THE EFFECT OF 1:1 TECHNOLOGY ON
STUDENT ACHIEVEMENT

by

Tanya Appling

An Abstract
of a research paper submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Library and Informational Services
in the Department of Educational Leadership and Human Development
University of Central Missouri

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ABSTRACT

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Tanya Appling

The advancement of technology has had a significant impact in the public school setting in America. With the surmounting pressures of high stakes testing and global academic comparisons, school districts across the country are trying to find methods to improve student scores while at the same time preparing students for the 21st century. Adopting 1:1 technology initiatives, school districts hope to raise the academic progress of America’s students. This is a literature review that supports the notion that 1:1 technology initiatives do raise the achievement scores of students. According to research, technology has an impact in three areas: public education, student motivation and learning, and teaching. Each of these areas contribute to the academic achievement of students; and if a 1:1 technology initiative was established in a school district, it is worth taking into account how that technology would affect the school, its students, and the teachers.
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CHAPTER 1:  
INTRODUCTION

Schools are tasked with the seemingly impossible mission of not only making sure students are proficient in reading, writing, and math but also proficient in 21st century skills. Qualities such as collaboration, critical thinking, and the ability to analyze information all embody 21st century skills (Sauers & McLeod, 2012); and school districts around the country are trying to find ways to equip learners with these abilities while at the same time maintaining high expectations for meeting state standards and objectives. In a study done by the Hanover Research Council the researchers noted that “in a time of increased accountability and the need to meet baseline standards as set forth by state policies and federal requirements such as No Child Left Behind, it has become increasingly important for school administrators to explore innovative strategies that may help boost student achievement” (2010, p. 2). One example of an innovative strategy is the implementation of 1:1 technology programs in school districts across the country.

Even though 1:1 technology in schools has increased within the past decade, there have been few large-scale research studies done on the impact of these programs on teaching and learning (Bebell & Kay, 2010; Abud, 2014). This raises a question in the highly stressful academic climate of high stakes testing. Do 1:1 device initiatives really impact student learning and achievement? When studying the effectiveness of this technology on student achievement, the review of literature examined three integral areas: the impact of 1:1 technology on public schools, student motivation and learning, and teaching.
1:1 Technology on Student Achievement

Statement of the Problem

In the stressful climate of high stakes testing in the educational system, many schools are looking for ways to improve the academic scores of students. Tasked not only with ensuring students are knowledgeable in the content areas of reading, math, and science, districts also have the added pressure of ensuring students are prepared for the 21st century. Society has become more entrenched in technology, and it is embedded into almost everything people do. Students need to be prepared for a world that is not only looking for skills related to reading, writing, and math, but also skills that require critical thinking, collaboration, and information analysis (Sauers and McLeod, 2012). Schools that are spending millions of dollars on 1:1 programs aimed at developing these skills have research as a way to inform, maintain, and guide their programs as they attempt to raise student achievement.

Purpose of the Study

The purpose of this review of literature is to examine the effects of 1:1 technology initiatives on the academic achievement of students. Despite the growing popularity of 1:1 computing initiatives in schools across the country, this academic intervention is still new in the education arena. According to Sauers and McLeod, “much more research is needed related to the benefits and/or drawbacks of handing every student a robust computing device all day, every day for academic purposes” (2012, p. 2). Because more schools are adopting 1:1 technology, the availability of testable subjects are becoming more prevalent, and the education field is able to conduct studies on the effects of these 1:1 programs on student achievement.

Furthermore, 1:1 technology adoption is costly. According to research by Sell, Cornelius-White, Chang, McLean, and Roworth (2012), making sure schools have the technology they need has become a billion dollar endeavor in this country. In 2009, the government spent more
than $650 million for just one grant alone (pg.1). With the expenses so high and school budgets so rigid, school districts use research in order to know they are making wise choices when it comes to spending money on resources that will give them the most benefit when it comes to academic achievement.

**Research Questions**

The following questions guided the research study:

1. How has public education evolved as a result of technology?
2. What strategies are teachers using to improve student motivation and learning that weren’t available before the integration of 1:1 technology?
3. How is the role of the teacher changing because of technology?

**Limitations**

The limitations of the study include the amount of time given to complete the study. Additionally, there have been few large-scale research studies performed on how 1:1 technology affects student achievement. Therefore, the research gathered for the literature review not only included some of those studies, but also included online journals and articles about other factors that affect student achievement and how those factors are affected by the integration of technology. The results of this study cannot be simplified to mean all schools that adopt a 1:1 technology initiative will improve student scores; but rather, it is an examination of the possible impact this technology can have on the factors that play a role in student achievement.

**Definition of Terms**

1:1 technology: this phrase is defined as “every student gets their own computing device” (Abud, 2014, para. 1) provided by the district.
Academic achievement: for this literature review this phrase is operationally defined as the standardize test scores under the subject of English Language Arts which includes reading comprehension, vocabulary acquirement, and writing skills.

Academic setting: a classroom within the confines of a school building.

Blended Learning: a combination of face-to-face interaction and Web based programs and materials in a classroom environment.

Device: any computing tool (tablet or laptop) used in the academic setting.

English Language Arts Standardized Test: the Missouri Assessment Program (MAP test) given to every public school student according to their grade level in the state of Missouri each year, which evaluates reading comprehension, vocabulary acquirement, and writing skills.

Faculty: any teacher or administrator in a school building.

Middle school: an academic program that is comprehensive in nature and includes students in grades 7-8.

STEM education: STEM is an acronym for science, technology, engineering, and mathematics. STEM schools integrate all these elements in units and lessons plans by creating a curriculum that is focused on problem solving and discovery.

STEAM education: STEAM is an acronym for science, technology, engineering, arts and mathematics. STEAM schools integrate all these elements in units and lesson plans by creating a curriculum that is focused on problem solving and discovery.

Traditional teaching: teaching that involves textbooks, lectures, and paper and pencil tasks.

Virtual School: a school whose entire curriculum is online.
Web 2.0 tools: digital tools found on the Internet which foster collaboration and creation among students and faculty members.

**Research Design**

In this research study, no formal research was conducted. Instead, information was gathered from a variety of online sources in order to support the research questions addressed at the beginning of the study. Existing literature was used to examine each of these research questions in depth in order to support the hypothesis that 1:1 technology improves student achievement.

Articles were retrieved from the following databases, journals, and websites: *International Education Studies; The Journal of Technology, Learning, and Assessment; Principal Leadership; Education Research Complete; Journal of Research in Science Teaching; Education Research Complete;* and *ERIC*. Search terms included: “1:1 technology effect on academic achievement,” “technology effect on achievement,” “technology effect on student motivation,” “technology effect on teaching,” “technology effect on modern education,” and “technology effect on public education.”

**Conclusion**

Included in this study are three chapters related to how 1:1 technology improves student achievement. Chapter 2 is the review of literature, which examines how three integral elements of student achievement; the public school system, student motivation and learning, and teaching, are positively affected by the integration of technology, and therefore supporting the hypothesis that 1:1 technology improves student achievement. Chapter 3 answers the research questions addressed in Chapter 1 and ends with conclusions about the information examined.
CHAPTER 2:
REVIEW OF LITERATURE

Introduction

In conducting research on whether or not technology has a positive impact on student achievement, three main categories were addressed: 1:1 technology’s impact on public education, its impact on student motivation and learning, and its impact on teaching. For each of these areas, evidence is presented that supports how implementing a 1:1 technology initiative will improve student achievement. One to one technology initiatives are defined as every student having a computing device that can be taken home after each school day (Sauers & McLeod, 2012). The impact of these initiatives is great and has profound impact on public education, student learning and motivation, and teaching. Each section examines the positive and negative aspects of technology as it relates to the specific category and seeks to understand different subjects that arise as a result of technology integration, indicating that ultimately 1:1 technology integration improves the achievement of students.

1:1 Technology’s Impact on Public Education

By analyzing 1:1 technology’s impact on education, student motivation and learning, and teaching, the objective was to establish how it positively affects student achievement through each of those facets. Education as a whole, and the evolving nature of how schools “do school,” influences student achievement as well as motivation and how students learn in the 21st century. This section examines how technology has transformed each of these aspects, and examines the effects, positive and negative, that 1:1 technology has had on all of them.

Technology impacts public education through the development of virtual and blended classrooms. This model of learning has changed the face of public education dramatically within the past 10 years. In this section the popularity of virtual classes and their positive and negative
aspects are described. Then blended learning is discussed, demonstrating how this type of educational model is likely to become a prominent method of teaching for educators in the future.

1:1 Technology’s Impact on Virtual Learning

One to one technology has had an influential impact on public education with the rise of virtual education. With more people having access to WiFi and Internet services, public education has seen a rise in virtual education for students who desire an alternative setting for their learning. Virtual education is defined using several criteria. First, it involves students and teachers being located separately for all or part of the learning experience. Second, virtual education that is offered is affiliated with an established school system. Third, a computer network and system to present material is used. Lastly, there is a two-way communication among teachers, students, and other staff members (Paulsen, 2002). Within the realm of virtual education, there are two facets that must be addressed: virtual schools and virtual courses. A virtual school is defined as “an educational organization that offers K-12 courses through Internet or Web-based methods” (Clark, p. 1). It is a school whose entire curriculum is online and students and teachers are learning together but not in the same classroom or even building. A virtual course is one class whose criteria meet that of a virtual education, but it is only one course as opposed to the entire curriculum being online. Districts that use 1:1 technology have the flexibility to utilize both facets of virtual education, and therefore districts are able to reap the benefits that virtual education has on student achievement.

Some believe that the personalized learning and the flexibility of when one receives instruction is a draw for virtual education, particularly for those in high school (Tucker, 2007). For students who have jobs or have families to take care of, virtual education breaks down the
barriers of time and space that traditional education imposes. For example, students who work jobs with varying hours each week do not have to worry about making it to a specific class at a specific time; they can log in and start learning as early or as late as they want. John Laider, writer for the *Boston Globe* (2014), interviewed students and teachers from the TEC Connections Academy Commonwealth Virtual School in Massachusetts about their reasons for taking online classes full time. Many asserted that the environment of the virtual classroom is flexible, with deadlines for assignments still expected but without the added pressure of the “clock ticking,” signaling the end of a class period.

Others believe virtual education helps those who struggled in the traditional classroom setting. Athletes, those with learning disabilities, students with medical problems, gifted and talented students, and a myriad of other types of pupils seem to thrive in the virtual environment. Jones (2012), writer and correspondent for *CNN*, followed a 7th grader name Katerina Christhilf, a girl whose passion and focus was to become a ballet dancer. Taking ballet lessons at least four times a week with each lesson lasting several hours a day and having eight-hour practices every Friday, Katerina would only have time for school on the weekends. However, with the convenience of online classes, she is now able to take a full course load that works with her schedule. Even though school does not look ‘normal’ in Katerina’s life, it works for the type of life she wants to have. There are thousands of students with lives similar to Katerina’s, and online education opens opportunities that in years past were not available.

Even though the popularity of virtual education is on the rise, there is still much debate as to whether or not it is equal to or better than a traditional classroom. A hurdle for proponents of virtual education is the lack of evidence to determine whether it is effective on student learning and performance (Miron & Urschel, 2012). One criticism is that online students typically do
worse on state tests than students who are in the traditional school setting. A study done on K-12 Inc., the nation’s largest operator of online education classes, found that students in the program have lower test scores than those in brick and mortar schools (Brown, 2011). In addition, a study of eight cyber charter schools done by the Center for Research on Education Outcomes found that students received much lower scores in reading and math than their traditional counter parts (O’Hanlon, 2012).

Furthermore, opponents of virtual education argue that it can be difficult for online teachers to quickly assess whether their students truly understand the objectives. In the traditional education environment, teachers are able to gauge whether students comprehend through a variety of factors such as facial, verbal, and physical cues. In a virtual education environment, these cues can be missed, especially if teachers and students only connect “face to face” a couple times a week. Similarly, critics of virtual education emphasize the need for younger students, elementary and middle school, to be socialized with peers. In a brick and mortar setting, students are able to regularly connect with peers and adults, making it possible for students to interact with people in socially acceptable ways. Virtual education provides ways for students to interact via a technological medium, but provide little chance for students to interact face to face (O’Hanlon, 2012).

One of the most criticized elements of virtual education is that many of the operators are for-profit companies using taxpayer dollars to fund their online curriculum. According to Education Week, these private companies are able to not only apply for charter school status and act as public school sectors, but they are finding ways to pocket a lot of money (O’Hanlon, 2012). With education budgets being so tight already, this is a major concern (Jones, 2012).
Despite the criticisms, research shows that virtual education is a viable learning option for students in the United States. As stated previously, many students who participate in virtual education enjoy the flexibility. They can choose to focus on a particular subject at any time they want and to not worry about time and space constraints of traditional classrooms. Students also do not worry about the pace at which assignments are completed. The virtual environment caters to individual learners and their schedules (Goodman, 2013). 1:1 technology initiatives ensure that students have access to these benefits virtual education offers.

**1:1 Technology’s Impact on Blended Learning**

For those who prefer more face-to-face interaction with the benefits of a 1:1 technology infused classroom, there is an option known as blended learning. Blended learning classrooms, or classrooms that have a mixture of technology and face-to-face interaction, are opening up the doors for students to have their learning more personalized and tailored to fit their individual needs. According to John Bailey, Scott Ellis, Carri Schneider, and Tom Vander Ark (2013),

> Blended learning is not just another district initiative. It is a fundamental redesign of instructional models with the goal of accelerating learning toward college and career readiness. It is a large-scale opportunity to develop schools that are more productive for students and teachers by personalizing education to ensure that the right resources and interventions reach the right students at the right time (p. 1).

Through the use of 1:1 technology, the goals of blended learning are achievable, and the many challenges of traditional education are overcome (Walsh, 2012). The challenge with the traditional education settings is the variety of students and their ability levels combined with the lack of time and lack of resources for teachers that ensure all students meet state objectives. The result is teachers catering to either the highest tier of learners, or more often than not, the lowest
1:1 Technology on Student Achievement

tier, leaving subgroups of students behind (Richards & Omdal, 2007). Blended learning programs aim to avoid this problem in public education by providing learning experiences that will help all students understand objectives through the support of the teacher and virtual mediums. Learning tools such as web-based programs, real-time and virtual collaboration, videos, and social media outlets are used in blended programs to ensure student success (Singh, 2003). Kelly Walsh (2012) explains that, “With 1:1 technology, content delivery can be differentiated, particularly through video. Videos can be paused and viewed multiple times by students for whom the traditional lecture moves too quickly. Far better still, however, the entire model of content delivery through lecture-based learning can be replaced by student research or even project-based learning” (para. 3).

As with every new technology endeavor, blended learning and its impact on education have some asking the question, “Does it work?” Thomas Arnett (2014) of the Clayton Christensen Institute for Disruptive Innovation uses the analogy of: do wings give the ability of flight to machines? Simply explained, he describes how wings have given many objects the ability to fly. However, just having wings does not ensure that a mechanism will be successful at flying or be able to fly at all (para. 3). There are other factors that must be present in order for flight to be possible. The same goes for blended learning environments. Just because students and teachers have access the necessary materials (wings) does not mean that they will be able to utilize those materials correctly. There must a core understanding for how devices, software, and hardware will be used in order to bring about desired results.

Arnett (2013) uses the aviation analogy further to explain how technology is not the “end all be all” of learning, but merely another tool in the teacher’s belt. Just like people have long been flying in hot air balloons before the invention of wings, teachers have been using successful
methods of learning to improve student achievement long before blended learning came onto the scene. The key, Arnett (2013) explains, is having the knowledge of when to use each tool so that it can make the greatest impact in education (para. 6). Technology is a tool that must be utilized regularly in the classroom if students are going to be successful in the 21st century (“Educators, Technology, and 21st Century Skills,” 2010), and 1:1 technology enables teachers and students to have easy access to this tool on a daily basis.

One to one technology has had major impacts in public education. Because of this technology, students are now able to attend school in the comfort of their living rooms or traveling on the road. People who have different lifestyles and schedules that may conflict with the traditional education environment have an education made more accessible. In addition 1:1 technology has also opened up the doors to having a more personalized learning experience for the individual student while at the same time allowing students to interact face-to-face with teachers and peers.

1:1 Technology Impacts Student Motivation and Learning

Motivation and learning are closely intertwined in education. Looking at several research studies, evidence indicates that incorporating technology into the classroom raises student motivation and consequent learning (Gulek & Demirtas, 2005; Hung, Hwang, & Huang, 2011; Mistler-Jackson & Songer, 1999;). Nevertheless, without the knowledge of how to incorporate technology effectively, teachers in the 21st century are finding it increasingly difficult to captivate and motivate students to learn. Examining the relationship between the traditional way of teaching and how students learn today, a disconnection is found between how teachers teach and the way students learning. This disconnection results in the lack of motivation and learning achievement teachers see in the classroom (Chen, 2010, para. 2).
More is required of teachers when technology is used in the classroom (Jones, 2001, p. 35). Simply placing a device in the hands of students does little to raise motivation and achievement. Technology can enhance the learning objectives and cater to the 21st century learner. When technology is infused, it develops the skills 21st century learners need to be successful. If a teacher desires to successfully implement 1:1 technology into a learning environment, taking a look at students’ interests is a starting point. For example, the inclusion of digital games and social networking websites motivate students in the classroom (Petkov & Rogers, 2011, p. 9).

Motivation has a major impact on the academic achievement of students. In a 2003 Gallup report, researchers found that motivation is “one of the most important non-cognitive factors correlated with academic success” (Wardlow, p. 1). Teachers across the country consistently struggle trying to figure out strategies and methods that will get their students interested in learning. Being a 21st century teacher, one must possess the knowledge and skills to captivate and motivate 21st century learners (Granito & Chernobilsky, 2012, p. 5). “Digital natives respond well to technology infused activities because of their familiarity with technology” (p. 3), and teachers who regularly use technology in their lessons see an increase in student motivation to develop knowledge of a particular subject, work on computer skills, and consequently, writing skills (SRI International, n.d.).

In a study done by Kinzer and Leu (1997), technology was used in the classroom and evaluated to see if there was any significant positive impact on 6th grade students’ information gathering and writing skills (para. 1 as cited in O’Hara & Pritchard, 2014). Their study researched these students for two years, and found that in classrooms where technology was used frequently, students showed significant improvement in skills such as finding the main idea of a
passage, recognizing supporting details, and identifying cause and effect relationships. Writing was also better with these 6th graders, as their papers were more organized and cohesive compared to the control group of students who were taught using the same methods without technology (O’Hara & Pritchard, 2014).

Supporting the notion of technology being a motivator for students was a study done by Beeland (2002). His study showed how interactive whiteboards increased the motivation levels of students in the classroom. Included in his research was the frequency of visual images, video, texts, and sound incorporated into different lessons and how students and teachers interacted with these elements on the whiteboard. The results showed an increase in student engagement during lessons, thus creating the conclusion that utilizing a variety of media has a positive impact on motivation depending on how often it was used and what elements the students and teachers interacted with (Gardner, 2011). This finding transfers to a 1:1 environment, because it also provides for the use of many forms of media.

Additionally, the traditional way of teaching is no longer working with today’s learners. Students taught to simply memorize facts, read textbooks, and listen to lectures struggle to stay motivated in the classroom. According to Chen (2010), it is not necessarily what students are taught that may be the culprit in the lack of motivation; it may be how they are taught the information. With the world at the fingertips of many students, teachers can utilizing the vast amount of resources the digital age has to offer. “Technology in its many forms is showing how teaching and learning can paint with a much broader palette of colors; from images and music to games, simulations, wikis, and many others, any time, any place, on laptops, desktops, and smartphones (2010, para. 3).
Research conducted by Madrazo supports the idea that utilizing 1:1 technology to access Web 2.0 tools like blogs, wikis, and websites enhances the motivation and learning of students. Using at-risk high school students as subjects in her study, she concluded, “that students are positively motivated to learn when technology is used as a vehicle to deliver instructional content at [the] school” (2011, p. 68). Citing specific teacher examples from her research, Madrazo continues the discussion by adding that teachers who successfully integrated Web 2.0 tools into their classroom further enhanced 21st century skills, and these skills showed in the digital products students created (p. 73).

Nevertheless, infusing 1:1 technology into the classroom does not necessarily mean students will automatically become more motivated to learn. In fact, simply placing a device in the hands of a student has as much motivational impact as a paper and pencil assignment. An analysis of effectiveness of instructional technology in the classroom done by Dunmire concluded that, “to be effective, innovative and robust technologies must be used to support the desired outcome of teachers” (2010, p. 3). He goes on to say that a change must occur in educational practices as well as “curriculum, time, space constraints, and other logistical and social factors” (p. 3). Therefore, even though 1:1 technology use can increase motivation in the classroom, the instructional practices of teachers have the greatest amount of impact on student motivation (Phillips, n.d.).

Over a decade ago, teachers and leaders in education began to look at and develop a framework for what skills were necessary in the 21st century. As the world became more technologically advanced and technologically connected, this framework of skills began to grow, creating a structure that was too big and too complicated for classroom teachers to navigate. To resolve the issue, the National Education Association (NEA) developed the Four C’s, skills that
every 21st century learner must have. These skills are collaboration, critical thinking, creativity, and communication (NEA, n.d). When teachers construct lessons with the four c’s in mind, using technology as a tool, learning and student motivation increase. Today’s learners are ready for collaboration, communication, creativity, and critical thinking. Without the 4Cs there is a disconnection between how students are taught in school and the way people in the outside world tackle problems, socialize, and complete tasks (Klopfer, Osterweil, Groff, & Haas, 2009).

Playing video games is an example of the 4C’s in practice. It is a pastime students know all too well. With over 45 million households possessing some sort of gaming system, millions of students across the country are interacting with this medium on a daily basis. Students are now spending more hours playing video games than they are watching TV; the average amount of time an 8th grade boy spends playing video games in a week is about 23 hours, while the average for a girl the same age is about 12 hours. With these statistics, it is recommended teachers look at using online games as a way to motivate students and raise their achievement (p. 4)

However, when one mentions the phrase ‘online gaming,’ a myriad of images and preconceived misconceptions come to mind. Games such as Farmville, World of Warcraft, and Minecraft seem like they have little educational value, but embedded into the heart of these online games are ways for people to interact and build community, display creativity, collaborate with teams, communicate with others, and use critical thinking skills to achieve desired goals. Klopfer, Osterweil, Groff, and Haas (2009) support the idea that digital gaming provides teachers with innovative tools to teach brand new concepts such as coding and computer programming that were not around 20 years ago. Some of these new concepts cannot be taught through traditional methods but must be taught through the lens of 1:1 technology and online gaming (p. 4).
Although there is little research on the effects of gaming on academic achievement, there is research that shows a positive effect on student performance. In a 2013 study, researchers found that students who played online games retained more material than students who did not. On average, students who participated in online games saw their learning achievement increase by 12% because of their interaction with gaming (Shapiro, 2014, para. 6).

Additionally, a survey done in the Games and Learning Research Report (2013) found that 55% of teachers use some sort of online game in the classroom once a week. The survey also found that teachers use a variety of online games. Thirty percent of teachers have students play games individually, while 34% have students play in small groups or pairs. Fewer teachers (17%) stated they play games as a whole class. As more opportunities and knowledge arise for online gaming, classrooms across the country might see an increase in this instructional delivery method.

Along with online gaming, teachers are also harnessing the power of social networking as a platform for learning and motivation in the classroom. People in general have become consumed with the endless amount of social connectivity technology offers (Hendrick, 2013, para. 3). Today, people are able to not only connect with others thousands of miles away, but they are able to do it anywhere and anytime. This amount of social connectedness has profound impacts on the education world. Students are able to learn with students in China, hold conversations with students in London, and create digital media with students from Italy. Social networking is the catalyst that sparks these types of educational relationships.

Teachers in high school and colleges are finding that social media networks such as Twitter and Facebook offer a collaborative aspect to their classrooms that was not present before the invention of such sites. Students are able to share their knowledge and ask questions that many of them probably could not do in a face-to-face group setting like a K12 classroom. Social
networking has taken on an entirely new facet as students and teachers are learning how to use it effectively communicate and share ideas (Vartan, 2012, para. 1-2).

Additionally, the creation of STEM and STEAM schools are in education’s forefront for students of the 21\textsuperscript{st} century (Chen, n.d.). Incorporating science, technology, engineering, art, and mathematics, these schools hope to immerse students in a curriculum rich in innovation, creativity, and discovery. Using problem or project based learning as instructional models, STEM and STEAM schools embrace the skills of collaboration, creativity, critical thinking, and communication.

In 2006, national and state policy makers started evaluating the overall focus on STEM and STEAM subject areas. Statistics and surveys from around the globe showed how the United States was lagging in science, technology, engineering, and math; and educators across the country started assessing how these areas could be improved in America’s schools through the creation of STEM and STEAM facilities. One of the key factors in making a STEM school was the effective integration of technology into the daily fabric of the school day (Hom, 2014, para. 9; Rowley, 2012, para. 12). One to one technology allowed every student to practice the skills needed for the 21\textsuperscript{st} century and STE[A]M concepts on a daily basis at their own pace.

With the integration of technology in education, the impact it has had on motivation and learning is powerful. If teachers are able to utilize 1:1 technology effectively in the classroom, motivation levels and academic achievement are positively impacted. Technology has also changed the way students learn. Through collaboration, creativity, critical thinking, and communication, students are interacting more with content than ever before. This shift in how students absorb information is enhanced through the integration of 1:1 technology.
1:1 Technology’s Impact on Teaching

Out of all the factors that influence student academic performance and achievement, research suggests that teachers matter the most (Steele, 2014, para. 2). However, in the digital age, many teachers are finding that educating 21st century learners is a challenge. In two surveys conducted by the Pew Internet Project (2012) and Common Sense Media (2012) teachers share the belief that technology is affecting students’ attention spans and hindering them from completing complex and difficult tasks (Richtel, 2012, para. 1). In examining 1:1 technology’s impact on teaching, research indicates that the roles of the teacher are changing dramatically (Lanier, 1997, para. 1). This section begins by exploring how, in many ways, students now have the capability to become teachers themselves. Next how 1:1 technology has changed the way teachers communicate with students is discussed. Also discussed briefly in this section is how 1:1 technology is used by teachers to receive and deliver professional development to keep up with the changes taking place in education.

With information being available at the fingertips of students, teachers are no longer the ones with all the answers. Because of the wealth and vastness of information available on the Web, students are becoming their own teachers; videos, blogs, wikis, and other digital tools are allowing students to become more independent and collaborative in their learning. What this means for teachers in the 21st century is they are no longer ‘the sage on the stage.’ Instead, technology has made it possible for teachers to become facilitators and collaborators in education.

Mike Britland (2013), a teacher and blogger for the The Guardian, claims the teacher’s role has changed from the upfront lecturer to collaborator and facilitator. He states:
Making use of technology to allow students the freedom to discover solutions to problems both independently and collaboratively is a force for good. As educators we strive for students to engage with our subject beyond a superficial level. We want them to be active learners, learners who have a thirst for discovery and knowledge. Technology places the world in the hands of every student inside the confines of your classroom (para. 4).

Making the shift from upfront teacher to facilitator is not an easy endeavor, particularly for veteran teachers who are used to the traditional methods of instruction. However, change is necessary if educators are going to teach today’s youth (Britland, 2013). Through 1:1 technology initiatives, students are no longer the bystanders in their education; they become collaborators with the teacher and their classmates. The teacher is no longer the only one in the classroom with the tools to teach. Having access to technology allows students to become more active in their education. Because every student has a device with which to create, communicate, and collaborate, the classroom becomes a place where information is shared through multiple mediums at all times during the school day and even at home (SRI International, n.d.).

Heick (2012) explains that 1:1 technology has changed how teachers communicate with students. Gone are the days when people would send thank-you notes as a form of appreciation. Now, students are using texts, tweets, and “likes” as a form of showing gratitude. Students have their own shortened textual language which many believe is a hindrance to learning proper grammar, speech, and spelling. In order to stay current with the times, teachers are “often tasked with keeping up with the latest technological lingo to communicate with their students” (para. 5).

With 1:1 technology students have more access to the teacher outside of the classroom walls. Communication is more open and fluid, with a back and forth exchanges between
educators and students being more common in today’s classrooms (Sabo, 2013, para. 2).

Additionally, instant feedback from the teacher allows students to correct errors and mistakes in thinking as it relates to objectives. Teachers are able to catch those errors and communicate with students quickly so that learning and discovery can continue (Sabo, 2013, para. 2).

Also because of 1:1 technology, teachers are now able to provide their own personalized professional development. Teachers have a vast amount of resources for professional development available for free. Videos, blogs, websites, and wikis are used by teachers to create their own personalized professional development. Because technology provides access to a wealth of resources, teachers are able to connect with other educators, making it possible for them to create personal learning networks (PLN). These networks include colleagues, administrators, leaders in the field, and other experts, and are geared toward sharing information and resources. PLNs can be established that include hundreds of educators across the country. These networks are creating better teachers each day. PLN’s are changing the way teachers collaborate with one another and are having a dramatic impact on the way teachers interact with students in the classroom (Graffin, 2011, para. 2).

1:1 technology has had a dramatic effect on the roles of teachers and education in general. Teachers are no longer the sage in the front, lecturing from a podium with students sitting idly by absorbing the information. Students are now able to take an active role in their education, collaborating and creating, because of possibilities provided by technology. By learning how to accommodate today’s learners, teachers prepare them for the future.

**Conclusion**

Technology has a major influence on public education, student motivation and learning, and the way teachers deliver instruction. Each of these aspects contribute to student achievement;
and with school districts across the country infusing technology into the curriculum, researchers are exploring whether 1:1 technology is effective. The research shows that, although there are some negative aspects of technology and education, using 1:1 technologies provides more options for students to get their education, increase their motivation and learning, and change the way teachers deliver instruction.
Implementing a 1:1 technology initiative will improve academic achievement of K12 students. This literature review answers three questions related to 1:1 technology and student achievement. The first question is how has public education evolved as a result of 1:1 technology? A second question is: what strategies are teachers using to improve student motivation and learning that weren’t available before the integration of 1:1 technology? The third and final question answered is how is the role of the teacher changing because of technology?

**The Evolution of Public Education**

Twenty-first century learners need an education system that is conducive to the unique learning styles of these students. 1:1 technology is an element schools can incorporate in order to reach 21st century learners (Huneycutt, 2013, para. 1). One to one technology has changed the way schools operate and deliver instruction (Lynch, 2014, para. 1). For example, K12 schools are offering online options for students to learn content. This has opened up possibilities for students with disabilities or other life circumstances that may hinder them from attending classes in a traditional school setting. In addition, online schooling offers more personalized learning through online courses and enables students to be engaged with content when it is convenient for them. Students are not necessarily on a bell schedule, but on a schedule that is more conducive to their learning style and schedule.

The concept of a “blended learning environment” has evolved as a result of 1:1 technology. Allowing for a balance of technology use and face-to-face time, blended learning gives students a chance to experience both virtual and traditional school settings. While virtual schools are geared toward students who are highly motivated, success rates with blended schooling options are seen more frequently.
1:1 Technology Motivates Students and Impact Student Learning

Because of technology, teachers are now able to motivate students in ways that were previously not possible. Motivation is a big factor in student achievement (Wardlow, 2014), and students are highly motivated to use 1:1 technology. The Internet has a wealth of information that is given in a variety of media to help students gain further knowledge of concepts taught in the classroom. Videos, songs, games, text, and social media all play a role in the development of the 21st century learner. These mediums offer unique learning experiences for students in today’s 1:1 classroom.

Another strategy being used in the classroom is online gaming. Online gaming is becoming a popular method of motivating students to learn and practice content. Students are able to stay engaged in content while having fun at the same time. Through online games, students are also able to problem solve and even work collaboratively with a group to achieve a common goal (Kiang, 2014, para. 2).

Another learning strategy teachers are utilizing in the classroom is the power of social networking. One to one technology has made society more connected, and people are able to share ideas and thoughts with one another without the boundaries of classroom walls. Social networking has become a powerful motivator for students to interact with learning objectives. Learning has become more of a social concept, and teachers are harnessing its influence to reach 21st century learners.

Because of this shift from lecturer to facilitator, teachers are no longer the only ones with all the knowledge. Students are also the ones who have the potential of becoming the ‘teacher’ in the classroom, sharing knowledge and experiences with peers and the adults. This participatory climate in the classroom opens up possibilities for students to be more active in their education
and learning. In the end, students who are participating are more engaged, and students who are more engaged, do noticeably better in academics (Wardlow, 2014).

**The Role of the Teacher Changes with 1:1 Technology**

When one thinks of the traditional classroom, it the teachers are the ones who primarily deliver content. However technology has transformed the way teachers run their classrooms and how teachers and students interact with one another in the classroom environment. Teachers are no longer the only ones delivering content; the extensive information available on the Web creates a school environment that is more collaborative and student focused.

With 1:1 technology becoming a permanent feature in many K12 schools, the traditional teacher is slowly evolving to one that is more facilitator than lecturer. Students are now able to access much of the information that was once solely given by the teacher. In the modern classroom, teachers understand how students can effectively use this information in a way that will prepare them for the 21st century. Teachers are guiding student learning as they navigate various resources found on the Internet.

One to one technology has also changed the way teachers and students communicate. Communication is ongoing and not limited to the classroom walls; it is as easy as a student having a question while working on an assignment at home and using some sort of safe two-way communication channel to get a quick answer from the teacher. A teacher can post a change to the next day’s itinerary and students receive that news of that change immediately on their 1:1 device. Because of technology, communication has become more open and fluid.

Technology has also opened the doors for a myriad of professional development opportunities for teachers. Connecting with one another from across the country and the globe, teachers are no longer limited to the building in which they work to find resources for their
classrooms; teachers now have the capabilities to collaborate with other professionals who are outside the traditional boundaries of communication. Skype, Twitter, blogs, videos, and other forms of media have allowed teachers expand their knowledge of the teaching professions in ways previously not possible.
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