only areas of commonality but also perceived differences in the impact of one-to-one programs between the three groups. The individual information from each group would also be enlightening in order to construct a picture of how one-to-one computing ratios impact student engagement.

The most telling stakeholders to include would be the students themselves. The Mitchell Institute, from where this survey was taken, has surveys for both parents and students. Given the complexity of student engagement, the phenomenon of student engagement as a whole cannot be
adequately addressed without input from the students themselves. Therefore, a student survey should include the following items:

- Grade level
- Gender
- What is the highest level of education completed by either of your parents?
- What grades do you usually receive in school?
- How much do you use a laptop at school during a typical week?
- In which subjects do you use your laptop for classwork or projects? (Check all that apply.)
- In which classes is using the computer most beneficial to your learning?
- How often do you use your computer to do the following:
  - Search for information?
  - Create presentations and projects on your own?
  - Work on assignments in small groups?
  - Organize information?
  - Take notes in class?
  - Communicate using e-mail or instant messaging?
  - Take a quiz, test, or assessment?
  - Complete homework?
  - Do drills to increase skills in math, English, etc.?
  - Work on websites, digital films/media, etc.?
- Would you say that the following practices occur in your classes less often, about as often, or more often now than they did before the laptop program began:
  - Students teach other students?
  - Students teach the teacher?
  - Students select their own research areas?
  - Students explore a topic on their own?
  - Students work in groups?
  - Students present their work in class?
  - Students engage in multiple activities during class?
  - Students write more than one page?
  - A textbook is the primary guide?
  - Student interests influence lessons?
  - Students answer textbook questions?
  - Direct instruction by teachers?
  - Quizzes and tests?
  - Teachers make connections across classes?

While understanding student engagement in its totality was not the objective of this research, recreating this research with students would deepen the body of knowledge surrounding technology and student engagement.
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Russell, M., Bebell, D., Cowan, J., & Corbelli, M. (2002). *An AlphaSmart for each student: Does teaching and learning change with full access to word processors?* Chestnut Hill, MA: inTASC.


Sauers, N., & Mcleod, S. (2012). *What does the research say about one-to-one computing initiatives?* Lexington, KY: UCEA Center for the Advanced Study of Technology Leadership in Education, University of Kentucky


Appendix A: Survey Instrument

Survey for Staff

1. Which subjects do you teach?
   □ Art / Music   □ Foreign Language   □ Language Arts / English   □ Math
   □ Science   □ Social Studies   □ Other ________________________________

2. How many years have you been teaching?
   □ 3 or less   □ 4-6   □ 7-9   □ 10-12   □ 13-19   □ 20+

3. How would you rate you overall skills with the Chromebook / Chrome platform prior to the start on the schools one-to-one initiative?
   □ Novice (still learning to use the device)
   □ Beginner (use some apps, access the Internet)
   □ Intermediate (create class materials, assign projects use some apps)
   □ Advanced (regularly use technology and can/ have helped other staff)
   □ Expert (use technology for assessment, collaboration, use multiple apps)
4. How would you rate your overall skills with the Chromebook / Chrome now?

☐ Novice (still learning to use the device)

☐ Beginner (use some apps, access the Internet)

☐ Intermediate (create class materials, assign projects use some apps)

☐ Advanced (regularly use technology and can/ have helped other staff)

☐ Expert (use technology for assessment, collaboration, use multiple apps)

5. How often do you use the Chromebooks / Chrome Platform in your class to do the following?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Never</th>
<th>Less than monthly</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduct research for lesson plans</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Develop instructional materials or presentations</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Produce homework assignments</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Assess students</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Manage student information</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Communicate with students or parents</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Communicate with colleagues</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
</tbody>
</table>
6. Would you say the following practices occur in your classroom less often, about as often, or more often now than they did before the Chromebook initiative began?

<table>
<thead>
<tr>
<th>Practice</th>
<th>Less often</th>
<th>About as often</th>
<th>More often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students teach other students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students teach the teacher</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students select their own research area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students work in groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students review / edit their own work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students engage in multiple learning activities during class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students do different assignments in one class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students write more than one page</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A textbook is the primary guide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student interest influence the lesson</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct instruction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quizzes and tests</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher evaluates student work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students evaluate other students work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students evaluate their own work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curriculum connects to other disciplines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students are off task</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students are engaged in their work</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7. Please indicate the effect you think Chromebooks have on different groups of students in the following areas:

<table>
<thead>
<tr>
<th></th>
<th>Traditional students</th>
<th>At-risk or low-achieving students</th>
<th>High-achieving students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Declined</td>
<td>No effect</td>
<td>Improved</td>
</tr>
<tr>
<td>Participation in class</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Preparation for class</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Attendance</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Behavior</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Motivation</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Engagement</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Ability to work independently</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Ability to work in groups</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Ability to retain content material</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Quality of work</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Interaction with teachers</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Interaction with other students</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>
8. In what areas do you think the Chromebook program has had a positive impact?

- [ ] Students computer literacy
- [ ] Quantity and quality of what students learn in school
- [ ] Personalized learning opportunities for each student
- [ ] Rigor of curriculum
- [ ] Reliable assessment of student progress
- [ ] Your access to educational resources
- [ ] Student engagement
- [ ] None

9. Do you think the Chromebook program has had any negative impacts?

If yes, please describe:

10. Are there positive impacts to the Chromebook program that you have not already indicated in this survey?

If yes, please describe:
Appendix B: Informed Consent Letter

IMPLIED CONSENT FOR ON-LINE SURVEYS

PROJECT TITLE: Teacher Perceptions of Student Engagement in a One-to-One Computing Environment

PRINCIPAL INVESTIGATOR: Michael Fiorillo, Principal Frank Antonides School

MENTOR: Ross Kasun Ed.D.

Forwarded by proxy

My name is Michael Fiorillo and I am a doctoral candidate at Saint Peter’s University in the College of Education, Department of Educational Leadership. I am e-mailing to ask your permission to participate in a research study I designed. As a doctoral candidate I have received permission from St. Peter’s University, to conduct this research study in fulfillment of the requirements of my degree. This research will investigate the phenomena of student engagement in one-to-one computing environments. While many studies point to the positive impact of one-to-one computing ratios on student engagement there is little research exploring the phenomena of student engagement in a one-to-one environment from the perspective of the teacher. This research looks to fill that gap in the research by seeking to better understand how teachers see one-to-one computing’s impacting student engagement and what teaching strategies, if any, lead to increases in student engagement in a one-to-one environment.

The survey instrument being used in this study can be completed online and will take 10 minutes to complete. Participants will be able to access the survey through the Google Form attached to this email. You will have access to the survey for two weeks.

You are being asked to take part in this study because you have been identified as a teacher in a school where there is a one-to-one student to computer ratio.

Please be assured that you will have complete anonymity and freedom of response. The data received will be collected by a proxy at Saint Peter’s University. The researcher will not know who responds or who does not respond to the study. The questionnaire does not request demographic information, and the answers cannot be used to infer your identity.

Participation in this study is entirely voluntary and all information will be treated with the strictest of confidence. There are no risks to you or the researcher if you choose not to participate. You can choose not to participate at all or to leave the study at any point. You may skip any questions you do not wish to answer.

The research data will be securely stored on a USB memory stick. The USB memory stick will be stored in a locked file box in a locked room. The researcher will be the only person with access to the data.

If you have any questions regarding the survey, this research project in general, or about your rights as a research participant, please contact the following individuals: Researcher: Michael Fiorillo: mfiorillo@wlbschools.com, or IRB chair: Dr. Peter Cvek- email address: pcvek@saintpeters.edu.
Consent to participate is indicated by completing the online survey. Please keep this copy of the informed consent form for your records.

Thank you in advance for your participation in this research study. If you need additional information or would like a copy of her research, please do not hesitate to contact me. I look forward to hearing from you.
Appendix C: Permission Letters
February 18, 2015

Dr. Peter P. Cvek
IRB Chair

The purpose of this communication is to acknowledge that Michael Fiorillo has been granted permission to conduct research for his dissertation in the Shore Regional and West Long Branch School Districts. Should you have any questions or concerns feel free to contact me via email at tfarrell@wlbschools.com or (732)222-5900 ext. 1304.

Sincerely,

Thomas G. Farrell
Shared Superintendent of Schools
Oceanport, Shore Regional, and West Long Branch School Districts
March 2, 2015

Re: Dissertation

To Whom It May Concern:

I hereby give consent for Michael Fiorillo to survey my staff for his dissertation work. He will keep all related student information confidential.

If you have any questions or require further information, please feel free to contact me at (732) 222-5900, Extension 1252.

Sincerely yours,

James J. Erhardt
BME Principal
March 2, 2015

Mr. Fiorillo,

You have my permission to solicit survey responses from SRHS staff for the purposes of your dissertation. If you need any further assistance, please let me know.

Sincerely,

Vincent G. DalliCardillo
to me, Adam

Hi Michael,
I am the former Research Director at Mitchell Institute, and now a research consultant to them. I developed the survey instruments for the one-to-one laptop study, which have been widely used/modified over the past decade. You are welcome to use them for your study, and to modify them as needed.
Best of luck with your research!
Take care,
Lisa

Lisa Plimpton
lisa@plimptonresearch.com
207-239-0344