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A Study of Teacher Perceptions of 21st Century Student Learning in a One-to-One Instructional Environment

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A Study of Teacher Perceptions of 21st Century Student Learning in a One-to-One
Instructional Environment

By
Laura M. Brooks

A Dissertation Submitted to the
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in Partial Fulfillment of the Requirements
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Approval Page

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Abstract

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The purpose of this mixed-methods study was to examine teacher perceptions of the extent to which they promoted student acquisition of 21st century skills in a one-to-one laptop program. Many proponents of one-to-one learning suggest that 21st century learning skills are best acquired in a student-centered, constructivist learning environment; therefore, constructivist learning theory was the conceptual framework for this study. The researcher also sought to discover any benefits or challenges that teachers encountered while implementing the laptop program. Eighty-six teachers at a southeastern state public high school responded to a survey, and 10 of those teachers were interviewed. The researcher also interviewed participating teachers' students to determine the extent to which their responses corroborated teacher perceptions. Findings suggested that most classes at the research site were not taught in accordance with constructivist learning theory. Though most teachers perceived that the laptop program enhanced student learning, students reported that laptops were often a mere substitute for paper and pencil. Teachers found that the greatest benefit of the one-to-one laptop program was that all students were given equal access to resources. Teachers and students agreed that students benefitted from always having instant access to information with the laptops. The researcher suggests that future technology training for teachers be more content-specific and encourage constructivist learning.

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Chapter 1: Statement of the Problem

Introduction

Richard Riley, Secretary of Education under President Clinton, noted that “We are currently preparing students for jobs that don’t yet exist . . . using technologies that haven’t yet been invented . . . in order to solve problems we don’t even know are problems yet (Trilling & Fadel, 2009, p. 3). It is no longer a question of whether technology is needed in schools to prepare students for higher education and the workplace. Instead, it is a question of how to effectively implement ubiquitous computing in schools. Many school districts are allocating funds to purchase laptop computers in an effort to promote 21st century skills. These school districts hope that in providing a laptop for every student for use at home and at school, student achievement and engagement will increase and students will gain the necessary skills for their future jobs. Teachers are tasked with implementing these one-to-one programs in the classroom. Are teachers effectively implementing the technology? Do teachers find the integration process to be challenging, or are they excited about transitioning from teacher-centered instruction to a more student-centered learning environment? Are teachers promoting the 21st century skills of critical thinking, problem-solving, communication, collaboration, and innovation through technology integration?

Two recent surveys point to teacher opinions about technology integration in schools. The Teachers’ Dream Classroom survey (Devaney, 2016) asked 413 teachers from all over the United States about the benefits and challenges of teaching with technology. Ninety-one percent agreed that “technology provides a greater ability to teachers to tailor lessons and homework assignments to the individual needs of each student” (Devaney, 2016, p. 1); however, these teachers also listed frustrations with

technology. Some of the challenges teachers perceived to integrating technology were (a) insufficient time to incorporate the technology, (b) inadequate technical support, (c) the distraction of students by the technology, and (d) inadequate teacher training.

Many responses of the Teachers' Dream Classroom survey were similar to the responses of the BrightBytes survey that was conducted in 2015 at the site of this study. Most teachers reported that technology allows them to do a lot more than before and that it motivates students to learn; however, they also reported that technology can be a distraction to students, and that it requires too much planning on the part of teachers. In contrast to the Teachers' Dream Classroom survey, 40% of respondents to the BrightBytes survey found that Internet filters hindered learning more than half the time, suggesting that the site of this study may have more restrictive Internet filters than those of other school districts.

This researcher found that few school districts publish survey findings regarding one-to-one laptop programs. Perhaps school districts are hesitant to make public to the taxpayers any challenges that accompany such costly initiatives. On the other hand, hardware and software companies that stand to profit from technology integration often report survey findings that note only the positive effects of one-to-one computing in schools. This study sought to obtain unbiased reports of the perceived benefits and challenges of a one-to-one laptop program in a public high school located in the southeastern United States.

Statement of the Problem

Studies of one-to-one laptop programs often focus on how ubiquitous technology affects student achievement and motivation to learn. Researchers have found some gains in student test scores since laptop programs have become more common in schools

(Bebell & Kay, 2010; Gulek & Demirtas, 2005; Holden & Maninger, 2009; Prensky, 2001, 2008; Ruch, 2016; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010; Smart, Kumar, & Kumar, 2004; Suhr, Hernandez, Grimes, & Warschauer, 2010). Many researchers have noted that gains in test scores tend to be subject specific; however, findings vary greatly among studies as to which subjects show the greatest score increases after laptop programs are implemented. Bain and Weston (2009) pointed out that “when computers receive limited use or inconsistent deployment across classes, it makes little sense to expect any kind of return on the investment in technology, especially in relation to student achievement” (p. 2).

It stands to reason that today’s students, who have always lived in a digital world, are more likely to be engaged in a one-to-one classroom than in a traditional, teacher-centered classroom. Students who are more engaged in the classroom tend to have higher test scores (Jablon & Wilkinson, 2006; Marks, 2000). Graesser (2013) pointed out that “Students live in a rich world of multimedia, animation, and film, so learning environments need to include these components to optimize engagement and motivation” (p. 96). Indeed, many researchers note higher student engagement in technologically-rich, student-centered classrooms (Bebell & Kay, 2010; Downes & Bishop, 2012; Gulek & Demirtas, 2005; Kopcha & Sullivan, 2008; Lowther, Ross, & Morrison, 2003; Pinsky, 2001, 2008; Ruch, 2016; Shapley et al., 2010; Suhr et al., 2010).

While one-to-one laptop initiatives can increase student achievement and engagement, these programs also seek to prepare students for college and careers by reinforcing 21st century skills. Young (2012) noted that “Although people working in the 21st century are dependent upon current technology, there is a disconnect between what is taught in school and what is needed to be successful now and in the future” (p. 2).

The U.S. Department of Education (2017) explained the necessity of 21st century skills in education:

To remain globally competitive and develop engaged citizens, our schools should weave 21st century competencies and expertise throughout the learning experience. These include the development of critical thinking, complex problem solving, collaboration, and adding multimedia communication into the teaching of traditional academic subjects. In addition, learners should have the opportunity to develop a sense of agency in their learning and the belief that they are capable of succeeding in school. (p. 10)

The International Society for Technology in Education (ISTE) created standards for educators to better prepare students for a more global, technology-infused future; however, it remains to be seen if teachers are including the ISTE standards in their lesson planning or even utilizing the laptop computers in ways that go beyond substitution of previous methods of instruction. Delaney (2011) pointed out that “bringing technology tools into the classroom doesn't necessarily mean that teachers are leveraging them to develop students' 21st century skills” (para. 3).

It is incumbent upon teachers to effectively implement one-to-one laptop programs in schools; therefore, if teachers are not comfortable with or do not “buy into” the laptop initiative, the program will likely fail. This researcher studied a school district that has noted the following concerns:

Teachers continue to fall across a wide spectrum of ability and acceptance of the technology in the classroom. The technology integration specialist in each building is an integral part of assisting teachers in moving forward with effective use, however, having teachers come to the realization that a shift in pedagogy is

necessary is still difficult to attain. (Spartanburg School District Seven, 2015, p. 14)

The district maintains that the laptop program was implemented to inspire “collaboration with other students” (Spartanburg School District Seven, 2015, p. 6) and that it “enhances problem-solving, critical thinking, and analytical skills, arming them with skills and concepts they will need to compete in a highly technological knowledge-based economy” (Spartanburg School District Seven, 2015, p. 7). This objective also points to the assertion by many researchers that collaboration – often via technology – has become an essential skill for college and career readiness (Conley & Darling-Hammond, 2013; Wagner, 2008). The problem is that though this school district has the necessary technology, we do not know if teachers are effectively implementing technology in ways that promote student acquisition of 21st century skills. While studying the perceived benefits of the one-to-one laptop program, it is also important to gain an understanding of the challenges that teachers encounter with implementing the program.

Purpose Statement

A teacher’s experience and perceptions affect any mode of instruction – particularly in a one-to-one classroom. Researchers find that teacher technology use correlates to their belief that the technology supports learning goals (Ertmer & Ottenbreit-Leftwich, 2010; Howard, Chan, Mozejko, & Caputi, 2015; Hutchison & Reinking, 2011; Lowther et al., 2003). Teachers are more comfortable teaching in the ways in which they were taught; therefore, “Technology is too often integrated into traditional teacher-centered instructional strategies producing mixed results in student outcomes” (Ruch, 2016, p. 17). Many researchers find that teachers primarily use computers in the classroom as administrative tools (for taking attendance, recording grades,

sending/receiving emails) and that few teachers utilize laptop computers to facilitate student learning in meaningful ways (Bain & Weston, 2009; Cuban, Kirkpatrick, & Peck, 2001; Ertmer & Ottenbreit-Leftwich, 2010; ISTE, 2017; Partnership for 21st Century Learning [P21], 2011). Because some teachers may not utilize laptop computers in the classroom in meaningful ways, it is important to ask teachers how they use the technology. A more accurate description of teacher technology integration may be obtained by also asking students how they find their teachers tend to utilize the laptops in a one-to-one classroom. Because teacher beliefs influence how they integrate technology and because teachers are integral to the one-to-one program, it is important to study how educators believe learning is enhanced by technology and the challenges they perceive.

Conceptual Base

Many proponents of technology integration assert that ubiquitous computing complements constructivist pedagogy. Duffy and Jonassen (1992) explained that “Constructivism proposes that learning environments should support multiple perspectives or interpretations of reality, knowledge construction, and context-rich, experienced-based activities” (p. 137). It is often argued that these kinds of learning experiences are more available in a classroom with one-to-one computing (Donovan, Hartley, & Strudler, 2007; Gulek & Demirtas, 2005). According to Vogel-Walcutt, Gebrim, Bowers, Carper, and Nicholson (2011), constructivist learning’s “overarching goal is to aid the learner in constructing his or her own model of information rather than simply providing that information” (p. 135). Kaya (2015) referred to Marlowe and Page (2005) when summarizing the foundations of pedagogical constructivism as

- a.) Constructing knowledge, not simply receiving it;
- b.) Thinking and analyzing, not just accumulating or memorizing;

- c.) Understanding and applying, not just repeating back;
- d.) Being active rather than passive (p. 4).

Juvova, Chudy, Neumeister, Plischke, and Kvintova (2015) added that constructivist learning theory emphasizes an increased motivation to learn, differentiated instruction, teamwork, learning from research, cooperation with the school and community, and a systematic approach to problem-solving. Many researchers like Becking (2011) found that instructors move toward constructivist pedagogy when “portable technology” is available to all (p. 13). Teachers may naturally adopt a more constructivist approach when implementing technology in the classroom; however, Fullan (1993) asserted that with any kind of educational reform, teachers require “time to work through the proposed changes, a critical perspective from which to examine their beliefs and practices, and the opportunity to collaborate and dialogue with other interested educators” (Serafini, 2002, p. 72). Although technology appears to lend itself to constructivist pedagogy, it is important to study the challenges teachers perceive when attempting to integrate technology and a constructivist approach to teaching.

Research Questions

In an effort to understand how technology is being implemented and how it is perceived in a one-to-one program at a high school in the southeastern United States, the following questions are addressed.

1. To what extent do teachers perceive they effectively integrate laptop computers to promote student acquisition of 21st century learning skills?
2. What benefits do teachers perceive in implementing technology into instruction in ways that promote 21st century learning skills?
3. What challenges do teachers perceive in implementing technology into

instruction in ways that promote 21st century learning skills?

4. To what extent do student perceptions of laptop computer integration differ from the reported perceptions of teachers?

Professional Significance of the Problem

The U.S. Department of Education (2017) noted that “to realize fully the benefits of technology in our education system and provide authentic learning experiences, educators need to use technology effectively in their practice” (p. 3). One-to-one laptop programs come at great cost and with significant expectations for enhanced instruction and learning. This study sought to examine to what extent teachers utilize the technology to enhance student acquisition of 21st century skills. Since teachers have been tasked with implementing the one-to-one laptop program, it is also important to examine teacher perceptions of the benefits and obstacles to integrating the technology. The results of this study may inform other school districts of the areas to address and the pitfalls to avoid when implementing a one-to-one program.

Overview of the Methodology

The researcher selected a mixed-methods approach to understanding teacher perceptions of their integration of laptop computers. The researcher sent an email to all certified teachers at Southeastern High School. This email requested that teachers follow a link to SurveyMonkey™. Most questions on the survey provided Likert-like responses. At the end of the survey, participants were invited to provide any opinions or advice regarding the one-to-one program. They were also asked to provide an email address if they were willing to be interviewed. The email addresses were not linked to any of the previous responses to the survey. The researcher utilized descriptive statistics to quantify respondent perspectives.

Next, the researcher utilized a prompt to interview teachers and students regarding their perceptions of the one-to-one laptop program. The researcher transcribed and coded the interview responses. These interview responses were compared to the survey responses in an effort to “confirm or disconfirm each other” (Creswell, 2014, p. 219). The participants in the study remained anonymous.

Definition of Key Terms

Critical thinking. Critical thinking occurs when students engage in purposeful reflection using “multiple thought processes at once” to make informed judgements and decisions (Stobaugh, 2013, p. 2).

Collaboration. Collaboration takes place when students cooperate with each other to find solutions to challenges.

Communication. Students communicate when they organize their ideas and findings in an effort to meaningfully share concepts with others orally or in writing.

Creativity. Creativity is displayed when students show originality and innovation in their thought processes and in the work that they produce.

Limitations

This study is limited to one high school in the southeastern United States. Teachers and students at the research site do not represent all high school teachers and students. The perceptions of the teachers and students interviewed also do not represent all teachers and students at the site of this study.

The research findings were limited by the willingness of teachers to respond to the survey and by the willingness of teachers and students to participate in interviews. This study was also limited by the survey questions and interview prompts, as they pertained only to perceptions of how laptops are integrated at one school. The questions

and prompts were additionally limited by a focus on 21st century learning and constructivist learning theory.

Although the findings of one high school cannot be generalized to all high schools, the results may inform other school districts that are considering implementing a one-to-one laptop program in a high school. The findings may also inform this school district about the successes and the areas requiring growth in its own program at the high school.

Organization of the Dissertation

The researcher used a mixed-methods approach to determine the extent to which teachers at a southeastern high school perceived they integrated technology to promote 21st century learning skills. The first chapter introduces the dissertation. The second chapter reviews literature pertaining to the evolution of educational technology (ET) and findings associated with the benefits and challenges of one-to-one laptop implementation. The third chapter describes the research methods, setting, participants, and instrumentation pertaining to this study. The fourth chapter conveys the results of the survey and interviews. The final chapter discusses the results and connects them to the literature that was reviewed in Chapter 3. The researcher also shares recommendations for further study in Chapter 5.

Chapter 2: Literature Review

Introduction

Many schools are considering implementing one-to-one technology; that is to say, each student is provided with a web-enabled device for use in the classroom. Districts that implement a one-to-one initiative often allow students to take the devices home for educational purposes outside of the classroom. Obviously, there are significant costs involved in supplying all students with up-to-date technology. Some argue that the costs are too high or that schools are expecting great results by merely supplying the technology and doing little to facilitate effective implementation. This literature review explores the history of ET, the demand for one-to-one implementation, and the results of such initiatives in schools. This literature review examines the definition of ET, the history of technology integration, and the reported benefits and challenges to implementing a one-to-one laptop program.

Defining ET

ET, often referred to as instructional technology (IT), has been defined many ways and has evolved over time to reflect changes in society. According to Januszewski and Dorbolo (2001), more effort has been made to define ET than any other field (as cited by Lakhana, 2014). This is due, in part, to the changes in instructional tools and to changes in educational philosophy over the past century.

Instructional Tools Throughout the Ages

Though many people today associate ET with computers, by Cuban's (1986) definition, any tool that supports learning could be considered ET. One of the earliest educational tools was the quill pen, which was used in 18th century schools. Teachers were often hired for their prowess at repairing students' quill pens (Ferster, 2014);

however, the quill pen could not be used for whole-class instruction. The nature of teaching changed with the introduction of the chalkboard in the early 19th century, as teachers could use this tool with the entire class at once (Ferster, 2014; Lee & Winzenried, 2009).

In 1922 Thomas Edison said, “I believe that the motion picture is destined to revolutionize our system and that in a few years it will supplant largely, if not entirely, the use of textbooks” (Cuban, 1986, p. 9). Indeed, there was significant production of silent films for education from 1910-1929; however, the Great Depression caused a steep decline in educational films, as production became cost prohibitive (Lee & Winzenried, 2009). Educational films were shown occasionally in classrooms after the WWII with 16-mm film projectors; however, a very limited number of projectors and films were purchased for schools. Most films were borrowed and did not necessarily arrive in time to coincide with a lesson (Lee & Winzenried, 2009).

The USSR’s launch of the Sputnik satellite in 1957 fueled a sense of urgency in Americans to create innovative educational environments in an effort to compete with the Soviet Union’s advances in technology. There were some significant public educational projects that utilized television as a source of instruction during this period; however, as with most new technology, televisions were cost prohibitive at first. Entire schools had to share one or two televisions (Lee & Winzenried, 2009).

Photographic slides and projectors were easy to use and relatively inexpensive in the early 1950s. Eastman Kodak’s Carousel projectors became available in 1961 and were the biggest competitor in the field. These slide projectors were produced until 2004. Photographic slides were primarily incorporated into science and art classrooms (Lee & Winzenried, 2009).

One piece of technology that did become quite prevalent in the classroom was the overhead projector. The overhead projector was inexpensive enough for a school to purchase one or two in the 1960s and was found in most classrooms by the 1980s. Although there was frustration and cost associated with blown bulbs, overhead projectors allowed teachers to save notes and pictures for future lessons; and they were simple to operate (Lee & Winzenried, 2009).

One of the earliest textbooks relating to ET, *Visual Instruction in the Public Schools* (Dorris, 1928), attempted to define the new wave of instruction by first stating, “modern education is scientific: its procedure is based on psychological principles” (p. 3). Dorris went on to say that visual instruction was “the enrichment of education through the ‘seeing experience’” by using various visual aids like pictures, models, maps, and “motion pictures” (p. 6). Like many after her, Dorris did not separate the process from the media that was used. It is evident from the literature that even the first definers of ET could not decide whether ET was a philosophy, a process, or the devices used to supplement teaching.

In 1963, The Commission on Definition and Terminology defined ET (then known as audiovisual communication) as, “that branch of educational theory and practice concerned primarily with the design and use of messages which control the learning process” (Reiser & Ely, 1997, p. 65). Reiser and Ely (1997) suggested that this definition was the first that emphasized learning over teaching and subject matter over media.

The Association for Educational Communications and Technology (AECT) has also redefined ET numerous times. In 1977, the AECT defined ET as, “a complex, integrated process, involving people, procedures, ideas, devices and organization ... involved in all aspects of human learning” (AECT, 1979, p. 1, as cited by Reiser & Ely,

1997, p. 68). This definition focused on ET as a process but admitted that it involves ideas and devices. The AECT placed a greater emphasis on ET as a philosophy with its 1994 definition, “the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning (as cited by Reiser & Ely, 1997, p. 68). In 2008, the AECT shifted back to the emphasis on process (or practice) by defining ET as, “the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources” (as cited by Lakhana, 2014, p. 9). Though each of these AECT definitions is different, none of them focus as much on devices as Cuban’s (1986) definition of IT: “any device available to teachers for use in instructing students in a more efficient and stimulating manner than the sole use of the teacher’s voice” (p. 4). Earl (2002) suggested that Cuban’s (1986) definition was closer to “the prevailing public perspective,” as most people consider ET to be “a synonym for computer technology” (p. 3).

Individualized Instruction

From 1920 to 1980 most ET was presented audio-visually to an entire class. Student focus with audio-visual technology was on an external source of information rather than the teacher; however, audio-visual technology was seldom interactive or personalized, as all students received the same information simultaneously (Graesse, 2013). There were, however, some forms of ET during this time that were more individualized. Warschauer (2006) referred to B.F. Skinner’s teaching machine as “the first wave of instructional technology” (p. 18). B.F. Skinner was a Harvard psychologist who invented the teaching machine to apply behavioral psychology to learning. Skinner believed that students needed immediate feedback and positive reinforcement when

completing academic work. Students worked with small chunks of information at a time – usually filling in a missing word or symbol. If the student wrote the correct word or symbol, his or her “behavior” was reinforced, as the machine advanced to the next frame (Casas, 2002). Skinner (1958) noted that with the teaching machine, students were able to move at their own pace. Don Bitzer’s Programmed Logic for Automatic Teaching Operations (PLATO) was another teaching machine that was used from 1960 to the mid-1980s. The first version of PLATO consisted of a television, a keyboard, and a connection to the University of Illinois mainframe (Warschauer, 2006). The teaching machines of Skinner and Bitzer have also been referred to as “computer based training” (CBT). According to Graesser (2013), Bitzer accurately predicted in 1973 that CBT would be prevalent in homes, workplaces, and schools. Graesser went on to explain that the relatively low cost of CBT made its growth possible, and the immediacy of feedback offered by CBT made it successful. Graesser noted that CBT “has been empirically tested for decades and has shown learning gains that equal or exceed classroom teaching in meta-analyses” (p. 95).

Though CBT was found to be effective, it did have certain limitations. First, CBT was not conducive to deep learning. With CBT, students were only able to learn simple facts or rules. Any of the more complex concepts required direct instruction by a teacher. Second, CBT was not particularly engaging. Students who were not intrinsically motivated did not care to go through the steps of first studying small chunks of information presented by the teaching machine or computer, then answering multiple-choice questions, and finally restudying the information until obtaining mastery. The third limitation of CBT was that teachers needed to be trained to effectively integrate CBT with the curriculum; however, teachers did not receive sufficient professional

development in this area (Graesser, 2013). Teacher training continues to be an issue in today's efforts to integrate technology into the classroom.

The Demand for Computers in Schools

Personal computers, or microcomputers, were introduced in the 1980s as instructional tools. In 1983, the computer to student ratio was about 1:100. This ratio increased to 1:30 in just 5 years (Coppola, 2004). By 2005, the computer-to-student ratio was less than one computer for every four students (Warschauer, 2006).

In 1997, Microsoft Corporation launched the Anywhere Learning program in an effort to increase laptop usage in public schools; however, according to Warschauer (2006), "most public schools had difficulty sustaining full-scale one-to-one laptop programs" (p. 23). Cuban (2001) argued that computer hardware and software companies continually made software more complex, requiring more memory and hardware. Cuban's (2001) term for this form of inflating consumer costs for technology was "rampant featurism" (p. 57). Rampant featurism may be one reason school districts have been reluctant to implement a one-to-one initiative, as they fear being unable to maintain such a large and ever-increasing investment. While some insisted that school computers were not being used effectively, business leaders, economists, educational leaders, computer companies, and even politicians called for more computers in the classroom. In 1999, President Bill Clinton proclaimed, "In our schools, every classroom in America must be connected to the information highway, with computers and good software, and well-trained teachers" (Cuban, 2004, p. 75). The 2001 No Child Left Behind Act called for a national plan that would support effective technology integration in schools to prepare students for the 21st century (Coppola, 2004).

The One-to-One Initiative

Edwards (2014) defined digital conversion as, “The transformation of instruction from a paper-based world to a primarily digital world, in which every student and teacher has access to a personal computing device and the Internet anytime/anywhere” (p. 2). Coppola (2004) said, “Computers should not be located only in labs, but also in regular classrooms, accessible and organized, like tools you pick up when you need them” (p. 5). Penuel (2006) reported that ubiquitous computing allows students to more effectively communicate with each other and their teachers, to access more resources for learning, and to gain the necessary technological skills for 21st century jobs. Providing a computer for each student’s use at school and at home is said to close what is known as the “digital divide.”

The Digital Divide

Proponents of one-to-one initiatives have pointed to the digital divide as a rationale for ubiquitous computing in schools. The term digital divide usually refers to the differing levels of access to technology between students in more affluent districts and those of predominantly lower socioeconomic status (Dickard & Schneider, 2002; Hudson, 2011; U.S. Department of Education, 2017). Studies show that students of a higher socioeconomic status use the Internet at home more than disadvantaged students. The disadvantaged students must rely on access to technology at school (Cook & Halverson, 2009). Penuel (2006) said, “Many argue that providing students with better access to computers can provide students with more equitable access to resources and learning opportunities” (p. 332), thereby bridging the gap. Edwards (2014) called one-to-one computing in schools “today’s great equalizer because it includes every student,

enables individualized learning, and makes extended learning outside school hours possible for all” (p. 16). According to the Digital Promise’s (2014) Annual Report, the American education is not lacking in excellence; it is lacking in equity. This lack of equity is not only in schools but also in student homes. Warschauer and Ames (2010) suggested that autonomous learning via technology is preferable for students who have more educationally supportive and knowledgeable “mentors” at home. Warschauer (2006) reported that teachers at predominantly low-income schools are reluctant to assign computer-based homework, as students may not have sufficient access to computers and Internet at home. A lack of Internet access in homes is still a source of inequity for one-to-one schools; however, educational leaders now argue that a new divide has emerged as more districts have adopted one-to-one laptop initiatives in which students can also use the devices at home.

This new divide is referred to as the “digital use divide” (U.S. Department of Education, 2017). The digital use divide is a gap between the use of technology in transformative ways and mere substitution of former activities with an electronic device (U.S. Department of Education, 2017). The digital use divide can be seen in schools of any socioeconomic status, because simply providing access to computers and connectivity does not necessitate transformative use of the technology (Hudson, 2011; U.S. Department of Education, 2017; Penuel, 2006).

The Use of Technology in Schools

Cuban (2001) argued that although there were more computers available in schools, those computers were underutilized. Cuban (2001) found that “less than 5 percent of high school students had intense ‘tech-heavy’ experiences” and “less than 5 percent of teachers integrated computer-technology into their regular curricular and

instructional routines” (p. 133). Coppola (2004) said that in the earlier years of integration, “many thought the presence of computers would change the way teachers taught, students learned, and the way schools were organized” (p. 18); however, the 1995 Office of Technology Assessment (OTA) report found that many teachers were not using computers at all, and those who did employ computers in the classroom did so rarely (Coppola, 2004). Ten years after the OTA report, Bauer and Kenton (2005) conducted a study of 30 teachers who were considered the most “tech savvy” from four technologically innovative schools. Of these 30 teachers, 24 reported using technology less than 50% of the time for instructional purposes. The authors of the study asserted that the less tech savvy teachers were likely to have utilized computers much less than 50% of the time.

The desire to use technology in schools often outweighs the schools’ ability to effectively integrate the devices with the curriculum (Coppola, 2004). Penuel (2006) noted that innovative technology often goes unutilized by teachers because “schools lack the capacity to implement them well, policies are not congruent with technology use, or the culture of the school is not supportive of technology adoption” (p. 333). Morpew (2012) suggested that there is sufficient access to technology in schools, but technology should be integrated more effectively. Young (2012) concluded that “most teachers use technology as a teaching tool or as an organizational tool rather than as a way for students to create, problem solve, and think critically” (p. 5). Stager (2015) concluded that technology is used in schools today in much the same way it was used 25 years ago. Many attribute the underuse of technology to teacher lack of specific knowledge and skills pertaining to ET (Bell-O’Leary, 2015; Hew & Brush, 2007; Hixon & Buckenmeyer, 2009; Hughes, 2005; Kotrlík & Redmann, 2005; Penuel, 2006; Stolle,

2008).

Teachers guide student use of technology in the classroom (Bebell & Kay, 2010; Ruch, 2016). If the teacher does not feel comfortable with or is not knowledgeable about technology integration, he or she is less likely to guide students to use technology in transformative ways (Cook & Halverson, 2009; Kopcha, 2012; Levin & Schrum, 2012); however, many teachers report frequent use of technology to perform administrative or noninstructional tasks such as taking attendance, recording grades, and sending emails (Bell-O’Leary, 2015; Kopcha, 2012; Ruch, 2016).

Teacher Training

Coppola (2004) asserted, “Developing high-quality uses of computers in schools depends on keeping high-quality teaching at the core of the school” (p. 1) and that “often teachers are presented with the resources available and asked to integrate the technology” (p. 6). Coppola also reported, “Technology enables teachers with well-developed working theories of student learning to extend the reach and power of those theories; in the absence of these powerful theories, technology enables mediocrity” (p. xii). The 1995 OTA report suggested an increase in funding for professional development in technology from 15% to 30% (Coppola, 2004); however, Penuel (2006) found that professional development in technology often focuses on how to operate the technology rather than how to integrate it with their teaching. Koehler and Mishra (2009) pointed out that it is no longer sufficient for a teacher to have a good understanding of the subject he or she is teaching. Teachers must also understand how to apply technology to the subject matter. “Technology needs to be married to the curriculum from the beginning, emphasizing its relationship to teachers’ views about teaching and learning,” according to Hixon and Buckenmeyer (2009, p. 143). According to the 2016 National Educational

Technology Plan, “Professional learning and development programs should transition to support and develop educators’ identities as fluent users of technology; creative and collaborative problem solvers; and adaptive, socially aware experts throughout their careers” (U.S. Department of Education, 2017, p. 37). Hutchison and Reinking (2011) asserted that professional development for teachers requires specific instruction on how to integrate technology with the teaching goals and standards. Wambach (2006) cited author Gary Stager as saying, “Teacher professionalism is enhanced when teachers are equipped with the tools of 21st-century professionals” (p. 58); however, the manner in which teachers are taught to integrate technology is also important.

Ruch (2016) said that the “traditional workshop model” of professional development is not adequate for teaching how to effectively integrate technology in the classroom. Hixon and Buckenmeyer (2009) cited Levin and Wadmany (2008) who said that “long-term professional development programs, not just learning events, are vital for technology integration to succeed” (p. 259). Ertmer (2005) concluded that teachers need to have first-hand experience and observe others successfully integrating technology. Ertmer also maintained that teachers benefit greatly from professional learning communities for technology integration. Hixon and Buckenmeyer suggested that teachers also need “long-term support that is consistent with where teachers are in the integration process” (p. 143). Ertmer pointed out that a beneficial form of professional development for teachers could be “the opportunity to observe real examples, to engage in on-going and work-related professional development initiatives, and/or to participate in professional learning communities” (p. 311). Most authors agree that teachers require ongoing support in their efforts to integrate technology.

21st Century Skills

According to Trilling and Fadel (2009), the “Knowledge Age” began in 1991 when \$5 billion more was spent on information technology than on Industrial Age production. As the name suggests, knowledge is a commodity in the Knowledge Age (Trilling & Fadel, 2009; Voogt & Roblin, 2012). The rapid rate of technology innovation has caused job descriptions to constantly change (Wagner, 2008). Many of the jobs that will be held in the near future have not even been invented yet (Trilling & Fadel, 2009). Because schools prepare students for their future professions, it stands to reason that schools must be able to prepare students for jobs that do not yet exist. During the Industrial Age, students needed to memorize facts and rules in preparation for very specialized vocations (Trilling & Fadel, 2009); however, in the Knowledge Age, facts and rules can be acquired in seconds via the Internet. Instead, 21st century students require 21st century skills.

Many agree that the educational environment should relate to the “real world” and that incorporating technology into the 21st century classroom is essential to prepare students for the requirements of the modern workplace (Edwards, 2014; P21, 2011; Penuel, 2006; Trilling & Fadel, 2009; Voogt & Roblin, 2012; Wagner, 2008; Young, 2012). Edwards (2014) maintained that digital conversion provides all students “with anytime/anywhere access to resources and the opportunity to develop the skills they need for today’s workplace” (p. 5). Edwards went on to say that the “workplace demands not only digital skills but also the ability to work collaboratively and creatively and engage in independent research” (p. 5). Penuel (2006) said that ET can facilitate collaborative learning, problem-solving, and higher-order thinking – the 21st century skills needed in the workplace in today’s global society (Edwards, 2014; P21, 2011; Trilling & Fadel,

2009; Voogt & Roblin, 2012; Wagner, 2008; Young, 2012).

Many authors contend that our current curriculum is antiquated. Collins and Halverson (2009) asserted that there were “deep incompatibilities between the demands of the new technologies and the traditional school” (p. 6). Trilling and Fadel (2009) noted that the core curriculum of math, science, language, and the arts was created in the Middle Ages. Voogt and Roblin (2012) argued that the core curriculum must be redefined for the 21st century.

It is often argued that the only way to effectively prepare students for the future is to implement 21st century skills in the classroom and that doing so requires the effective integration of technology (Smith & Evans, 2010; Voogt & Roblin, 2012; Wagner, 2008; Young, 2012); however, Voogt and Roblin (2012) suggested that “there may be a gap between the needs of the knowledge society expressed by the advocates of 21st century competences” and the curriculum that is actually implemented (p. 301). According to a framework created by P21 (2009), the traditional core subjects should be taught along with 21st century themes like global awareness, financial literacy, civic literacy, health literacy, and environmental literacy (Trilling & Fadel, 2009). The P21 (2009) framework also advocates “a focus on creativity, critical thinking, communication and collaboration” (p. 3). Though many of these skills have been deemed important in the past, many experts agree that technology supports these skills in a student-centered learning environment more than the traditional form of instruction in which the teacher is the “sage on the stage” (Trilling & Fadel, 2009).

Prensky (2001) pointed out that today’s students are “Digital Natives” who have never lived in a time without digital media. Trilling and Fadel (2009) said that Digital Natives are the first generation of students to know more about “the most powerful tools

for change in our society” than their parents and teachers (p. 29). Growing up in a digital environment causes these students to have different expectations from their elders.

Digital Natives often expect student-centered, personalized learning. They also tend to believe that learning should integrate entertainment, play, collaboration, innovation, and speedy communication and reception of information (Prensky, 2001; Trilling & Fadel, 2009). The “one-size-fits-all factory model” of instruction from the Industrial Age is, according to Trilling and Fadel (2009), not ideal for digital natives (p. 30).

Teacher Resistance to Technology Integration

While today’s students have grown up in a digital environment, their parents and teachers did not. Those who must learn to utilize digital technology later in life are known as “Digital Immigrants” (Prensky, 2001). These Digital Immigrant teachers are most comfortable teaching in the manner in which they were taught – lecture and emphasis on memorization of facts, rules, and figures (Prensky, 2001, 2008; Trilling & Fadel, 2009); however, Digital Natives require a different kind of instruction, one unfamiliar to their teachers (Hew & Brush, 2007; Prensky, 2001; Trilling & Fadel, 2009). Hixon and Buckenmeyer (2009) and Li (2007) contended that teachers are particularly resistant to changing their teaching practices when doing so is mandated by administration. Ertmer (2005) suggested that teachers be encouraged to explore their own pedagogical beliefs to determine any biases or insecurities they may have about integrating technology. Teacher beliefs about technology determine whether they will integrate technology into their lessons; therefore, it is essential to give teachers opportunities to see effective, technology-rich instruction in an effort to change their beliefs rather than simply demand that they change their teaching practices (Ertmer, 2005; Hutchison & Reinking, 2011).

Technology is also underused in the classroom because teachers lack necessary knowledge and skills (Bell-O'Leary, 2015; Hew & Brush, 2007; Hixon & Buckenmeyer, 2009; Hughes, 2005; Kotrlik & Redmann, 2005; Penuel, 2006; Stolle, 2008). There is often a role reversal in the classroom, as students mentor teachers in utilizing technology. This role reversal and lack of control can cause teachers to feel uneasy and reluctant to use technology (Hixon & Buckenmeyer, 2009; Prensky, 2001; Trilling & Fadel, 2009).

Teachers report insufficient training as another reason for not implementing technology effectively (Hixon & Buckenmeyer, 2009; Hutchison & Reinking, 2011; Stolle, 2008; Young, 2012). Young (2012) stated that professional development must first address teacher beliefs by providing information about the benefits of technology integration. Studies indicate that professional development should also be geared toward integrating technology with specific subject areas, as many teachers do not know how to transfer their acquired technology skills to the goals and standards of their own curriculum (Almekhlafi & Almeqdad, 2010; Hixon & Buckenmeyer, 2009; Hughes, 2005; Lin & Lu, 2010; Ogwu & Ogwu, 2010; Young, 2012).

Time is another factor in effective technology integration. Kopcha (2012) and Hixon and Buckenmeyer (2009) reported that teachers need extra time to learn how to use new technology and to figure out how to integrate them with the curriculum. Hew and Brush (2007) pointed to a survey of over 4,000 teachers who found classes (usually 50-minute intervals) to be too brief for a teacher to effectively address all material while also integrating technology.

In summary, the literature points to a lack of understanding of how effectively teachers integrate technology to support and enhance 21st century learning skills. If teachers do not believe that laptops enhance teaching, they are not as likely to integrate

the technology in meaningful ways that best prepare students for future professions. In addition, teachers report that they need adequate training and time to prepare lessons that integrate technology and the “Four Cs” of critical thinking, communication, collaboration, and creativity (NEA, 2012).

Chapter 3: Research Methods

Introduction

School districts with the financial means to provide a laptop for every high school teacher and student have done so in an effort to enhance and promote 21st century skills while narrowing the gap between students who have access to technology at home and those who do not. The success of one-to-one laptop initiatives depends on teachers to integrate the technology effectively. Because teachers are essential to effective one-to-one programs, this researcher sought to gain an understanding of the benefits and challenges that teachers perceive when integrating laptops in their instruction.

The following research questions guided this study.

1. To what extent do teachers perceive they effectively integrate laptop computers to promote student acquisition of 21st century learning skills?
2. What benefits do teachers perceive in implementing technology into instruction in ways that promote 21st century learning skills?
3. What challenges do teachers perceive in implementing technology into instruction in ways that promote 21st century learning skills?
4. To what extent do student perceptions of laptop computer integration differ from the reported perceptions of teachers?

This chapter describes the data collection and analysis as well as the participants of the study.

Research Design

To gain an understanding of teacher perceptions of how they integrate 21st century skills and technology into their teaching, the researcher selected a mixed-methods approach to examine the research questions. According to Creswell (2014), there are

several other terms for mixed methods, including “integrating, synthesis, quantitative and qualitative methods, multimethod, and mixed methodology” (p. 217). A mixed-methods study can “provide a stronger understanding of the problem or question” than either quantitative or qualitative methods alone (Creswell, 2014, p. 215). The researcher chose a mixed-methods approach to gain an understanding of the perspectives of the teachers who are tasked with implementing the one-to-one program. The researcher utilized a convergent parallel mixed methods design (Creswell, 2014). “In this approach, a researcher collects both quantitative and qualitative data, analyzes them separately, and then compares the results to see if the findings confirm or disconfirm each other” (Creswell, 2014, p. 219).

Instrumentation and Analyses

For the quantitative phase of the study, the researcher administered a survey (see Appendix A) to teachers at one high school in the southeastern United States (N=109) via email. This email requested that teachers follow a link to take the survey developed by Constant (2011). Survey content validity (to demonstrate that the instrument actually measured what it purported to measure) was ensured through an iterative peer-review process involving professionals associated with the researcher. In reporting on the validity of the instrument, Constant stated, “the final analysis of pilot data included the examination of Cronbach’s (1951) alpha internal consistency reliability estimates” (p. 51) and that all items “had alpha reliabilities above .80 ($\alpha=.805$)” (p. 52). The researcher administered the survey via SurveyMonkey™, an online survey tool. Two reminder emails were sent after the initial request for teachers to take the survey. The researcher used questions from the Constant survey pertaining to teacher use and perceptions of the one-to-one program at the site. Responses to opinion questions were on a Likert-like

scale. After selecting responses to the questions, participants in the survey could offer opinions or advice about the one-to-one program. All responses to the survey were anonymous. At the end of the survey, teachers were asked to provide an email address if they were willing to be interviewed regarding their perceptions of the benefits and challenges of integrating technology. Responses to the survey were uploaded to the Statistical Package for the Social Sciences (SPSS). The researcher utilized descriptive statistics to quantify respondent perspectives.

Creswell (2014) pointed out that when collecting qualitative data, it is possible to gather extensive information from a small sample of people; therefore, the researcher interviewed a purposeful sampling of 10 teachers regarding their perceptions of the one-to-one program. The researcher utilized a prompt (see Appendix B) during the interviews to keep the focus of the interviews on the one-to-one laptop program. The interviews were audio-recorded and the recordings were transcribed.

To triangulate the data, the researcher also interviewed 10 students in Grades 9-12 regarding their perceptions of how teachers integrate technology in their classes. The student interviews were conducted in the same manner as the teacher interviews, utilizing a prompt (see Appendix C). Responses were recorded and transcribed. Utilizing grounded theory, the researcher compared student and teacher interview responses to each other and to the quantitative data. Creswell (2014) defined grounded theory as, “a qualitative strategy in which the researcher derives a general, abstract theory of a process, action, or interaction grounded in the views of participants in the study” (p. 243).

The quantitative and qualitative research were conducted concurrently. To analyze the qualitative data (the transcriptions of interviews), the researcher first read the text and then highlighted any parts that related specifically to the research questions.

Next, the researcher noted any repeating ideas within the relevant text. From the repeating ideas, the researcher formed themes. Auerbach and Silverstein (2003) defined a theme as, “an implicit topic that organizes a group of repeating ideas” (p. 38). After identifying themes, the researcher organized the themes into abstract groupings or “theoretical constructs” (Auerbach & Silverstein, 2003). According to Auerbach and Silverstein, the next step is to organize the theoretical constructs into a theoretical narrative that is “a personal story that describes the subjective experience of” the interviewees (p. 74).

Setting and Participants

For the purposes of this dissertation, the research site is called Southeast High School. The southeastern American city in which this school is located has a population of approximately 37,375. The high school has 109 certified teachers, 72.8% of whom hold advanced degrees. Eleven teachers are National Board certified. There are 14 professional development days for teachers in a school year. There are 1,312 students, and the student to teacher ratio is 18.2 to 1. Of these students, 51.2% are African-American and 35.6% are Caucasian. The majority (58%) of the students are eligible for “Free & Reduced” meals; 30.2% are identified for the Gifted and Talented program. Over 19% of the students are enrolled in Advanced Placement (AP) courses, with a success rate of 76.6% on AP exams in 2016. The graduation rate at Southeast High School is 85.7%.

Subjectivity Disclosure

The researcher analyzed the data, avoiding biases as much as possible; however, as Auerbach and Silverstein (2003) stated, “subjectivity and values are a necessary part of human interaction and therefore cannot be eliminated or controlled” in qualitative

research (p. 27). Auerbach and Silverstein also noted that *reflexivity*, the way in which the researcher's own subjectivity influences the research, is an objective of qualitative research. Upon reflection, this researcher noted experiences and opinions that pointed to a positive viewpoint of one-to-one laptop integration. As a teacher, the researcher was very enthusiastic when her school gained Internet access. The researcher found the Internet to be a valuable tool for researching while preparing lessons. The researcher felt that technology would become an integral part of instruction in the very near future and, therefore, chose to obtain a master's degree in instruction and technology. When the researcher's school district announced that all students in Grades 4-12 would receive a web-enabled device for use at school and at home, the researcher again felt hopeful and excited about the direction that the district was taking. This excitement was not shared by several of the researcher's coworkers. In fact, many of the comments and complaints made by other teachers led the researcher to want to find out why other teachers were less optimistic.

The researcher also has three children who have experienced the laptop integration at the research site. The researcher's children have noted varying levels of laptop integration by their teachers. The observations of the researcher's children led the researcher to wonder if there is a difference between teacher and student perceptions of how the laptop computers are integrated.

In addition, the researcher is a teacher at a middle school that feeds into the high school in which this study took place. The researcher knew some of the teachers and students who elected to be interviewed. Knowing the interviewees could allow for a deeper understanding of the perspectives. On the other hand, interviewees who know the researcher might feel inclined to respond in certain ways, thus influencing their

responses. The researcher hoped to gain a better understanding of how teachers perceive they integrate technology. In doing so, the researcher also hoped that her findings would be reported to the district in a way that would benefit all stakeholders.

The researcher maintained the anonymity and confidentiality of all participants and conducted all research in an ethical manner, in accordance with the IRB protocol.

Chapter 4: Results of the Study

The purpose of this study was to gain an understanding of teacher perceptions of a one-to-one laptop program. Constructivist theory serves as the conceptual basis for this study, as one-to-one laptop programs lend themselves to a learning environment that supports “multiple perspectives or interpretations of reality, knowledge construction, and context-rich, experience-based activities” (Duffy & Jonassen, 1992, p. 137).

Constructivist theory also aligns with the P21 framework and with the school district’s technology plan that states, “Our students are not only consuming a rich array of information, but also producing work that is as individual as they are” (Spartanburg School District Seven, 2015, p. 6). For this study, 21st century skills were identified as *creativity and innovation; critical thinking and problem-solving; communication and collaboration; and information, media, and technology*.

This chapter presents the results of the survey and interviews, as they pertain to each of the four research questions. A brief description of the methodology and participants is included as well as a summary of the findings.

Methodology

The study took place at a high school in the southeastern United States. This high school and the district in which it is located are in the fifth year of the one-to-one laptop program. A survey was sent to all 109 teachers at the high school. Eighty-six responded to the survey. Most of the questions were on a Likert-like scale; however, there were also three open-response questions on the survey. The researcher also interviewed 10 teachers and 10 students to triangulate the data. In interviews, teachers and students were asked to discuss how students use laptop computers in the classroom, how students benefit from the laptop program, and what suggestions they might have for improving the program.

The researcher selected a mixed-methods approach to examine teacher perceptions of how they promote student acquisition of 21st century skills in a one-to-one learning environment. A mixed-methods study was chosen because, as Creswell (2014) noted, using both quantitative and qualitative data allows the researcher to gain a deeper understanding of a problem. For this study, the researcher administered a survey (see Appendix A) to teachers at a high school in the southeastern United States. Eighty-six of the 109 teachers responded to the survey. The researcher also interviewed 10 teachers and 10 students individually and recorded and transcribed the interviews. The researcher and a second reader then coded the free responses to the survey and the interview transcripts.

Participants

There were approximately 1,312 students attending the high school at the time of the study. Ten students from the high school agreed to be interviewed for the study. Seven of these students were female. Of the 109 certified teachers at the high school, 86 responded to the survey. Over 40% of the respondents have more than 20 years of teaching experience, and 57 of the respondents were female. Table 1 shows the subjects taught by teachers who responded to the survey. Of the 10 teachers who agreed to be interviewed, four taught foreign languages. The other teachers who were interviewed taught health, math, history, science, English, and special needs. Six of the teachers interviewed were female.

Table 1

Subjects Taught by Survey Respondents

Subject	Respondents
Business	4.65% (4)
English/ Language Arts	12.79% (11)
Foreign Language	11.63% (10)
Health/ PE	3.49% (3)
Mathematics	16.28% (14)
JROTC	2.33% (2)
Science	16.28% (14)
Social Studies	10.47% (9)
Special Needs	9.30% (8)
Technology Education	2.33% (2)
Visual/ Performing Arts	9.30% (8)
Guidance	1.16% (1)

Results for Research Question 1

The first research question for this study was, “To what extent do teachers perceive they effectively integrate laptop computers to promote student acquisition of 21st century learning skills?” Because teachers are charged with effectively integrating the district-provided student laptops at the site of this study, it is important to note the district’s technology vision as it is described in the 2015 technology plan:

[We support] a technology rich environment that will provide global access to educational resources and information, foster critical thinking skills and creativity through digital technology, provide a medium for collaboration, and prepare our students for tomorrow’s world. We also envision an atmosphere for the classroom that will allow teachers to integrate technology to support learning across the curriculum, to engage all students in the learning process, and to utilize available information to improve student achievement. (Spartanburg School District Seven, 2015, p. 8)

P21’s (2009) *Framework for 21st Century Learning* outlined a learning environment like

the one described in the district's technology vision. Included in the P21 Framework are *learning and innovation skills* (creativity and innovation, critical thinking and problem-solving, communication, and collaboration) and *information, media and technology skills* (p. 1).

The results for Research Question 1 are discussed as they relate to each of the aforementioned 21st century skills.

Creativity and innovation. Thinking creatively involves creating “new and worthwhile ideas” and evaluating one’s own ideas (P21, 2009, p. 3). These original and inventive ideas are also communicated to others, with an understanding that creativity and innovation involve “small successes and frequent mistakes” (P21, 2009, p. 3).

Survey Question 13 (see Table 2) asked, “How often do your students create an original product (using laptops)?” Twenty-eight (32.94%) teachers said students “never” or “rarely” create original products with the laptops. Thirty-two (37.65%) teachers said their students “sometimes” create original products, and 25 (29.42%) reported that their students “often” or “always” create original products with the laptops.

Table 2

Integration of Laptop Computers

Survey Question	Never–Rarely	Sometimes	Often– Always
8. How often do you incorporate in-class research (using laptops)?	23.81% (20)	38.10% (32)	38.10% (32)
9. How often do you incorporate in-class reading (using laptops)?	31.40% (27)	40.70% (35)	27.90% (24)
10. How often do you incorporate in-class writing (using laptops)?	36.05% (31)	31.40% (27)	32.56% (28)
11. How often do you incorporate problem-solving (using laptops) in the classroom?	31.40% (27)	44.19% (38)	24.42% (21)
12. How often do you incorporate data analysis (using laptops) in the classroom?	47.67% (41)	33.72% (29)	18.60% (16)
13. How often do your students create an original product (using laptops)?	32.94% (28)	37.65% (32)	29.41% (25)
14. How often do your students use laptops for note-taking?	41.18% (35)	30.59% (26)	28.24% (24)
15. How often do your students use laptops for file storage?	18.60% (16)	29.07% (25)	52.33% (45)
16. How often do your students use laptops for in-class assignment completion?	15.48% (13)	25.00% (21)	59.52% (50)
17. How often do your students use laptops for homework completion?	36.05% (31)	27.91% (24)	36.05% (31)
18. How often do your students use laptops for finding information?	8.14% (7)	34.88% (30)	56.10% (49)

Note. Sample size may vary, due to skipped questions.

Questions 27-32 asked teachers, “How often do you utilize technology to employ the following teaching techniques with students in the classroom” (see Table 3)? Six

respondents (6.98%) reported that they never employ technology for creative expression when teaching. Thirty-five teachers (40.70%) responded with “sometimes,” and 45 (52.33%) teachers said they employ creative expression often or always.

Table 3

21st Century Teaching Techniques

Strategy	Never	Sometimes	Often–Always
27. Communication	2.33% (2)	30.23% (26)	67.44% (58)
28. Creative expression	6.98% (6)	40.70% (35)	52.33% (45)
29. Collaboration	11.63% (10)	44.19%(38)	44.19% (38)
30. Research	8.24% (7)	41.18% (35)	50.59% (43)
31. Analyzing/ problem-solving	5.81% (5)	53.49% (46)	40.70% (35)
32. Evaluating online resources	16.28% (14)	45.35% (39)	38.37% (33)

Note. Sample size may vary, due to skipped questions.

Question 34 asked teachers to evaluate their students’ experience in using laptops for creative expression (see Table 4). Six teachers (7.59%) reported that their students were “not experienced,” 42 teachers (53.16%) said students were “somewhat experienced,” and 31 teachers (39.24%) perceived students to be “experienced” or “very experienced” with creative expression using laptops.

Survey Question 19 asked, “Are there other purposes for which students use laptops in your class?” Teachers offered specific ways in which students use laptops for creativity and innovation in their responses such as photo editing, creating digital presentations (Keynote and PowerPoint), video recording, and creating iMovies. Of the 10 teachers who were interviewed, three said their students use laptops to create digital presentations, and one mentioned that students use laptops to record videos.

Table 4

Perceived Student Experience with Laptops

21st Century Skill	Not experienced	Somewhat experienced	Experienced – very experienced
33. Communication	3.57% (3)	30.95% (26)	65.48% (55)
34. Creative expression	7.59% (6)	53.16% (42)	39.24% (31)
35. Collaboration	7.92% (6)	53.25% (41)	38.97% (30)
36. Research	16.46% (13)	49.37% (39)	34.18% (27)
37. Analyzing/problem-solving	22.98% (17)	58.11% (43)	18.91% (14)
38. Evaluating online resources	25.68% (19)	54.68% (40)	20.27% (15)
39. General technology skills	0.00% (0)	34.88% (30)	64.71% (55)

Note. Responses of “no opinion” are not included and response rates vary.

Critical thinking and problem-solving. Per the P21 (2009) Framework

Definitions, critical thinking and problem-solving require effective reasoning, the use of systems thinking, making judgments and decisions, and solving problems “in both conventional and innovative ways” (p. 4). Question 11 of the survey (see Table 2) asked teachers, “How often do you incorporate problem-solving (using laptops) in the classroom?” Of the 86 respondents, 27 (31.4%) said they rarely or never incorporate problem-solving. Thirty-eight (44.19%) responded that they incorporate problem-solving “sometimes,” while 21 (24.42%) replied that they incorporate problem-solving “often” or “always.” Survey Question 12 asked, “How often do you incorporate data analysis (using laptops)?” Forty-one respondents (47.68%) said they “rarely” or “never” incorporate data analysis into their lessons. Twenty-nine (33.72%) teachers responded that they “sometimes” incorporate data analysis, and 16 (18.6%) said they “often” or “always” incorporate data analysis (see Table 2).

Survey Question 19 asked, “Are there other purposes for which students use laptops in your class?” Four of the 26 teachers who responded to this survey question noted ways in which students use laptops that could be considered critical thinking.

Three of these teachers wrote that students use laptops to conduct virtual labs. As one teacher specified, “We hook scientific equipment into the Laptop [*sic*] and Create [*sic*] charts and graphs from data.” Another teacher also mentioned that students use laptops to create charts and tables.

In interviews, several teachers mentioned ways in which their students use laptops for critical thinking and problem-solving. Teacher 2 said that students use laptops for “inquiry-based projects” and to create Excel spreadsheets for data analysis. Teacher 3 noted an example of critical thinking:

So, yesterday [students] answered these questions – they would look at this animation and I had questions that they would answer, and that was the front page, and on the second page, they actually had a little simulation. I love it when I can find a simulation for science! They actually were able to sit there and look at these enzymes and they could manipulate the variables, such as pH or temperature or the amount of enzyme, the amount of substrate.

Teacher 4 explained in an interview how students are shown photographs of cultural celebrations in China from *Google Images*. While viewing these photographs, students “ask questions about language content and cultural celebrations” and make comparisons between their own culture and that of China.

P21 (2009) described how one uses systems thinking with technology as the analysis of “how parts of a whole interact with each other to produce overall outcomes in complex systems” (p. 4). In an interview, Teacher 3 talked about how students connect microscopes to the laptops:

They link up to PhotoBooth and they can actually get a bigger picture of what’s going on. They can record. So, like last year, we looked at some live specimens

from pond water and they were actually able to record little videos of, you know, different organisms moving around in the water.

Survey Question 31 also asked how often teachers employ analyzing and problem-solving techniques with students (see Table 3). Of 86 respondents, 46 (53.49%) said they employ analyzing and problem-solving techniques “sometimes,” while 35 (40.7%) teachers responded with “often” or more. Only five teachers (5.81%) said they never employ analysis and problem-solving with laptops in their teaching.

Survey Question 37 asked teachers to rate their students’ experience with analysis and problem-solving using laptops. Most teachers (58.11%) considered their students to be “somewhat experienced.” Fourteen (18.91%) teachers said their students were “experienced” or “very experienced” in analyzing and problem-solving, while 17 (22.98%) found their students to be inexperienced in this area.

Communication and collaboration. The P21 (2009) Framework Definitions (2009) specified that to communicate clearly, one must “articulate thoughts and ideas effectively using, oral, written and nonverbal communication skills” (p. 4). Survey Question 10 (see Table 2) asked how often teachers incorporate in-class writing with laptops. Of the 86 teachers who responded to this survey question, 31 (36.04%) reported they rarely or never have students write in class using laptops. Twenty-seven (31.4%) teachers said they “sometimes” incorporate writing, and 28 (32.56%) responded with “often” or “always.” In interviews, four of 10 teachers mentioned their students use laptops for word processing in class; however, none of these teachers mentioned their students collaborate when writing.

P21 (2009) also included listening “effectively to decipher meaning” as a communication skill (p. 4). In response to Survey Question 19 regarding other purposes

for which students use laptops, two teachers mentioned listening activities. In an interview, Teacher 2 said her students use laptops to listen to an oral prompt and then respond in the target language. The same teacher noted that students communicate via Skype® with another Spanish I class. This teacher explained that the students from both schools are learning Spanish. She added, “So, we will Skype® and practice our broken Spanish.” On the other hand, another foreign language teacher said in an interview, “In a language class, you don’t communicate with a computer, you communicate with people,” and students do not have “a lot of one-on-one use of the MacBooks” in that class.

P21 (2009) pointed out that when collaborating, students should “demonstrate [the] ability to work effectively and respectfully with diverse teams” and “assume shared responsibility for collaborative work” (p. 4). Survey Question 29 (see Table 3) asked how often teachers utilize technology for students to collaborate. Ten of the 86 respondents (11.63%) said they never ask students to collaborate using technology. Thirty-eight (44.19%) reported they “sometimes” require students to collaborate with technology. The remaining 23 (26.74%) teachers said they “often” or “always” utilize technology for student collaboration.

When asked in Survey Question 35 (see Table 4) to rate the level of experience students have in collaborating using laptops, six (7.92%) teachers reported that students are not experienced. Forty-one (53.25%) of the respondents said students are “somewhat experienced,” while 30 (38.97%) reported that students are “experienced” or “very experienced” at collaborating with laptops.

In response to Survey Question 19 regarding other purposes for which students use laptops, two teachers said students use them to communicate. Of those, one specified that students “communicate with students in other countries.” Similarly, one teacher

responded that students use laptops for online discussion. Schoology®, an online Learning Management System (LMS), can also be used for communication and collaboration and was mentioned once in response to Survey Question 19. Schoology® was also mentioned twice in teacher interviews.

Information, media, and technology. Information, media, and technology skills are also vital 21st century learning skills. According to P21 (2009), these skills involve accessing information efficiently and effectively while evaluating the “information critically and competently” (p. 5). There is some overlap in the P21 (2009) Framework Definitions between “information, media and technology skills” and other 21st century skills. For example, P21 (2009) stated that media literacy involves understanding and utilizing “the most appropriate media creation tools,” which overlaps with creativity and innovation skills (p. 5). P21 (2009) also specified on page five that students utilize technology to “research, organize, evaluate and communicate” using technology. For the purposes of this study, the researcher classified *information, media, and technology skills* as pertaining to organization, evaluation of online sources, efficient location of information, and general technology skills (using laptops).

Survey Questions 8, 14, 15 and 18 (see Table 2) asked teachers how often students use laptops for information, media, and technology skills in class. Question 8 specifically asked, “How often do you incorporate in-class research (using laptops)?” Twenty (23.81%) teachers responded that they rarely or never incorporate research in class. Thirty-two (38.1%) said they “sometimes” incorporate research. The remaining 32 teachers (38.09%) reported that they “often” or “always” incorporate research. Of the 10 teachers who were interviewed, six reported that students use laptops for “looking up information.” It is not known if some teachers considered “looking up information” to be

the same as conducting research in class.

Survey Question 36 asked teachers, “How experienced are your students in using laptops for research?” Thirteen (16.46%) teachers reported that students were not experienced in this area. Thirty-nine (49.37%) said students were “somewhat experienced.” Twenty-seven (34.18%) teachers found their students to be “experienced” or “very experienced” in utilizing laptops for research.

To access information quickly, students may use laptops to store files. File storage is also a form of organization. Survey Question 21 asked teachers to give an opinion on the statement, “My students are using school-issued laptops to organize themselves.” Most teachers (81.7%) who responded to this question agreed or strongly agreed with the statement. Survey Question 15 (see Table 2) asked, “How often do your students use laptops for file storage?” Sixteen (18.61%) of the 86 respondents said their students “rarely” or “never” organize themselves by storing files on their laptops. Twenty-five teachers (29.07%) reported their students “sometimes” use laptops for file storage. The remaining 45 (52.32%) responses to the question were “often” or “always.” During an interview, Teacher 7 explained the importance of file storage for organization:

So, they always have a document for every little thing that they read. Um, and then it’s there all semester long. It sort of directs them to the essay they do for a unit and then at the end of the unit or at the end of a semester, all of that stuff combines for their essay and they kind of have it all in one location.

Another way students can organize themselves is by taking notes on the laptop. Survey Question 14 asked teachers how often their students use laptops for note-taking. Twenty-six (30.59%) teachers said students sometimes take notes on laptops. Twenty-four (28.24%) teachers said their students take notes on laptops “often” or “always.”

Eighty-six teachers responded to Survey Question 18 (see Table 2): “How often do your students use laptops for finding information?” Seven teachers (8.14%) said students “rarely” use laptops for this purpose. Thirty (34.88%) respondents said students “sometimes” use laptops to find information. Forty-nine teachers (56.98%) said students “often” or “always” find information using laptops.

Question 30 (see Table 3) asked teachers how often they utilize technology to employ research as a teaching technique in the classroom. The responses to Question 30 were similar to the responses to Question 18. Seven (8.24%) of the 85 teachers who responded to Survey Question 18 reported that they “never” use this teaching technique. Thirty-five (41.18%) teachers said they “sometimes” employ online research as a teaching technique, while 43 (50.58%) said they employ research “often” to “always.”

Two of the survey questions pertained to student evaluation of online resources. Survey Question 32 (see Table 3) asked how often teachers request that their students evaluate online resources. Fourteen (16.28%) teachers said they “never” have students evaluate online resources. Thirty-nine (45.35%) responded that they “sometimes” incorporate online resource evaluation. The remaining 33 (38.37%) responses were “often” or “always.”

Survey Question 38 (see Table 4) asked teachers, “How experienced are your students in using laptops for evaluating online resources?” Nineteen (25.68%) teachers responded that their students were “not experienced” in evaluating online resources. Forty (54.05%) teachers said students were “somewhat experienced,” and the remaining 15 (20.27%) reported students to be “experienced” or “very experienced” in evaluating online resources.

Teachers were asked in Survey Question 20 to give their opinion on the following

statement: “My students are learning basic technology skills.” Most respondents (95.29%) agreed that students are learning basic technology skills. Survey Question 39 (see Table 4) asked, “How experienced are your students in using laptops for technology skills in general?” Thirty (34.88%) teachers found students to be “somewhat experienced” in general technology skills, while 55 (64.71%) respondents perceived students to be “experienced” or “very experienced” in general technology skills. None of the respondents said students were “not experienced” in using technology skills.

Results for Research Question 2

It is important to note the ways in which students benefit from the one-to-one program, as the district has a large investment in the laptop computers with the hope of preparing students for college and careers in the 21st century. By asking teachers how they perceive students benefit from the program, one can better gauge the success of the laptop integration.

Research Question 2 was, “What benefits do teachers perceive in implementing technology into instruction in ways that promote 21st century learning skills?” Survey Question 40 specifically asked teachers, “In what ways do you think students benefit from a one-to-one learning environment?” (see Table 5). Each of the 10 teachers who were interviewed were also asked this question.

Anytime, anywhere learning. Forty-nine teachers responded to Question 40 of the survey that asked teachers to list ways in which they thought students benefit from a one-to-one learning environment. Fourteen of the 49 respondents pointed to the benefit of instant access to information. One teacher noted, “technology is readily available.” Another explained that students benefit from “always having what they need at their fingertips.” One teacher added, “learning and assessment are immediate.”

Table 5

Perceived Benefits of the 1:1 Program

Benefit	Teacher Interview Responses	Responses to Survey Question 40
Equal access	50% (5)	18.37% (9)
Differentiation	20% (2)	22.45% (11)
Instant access to information	20% (2)	28.57% (14)
Practice/ Review	60% (6)	6.13% (3)
Improved computer skills	20% (2)	4.08% (2)
Organization	30% (3)	0% (0)
Communication	10% (1)	6.13% (3)
Engagement	0% (0)	14.29% (7)

Note. Forty-nine respondents to Survey Question 40.

Three of the 10 teachers interviewed said students benefit from being able to look up information quickly. Teacher 4 pointed out in an interview that she and her students can go to the school courtyard or to the cafeteria with the laptops and have mobile, “active learning.”

Communication. In response to Survey Question 40, three teachers noted an increase in communication since the laptop program was implemented. One teacher said, “I see students sending emails and taking pictures of homework to send to me when they are absent.” Another noted that there is “easier communication with teachers and peers.” A third teacher wrote that there is “more efficient communication when used properly.” In an interview, Teacher 8 said the laptops make it easier to relay information to students when they are not in class.

Individualized learning. In the open responses to Survey Question 40 regarding benefits of the program, 11 teachers (22.45%) said laptops offer students “differentiated materials,” “individualized learning,” and the ability “to work at their own pace.” As one teacher noted, the one-to-one program allows for a “very customized and personalized learning experience.” Survey Question 22 asked teachers whether they agreed with the

statement, “It is important for me to use technology to address different learning styles and needs.” All but 10 of the 81 respondents agreed with this statement.

In an interview, Teacher 2 discussed how the one-to-one program allows her to differentiate in the classroom:

I love it for the differentiation because a lot of times, I’ll have IEPs and 504s. I’ll also have heritage speakers. I have people with either visual or auditory or processing disorders, and then I have my quote, unquote normal students. And so it allows me to definitely break the language down to wherever they need to be.

This foreign language teacher went on to talk about how “overachievers” use the laptops to look up new words to expand their vocabularies in the target language. Teacher 1 also said that laptops allow for accommodations for students with “handwriting issues.” This teacher pointed out that for students with autism who have “difficulty with change in location,” it is helpful to have laptops, so students do not have to transition to a computer lab.

Engagement. Seven of the 49 teachers who responded to Survey Question 40 noted that one-to-one computing has increased student focus and level of engagement. One teacher said that laptops allow students to learn “through technology and gameplay,” which is more engaging to high schoolers. Another teacher pointed out that laptops “have the full attention” of the students.

Although none of the 10 teachers who were interviewed specifically said that students were more engaged, two teachers talked about how much students enjoy the online learning games that pertain to their content area. Another teacher said in an interview that learning with laptops is very interactive. These teachers seemed to suggest that students are more engaged when learning with laptops. Survey Question 23 asked

teachers to respond to, “I use technology regularly to engage my students in learning.” The majority (90.52%) of respondents agreed with this statement.

Equality. Nine teachers said in their response to Survey Question 40 that one-to-one computing creates a more equal learning environment, as the district provides laptops to all students (including those who would not normally have access to them). One teacher wrote, “Since it is a district issued device, laptops level the education playing field. Economic status doesn’t change the availability of the material like say [sic] an expensive calculator in a math class versus what a student can afford.” In an interview, Teacher 7 said, “There’s not a student that’s dragging behind because everybody’s got the same thing available.” Teacher 9 pointed out that the one-to-one program equalizes students in access and in ability:

I think it’s nice for everybody to have the same technology because we’ve had problems (in the past) where a student didn’t have computer access at home, couldn’t type a paper, and that sort of thing. Now they’re able to start learning all of the same programs at the same time...and in the past when I’ve given PowerPoints, when we just had computer labs, a lot of the kids who didn’t have a computer weren’t sure. They didn’t know how to navigate the programs.

Teacher 10 said that “the biggest benefit” to the one-to-one program is that “Everybody has the same access to the same type of device [and] same material.”

Future ready. Technology is so prevalent in the 21st century workplace and higher education that one-to-one laptop programs are expected to prepare students for college and careers. Eight of the open responses to Survey Question 40 pointed out that the one-to-one program prepares high schoolers for the future and gives them “real world” experience with the skills to utilize the technology.

When asked in an interview about the benefits of a one-to-one program, Teacher 3 mentioned simulations and virtual labs that science students can experience with the laptops:

When I taught physical science, we did some model simulations like nuclear reactors. You know that's not obviously something we can do for real in class but we were able to do that with the simulations on the MacBook. That's a huge benefit!

Teacher 5 agreed that the laptop program puts students "in an advanced position over students in other environments" and added, "This is definitely the 21st century model." He went on to point out that since the district began the one-to-one program 5 years ago, student computer skills have increased dramatically:

When we first started, I spent a month teaching them how to set things up and how to use the MacBook, and now I spend no time – zero days. They know how. They are completely computer literate and it's amazing to see. So, I think that's a huge advantage.

Drill and practice. Two teachers noted in response to Survey Question 40 that laptops can be used for remediation or "extra practice." In an interview, Teacher 3 said that with the laptops, students can create virtual flash cards and "they can actually hit 'test' and it will generate a test and they can just sit there and practice taking tests."

Accessing information. Three responses to Survey Question 40 included the ease with which students are now able to research topics using the laptops. One teacher said that with all students having laptops, they can "do research and class assignments more easily," while another respondent said it "saves time for [students] in researching topics." In an interview, Teacher 7 said, "Research is a lot quicker...everything's right at

your fingertips.” This teacher went on to say, “If (students) have a random question – in the past, if it’s one you don’t expect, you’re like ‘Okay, I’ll get back to you on that.’ Instead, I can tell them, ‘Well, just look it up! You tell us!’”

Results for Research Question 3

Regardless of how successful a program may be, there is always room for improvement. The third research question was, “What challenges do teachers perceive in implementing technology into instruction in ways that promote 21st century learning skills?” Survey Question 41 asked teachers, “What challenges, if any, have you experienced while integrating technology with instruction? The 10 teachers who were interviewed were asked to give suggestions for improving the one-to-one program.

Technological difficulties. Thirteen teachers (26.53%) pointed out in their responses to Survey Question 41 that technology is not always reliable (see Table 6). Most of the responses mentioned issues with the Wi-Fi connection. One teacher wrote, “Our biggest struggle is that our classes are large. Trying to get all of our students on the internet at once is a challenge.” This teacher went on to write that he or she gives online quizzes “in shifts” to avoid having the whole class online at the same time. Another teacher wrote, “Every now and then because of weather there have been network interruptions.” Yet another wrote, “I have experienced the slothfulness of the WiFi technology.” Teachers also pointed to connection problems in interviews. Teacher 3 said, “I do have issues with the Wi-Fi in here occasionally.” This teacher suggested that the new high school (currently being constructed) should have “better infrastructure for the Wi-Fi.” Teacher 4 said in an interview that “Technology is a blessing but not dependable.” This teacher went on to say that she always has a “Plan B” for times when technology is not functioning properly.

Two teachers pointed out in interviews that the laptops are not always compatible with the other technology available in the classrooms. Teacher 5 said, “It would be nice to see a pairing between the Mac and all of our instructional tools that are PC.” Teacher 5 went on to explain that the MacBooks are “not compatible” with the recently acquired Android Active Panels that have been placed in each classroom. Teacher 7 also said the Active Panels are not always compatible with the Apple MacBooks teachers and students use. Teacher 7 said, “I wish that all of our technology was through one company.”

Table 6

Challenges of Technology Integration (Question 41)

Reported Challenge	Percentage of 49 Teachers Responding
Students lack technology skills	10.20% (5)
Laptops do not fit with the content area	4.08% (2)
Student distraction	34.69% (17)
Cheating/ plagiarism	6.12% (3)
Students forget to charge or bring laptops	4.08% (2)
Technology is unreliable	26.53% (13)
Passwords are forgotten	4.08% (2)
Too many sites are blocked	2.04% (1)
Teacher feels overwhelmed by technology	6.12% (3)
Equity of Wi-Fi access at home	3.92% (2)
Traditional pedagogy is preferred	8.16% (4)
Difficult to monitor student use	2.04% (1)

Although every student is provided with a web-enabled laptop computer by the district, access to the Internet at student homes varies. In response to Survey Question 41, one teacher wrote that “equity of WiFi access at home” was a challenge. Another wrote “lack of resources at home,” which seems to point to the same issue.

Student distraction. Seventeen of 49 teachers (34.69%) responding to Survey Question 41 asserted that laptops can be distracting to students in the classroom. One teacher wrote, “I believe that students are distracted by having so much access at their

fingertips and they tend to venture away from what they are supposed to be doing when using technology.” Other teachers specified that students tend to play games or listen to music with the laptops. One respondent noted that “good classroom management negates that”; however, another teacher wrote, “Students would rather play games than listen to instruction/lecture/discuss things with peers/teachers – even in a class where technology is really monitored.”

There is a program called Lanschool® installed on teacher laptops in this district. This software is for teachers to view each student’s laptop screen for better supervision; however, in an interview, Teacher 6 said, “I wish we could use Lanschool, because we have Lanschool but only certain teachers can use it, and so that defeats the purpose.” The teacher also said, “the students know” that the program often does not work well.

Plagiarism. Three teachers wrote in their responses to Survey Question 41 that students utilize laptops to “copy and paste” rather than write in their own words. One teacher wrote, “Thinking can get lost in the copy and paste world of technology” and “research with technology is often a ‘copy and paste’ endeavor without true evaluation of information.” Another teacher, who is presumably a foreign language teacher, wrote in response to Survey Question 41 that students use a “translator to do their work.”

Deficient computer skills. One teacher wrote that technology integration at the study site involved “just the normal learning curve” in response to Survey Question 41 regarding challenges; however, another teacher said students cannot type fast and that they are not as well trained to use the laptops as teachers are. Two other teachers mentioned their own feelings of inadequacy with technology. One wrote that the biggest challenge is “my own limitations of knowing how to use it and the overwhelming nature of always having something else to upgrade or learn.” Another teacher also wrote that

his or her greatest challenge is staying “up to date with the available technology.”

Traditional is better. Although proponents of one-to-one programs suggest that the lowest level of technology integration is mere substitution for paper and pencil, some teachers in this study seem to prefer the old way of doing things. In response to Survey Question 41, one teacher wrote, “I do feel that reading and writing skills are diminishing. I still believe in some ‘old school’ type things but it is difficult sometimes to find that happy medium.” Another teacher wrote, “Sometimes it’s just much easier and needed to give them a practice sheet.” Another survey respondent pointed out, “research shows that some learning needs to be old school – i.e. notetaking – so technology is not THE ANSWER for all learning endeavors.” Similarly, in an interview, Teacher 10 said the laptops should be promoted “as a tool, as opposed to an end-all-be-all” because “that puts undue pressure on the teachers to kind of teach outside of who they really are.”

One teacher responded to Question 41 by writing that there is a “lack of human to human communication” with the laptop program. Teacher 9 reiterated this opinion in an interview when she said, “In a language class, you don’t communicate with a computer. You communicate with people.” Teacher 6 seemed not to prefer “old school” pedagogy but explained why she did not integrate technology as much as she could. She said that teachers get enough training on how to use the technology but that they need training that is specific to their own content area. This teacher pointed out that she had been shown examples of how to incorporate the technology into math, but she was not a math teacher. She added, “if I could do more with it, I would.”

Results for Research Question 4

The fourth research question was, “To what extent do student perceptions of laptop computer integration differ from the reported perceptions of teachers?” The

researcher interviewed 10 high school students and asked each of them three questions that correlated with the teacher interview questions.

Interview Question 1. Each student and teacher was first asked what kinds of things students use laptops for in the classroom (see Table 7). Nine of 10 students said they are asked to turn in daily assignments digitally. Eight of these students specified that they submit assignments on Schoology®. Student 4 pointed out that teachers ask students to do “sheets” that they would have done on paper before the laptop program. Student 6 said students “usually log on to Schoology® and get a worksheet or look something up on the Internet.” Only three of 10 teachers mentioned in interviews that students turn in daily assignments digitally instead of on paper; however, Teacher 7 said computers have “sort of taken the place of pen and paper.”

Table 7

Laptop Use Reported in Interviews

Use of Laptop Responses	Teacher Responses	Student Responses
Research	40% (4)	40% (4)
Translation	20% (2)	0% (0)
Presentation	30% (3)	0% (0)
Word processing	40% (4)	20% (2)
Student collaboration	0% (0)	10% (1)
Student-teacher communication	10% (1)	10% (1)
Online textbook	10% (1)	10% (1)
Note-taking	50% (5)	10% (1)
Listening/speaking activities	10% (1)	0% (0)
Skype®	10% (1)	0% (0)
Assessment	10% (1)	10% (1)
Excel®	10% (1)	0% (0)
Video recording	10% (1)	0% (0)
Taking photos	20% (2)	0% (0)
Watching videos	20% (2)	0% (0)
Virtual tours	10% (1)	0% (0)
Drill & practice	40% (4)	20% (2)
Digital worksheets	30% (3)	90% (90)
Web quests	0% (0)	10% (1)
Listening to music	1% (1)	20% (2)
Access to information	30% (3)	30% (3)

Another area in which teachers and students reported significantly different levels of use was note-taking. One student mentioned using the laptop to take notes, while five teachers said that students take notes on laptops. Teachers listed more ways laptops are used in the classroom than students did. The uses mentioned by teachers but not by students were translation, listening and speaking activities, Skype®, Excel®, video recording, taking photos, watching videos, virtual tours, and presentations. Two students mentioned going to websites such as Quizlet.com and ixl.com to practice with the terms or skills they learned in class, whereas four teachers said students use laptops for practice or remediation. Only two students said teachers ask them to write essays with laptops, but four teachers said students use laptops for word processing. One student said teachers ask students to do web quests, and one student described collaborating on projects with other students; however, none of the 10 teachers interviewed mentioned these activities.

The same number of students and teachers mentioned using laptops for research (30%), looking up information (30%), online textbook (10%), assessment (10%), collaboration with other students (10%), and communication between students and teachers (10%).

Interview Question 2. The second interview question asked how students benefit from having a school-issued laptop (see Table 8). Teachers listed twice as many benefits as students did. Five of 10 students and three of 10 teachers mentioned that with laptops, students have instant access to information. Student 3 said, “I think it’s easier than, like, going to the computer lab for the sake of research.” Student 6 said, “It’s easier to just look up a lot of things at once, rather than having to go down to the library and get different books.”

Two students and one teacher pointed out that the laptop program prepares students for higher education or future careers. Student 10 said, “It helps me get experience with computers, which I had none of before.” Student 7 said, “I think it’s preparing me for college, because we will use computers in college.” Two students said they enjoy listening to music from the laptops while they are working. Other perceived benefits of the school-issued laptops reported by students were that they do not have to carry as many heavy textbooks and that typing is easier than hand writing. Half of the teachers interviewed said the greatest benefit to the laptop program is that all students are given equal access to a web-enabled device; however, none of the students mentioned this benefit.

Table 8

Interview Responses Regarding Benefits of the 1:1 Program

Benefit	Teacher Responses	Student Responses
Equal Access	50 % (5)	0% (0)
Differentiation	20% (2)	0% (0)
Collaboration	0% (0)	10% (1)
Instant Access to Information	20% (2)	60% (6)
Practice/ Review	60% (6)	0% (0)
Improved Computer Skills	20% (2)	20% (2)
Organization	30% (3)	0% (0)
Access to Music	0% (0)	20% (2)
Typing (vs. Handwriting)	10% (1)	20% (2)
Communication	10% (1)	0% (0)
Future Ready	10% (1)	20% (2)

Interview Question 3. The third question the researcher asked students and teachers in interviews was, “Do you have any suggestions for improving the laptop program” (see Table 9)? Four students said too many websites are blocked. Student 9 explained,

I think they should definitely go through and look at the kinds of websites they

have blocked because sometimes they have, like, legitimate things blocked and sometimes you'll have things that, like, your teachers will even tell you to go to and then they're blocked.

Table 9

Interview Responses Regarding Suggestions for the 1:1 Program

Suggestion	Teacher Responses	Student Responses
Fewer Site Restrictions	10% (1)	40% (4)
More Site Restrictions	0% (0)	20% (2)
Improve WiFi	20% (2)	0% (0)
Charging Stations	10% (1)	0% (0)
Non-Digital Options	20% (2)	10% (1)
Use Only One Platform	20% (2)	0% (0)
Improve Supervision Software	10% (1)	0% (0)
No Suggestions	20% (2)	30% (3)

Student 10 agreed: “Maybe if there’s like really bad sites, they should block them but harmless sites, I don’t think they need to block.” This student went on to say there are sites unrelated to school that might distract students when they are supposed to be working, “but if someone’s just on a Saturday wanting to go on a site, then that should be allowed”; however, three students said laptop computers can be distracting. Student 4 said, “I’m not gonna lie, a lot of people play games and stuff.” This student went on to say, “It’s not even just games. It’s stuff, like, I don’t know, like sports stuff a lot of times.” This student acknowledged it would be difficult to prevent these distractions but suggested the district “maybe cut back on the amount of stuff you can go look at.” One teacher suggested the supervision software be replaced or improved. This would also help to prevent cheating. Student 2 said laptops make it easier for students to cheat. She explained, “Kids email the documents” and “you can have a separate tab open and just, like, switch to it to get the answers.” She added, “I don’t like that we’re trying to get rid

of paper.”

Teachers also suggested that WiFi be improved, that the district limit technological devices to only one platform, and that charging stations for laptops be installed in classrooms. Three students and two teachers said they had no suggestions for improving the laptop program.

Summary

Research Question 1 addressed how teachers perceive they promote student acquisition of 21st century learning skills using laptop computers. These learning skills included creativity and innovation; critical thinking and problem-solving; communication and collaboration; and information, media, and technology. Most of the 41-question survey asked teachers how they incorporate these skills and the level of experience with these skills they perceive their students to have. Ten teachers were also interviewed and asked in what ways students use laptop computers in the classroom.

Research Question 2 addressed ways in which students benefit from the one-to-one laptop program that promotes 21st century learning skills. In interviews, teachers were asked how they perceived students benefit from the program. Question 40 of the teacher survey also asked teachers to list ways in which students benefit from a one-to-one learning environment.

Research Question 3 pertained to any challenges teachers might perceive in implementing technology into instruction in ways that promote 21st century learning skills. Question 41 of the teacher survey asked teachers to list challenges. Teachers were also asked in interviews to give suggestions for improving the program.

Research Question 4 compared student perceptions of laptop computer integration with the perceptions of teachers. Ten teachers and students were each asked three

questions in interviews. The first question asked how students use laptops in the classroom. The second question asked how students benefit from the one-to-one program, and the third interview question asked teachers and students if they had any suggestions for improving the program.

Chapter 5 summarizes the results of the study, suggests possible implications for the findings, and gives recommendations for further research on 21st century learning skills in a one-to-one learning environment.

Chapter 5: Discussion

Introduction

The purpose of this study was to understand teacher perceptions of how effectively they promote student acquisition of these 21st century skills in a one-to-one laptop environment. An enlightened person may infer that a one-to-one environment in which such skills are acquired is consistent with constructivist learning theory. Freed from lock-step, whole-group instruction, student motivation to learn increases as they personally construct – as opposed to passively receive – knowledge (Brooks & Brooks, 1999; Juniu, 2006; Keengwe & Onchwari, 2011).

In addition to a changed role for students from receiver to producer, constructivist learning theory supports changing the teacher’s role from “dispenser of information” to facilitator of learning (Keengwe & Onchwari, 2011). The savvy teacher encourages students to begin with their own suppositions and then to create new interpretations through inquiry and problem-solving. Moreover, teachers facilitate student collaboration to address real-world problems as the students engage in constructing meaning; thus, many advocates of one-to-one learning suggest that 21st century learning skills are best acquired through a constructivist learning environment.

When utilized effectively, students construct knowledge with laptops by using the 21st century learning skills of creativity and innovation; critical thinking and problem-solving; communication and collaboration; and information, media, and technology.

Conclusions

The first research question for this study was, “To what extent do teachers perceive they effectively integrate laptop computers to promote student acquisition of 21st century learning skills?” The conclusions for this research question are categorized

by the 21st century learning skills listed in above.

Creativity and innovation. Creativity and innovation are essential to constructivist learning. They are also important aspects of the one-to-one program designed by the school district in this study. Of the teachers who responded to the survey, more than a third said students never or rarely create original products; however, most teachers perceived students to be experienced in utilizing laptops for creative expression. Teachers also perceived that they use technology for creative expression in their teaching. The discrepancies in data pertaining to student creative expression may be due to the terminology of the question regarding “original products.” Teachers may have considered original products to be something other than presentations or other student activities involving creative expression that were described by teachers in interviews.

Critical thinking and problem-solving. During the Industrial Age, students needed to memorize facts and rules in preparation for specialized vocations; however, today’s students live in the Knowledge Age (Trilling & Fadel, 2009). Facts and rules can be quickly found on the Internet. Instead, students need to learn to solve problems and think critically in preparation for future careers – many of which have yet to be invented (Trilling & Fadel, 2009).

About a third of respondents to the survey said their students rarely or never use laptops for problem-solving. Almost half reported that their students rarely or never use laptops for data analysis; however, most teachers perceived that they model the use of technology for critical thinking and problem-solving in their teaching. Again, many teachers seemed reluctant to guide students to learn constructively. One teacher suggested that teachers need more technology training that is specific to their own content areas, alluding to the fact that many teachers do not know how to effectively

promote the use of laptops for higher-order thinking. Indeed, almost half of the teachers reported they often incorporate lecture and drill-and-practice in the classroom – activities that are more traditional and do not require technology or critical thinking.

Communication and collaboration. P21 (2009) suggested that students communicate orally, in writing, or by “listening effectively to decipher meaning” and that students should collaborate “respectfully with diverse teams” (p. 4). Morpew (2012) contended, “collaborative and cooperative experiences” contribute significantly to a constructivist learning environment” (p. 18).

Teachers in this study perceived that they incorporated communication with laptops often and that the one-to-one program had significantly increased communication between teachers and students; however, teachers perceived only a moderate amount of student collaboration with laptops. One teacher gave a shining example of student communication and collaboration with laptops, as she described how her students Skype® with students at another school to practice speaking Spanish; however, few teachers reported such effective promotion of student communication and collaboration. Teachers may feel a lack of control when students communicate and collaborate with laptops, as several mentioned the frustration of off-task behaviors with laptops that are difficult to monitor.

Information, media, and technology. Students in any one-to-one program should learn to access information efficiently, while evaluating that “information critically and competently” (P21, 2009, p. 5). These computer skills and the ability to discern what is accurate information are essential for college and careers in the 21st century.

Teachers reported that they promote computer skills and organization more

effectively than other 21st century skills. They also found students to be experienced in these areas; however, basic computer skills and organization are not associated with constructivist learning as much as most 21st century skills. Although teachers said that most students were computer literate, teachers found students to be inexperienced in evaluating online resources. This is significant because teachers reported that students often access information in class with the laptops. If students are not experienced in evaluating resources, they may be accessing inaccurate information.

The second research question was, “What benefits do teachers perceive in implementing technology into instruction in ways that promote 21st century learning skills?” It is important to note how students benefit from the one-to-one program to gauge the program’s effectiveness.

Equal and efficient access. The term digital divide refers to the differing levels of access to technology among students of different socioeconomic statuses. Edwards (2014) called the one-to-one laptop program “today’s great equalizer” (p. 16). In interviews and in response to survey questions, teachers in this study perceived the greatest benefit to students to be equal and efficient access to resources. Teachers pointed out that all students can access the Internet from school (and most can access outside of school) with the school-provided laptops. Teachers are pleased to see the program “evens the playing field” for all.

Individualized learning. Trilling and Fadel (2009) pointed out that 21st century learning should no longer be centered around the teacher, or the “sage on the stage.” Instead, today’s classroom is more student-centered and personalized. Individualized learning is also central to the constructivist model of learning. Most teachers in this study said it is important to use technology to address different learning styles and needs

(Survey Question 22). Interviews and open-response questions on the survey indicated that many teachers find the one-to-one program allows for greater differentiation and accommodations for students with special needs.

Communication. Asked in interviews to tell how students benefit from the one-to-one program, teachers said that it is easier now that all students have laptops to communicate regarding what students missed while absent from class. Although teachers perceived communication to be a benefit, they did not indicate that meaningful communication was taking place.

Engagement. More than nine of 10 teachers agreed with the statement, “I use technology to regularly engage my students in learning” (Survey Question 23). Teachers did not specify in interviews that students were more engaged when using laptops; however, they did talk about ways in which students use laptops that one might consider to be more engaging, such as participating in online learning games.

Drill and practice. A constructivist learning environment does not center around memorized facts or processes; however, teachers frequently mentioned websites or software that can engage students in practicing or reviewing content. Teachers perceived this practice or review to be a benefit of the laptop program.

Future ready. Preparing students for the 21st century workplace was a focus of the 2001 No Child Left Behind Act, and it certainly has been a goal of every one-to-one laptop program implemented. The survey in this study did not specifically ask teachers whether the one-to-one program prepares students for college and careers in which they will utilize 21st century skills; however, in interviews and in response to Survey Question 40 that asked teachers to list benefits of the program, teachers mentioned that the program prepares students for higher education or future careers. Teacher 5 said, “This is

definitely the 21st century model.”

Challenges come with any new program implementation. Survey Question 41 asked teachers to list any challenges they have experienced while integrating technology into instruction. Ten teachers were also asked during an interview to give suggestions for improving the program. The third research question for this study was, “What challenges do teachers perceive in implementing technology into instruction in ways that promote 21st century learning skills?”

Student distraction. The challenge listed most in response to Survey Question 41 was student distraction by laptops. Teachers said students were often off task by attempting to play games or listen to music on the laptops. Teachers also pointed out that the software installed on teacher computers to monitor student screens often does not work properly. Without effective monitoring software, it can be very difficult for a teacher to keep students on task.

Reliability. Although more than 95% of respondents to Survey Question 25 said the available technology functions adequately, more than a quarter of respondents to Survey Question 41 listed unreliable technology as a challenge. Most of the survey and interview responses pointed to problems with WiFi; however, teachers also said the recently purchased Android Active Panels were not compatible with the student and teacher MacBooks.

Training. Nine of 10 teachers reported they had been adequately trained to use the technology in the classroom; however, some teachers found it challenging to adapt what they had learned to their own content area in meaningful ways. The researcher suggests the district provide more content-specific technology training to enhance teacher promotion of deeper learning through 21st century skills.

Traditional is better. Young (2012) found, “most teachers use technology as a teaching tool or as an organizational tool rather than as a way for students to create, problem solve, and think critically” (p. 5). Some teachers in this study suggested they sometimes prefer traditional learning to that which integrates technology. One teacher wrote in response to Survey Question 41, “Sometimes it’s just much easier and needed to give them a practice sheet so they can improve their skills.” Other teachers pointed out that a laptop is simply a tool and not the “end-all-be-all”; however, the district has invested a lot of money and time into helping teachers integrate technology, and it is expected that teachers will limit the traditional paper and pencil, teacher-centered approach in favor of a technology-rich, student-centered (constructivist) form of pedagogy.

Plagiarism. Teachers said that students cheat or plagiarize more often with laptops. As one teacher said, “Thinking can get lost in the copy and paste world of technology.” Teachers also said that the software installed on teacher laptops for monitoring student computers does not always function properly. Improved monitoring software might also lessen student distractions, as teachers could monitor any off-task behaviors more effectively.

To triangulate the data in this mixed-methods study, the researcher interviewed 10 students. Students were asked the same three questions regarding use, benefits, and suggestions that teachers were asked in interviews. The fourth research question was, “To what extent do student perceptions of laptop computer integration differ from the reported perceptions of teachers?” The researcher noted that students tended to give much shorter responses than teachers. Teachers were also more positive than students about the one-to-one program.

Interview Question 1. Teachers and students were asked in what ways students use laptops in the classroom. Teachers listed many ways students use laptops that students did not list including, translation, listening activities, Skype, Excel, video-recording, taking photos, watching videos, and virtual tours. Most of these activities can only be done with technology; however, nine of 10 students said they submit digital assignments on their laptops that would have been done on paper before the one-to-one program was implemented.

Five of 10 teachers said students use laptops for note-taking. While this was the most often mentioned use by teachers, only one student said he or she took notes on the laptop. The same number of teachers and students mentioned using laptops to access information (three). Teachers responding to the survey also noted that students often access information with laptops.

Interview Question 2. The second interview question asked how students benefit from having a school-issued laptop. Students perceived the greatest benefit to be instant access to information in class, as opposed to going to the library or to a computer lab. Only two teachers mentioned this benefit in interviews. Teachers said students benefitted most from websites and software pertaining to remediation. None of the students mentioned remediation as a benefit to laptops. Perhaps students do not enjoy the software or websites used for remediation and therefore do not consider them to be beneficial. Five of 10 teachers interviewed also said students benefit from equal access to technology; however, none of the students mentioned this benefit. The difference in teacher and student responses regarding equality may be due to the fact that teachers instruct students of diverse backgrounds in different courses. Students who were interviewed for this study may not have experienced or associated with students of a

lower socioeconomic status and therefore may not have considered that other students would not otherwise have access to a laptop computer.

Interview question three. With any newer program, there may be room for improvement. Therefore, the third interview question was, “Do you have any suggestions for improving the laptop program?” Four of 10 students and one teacher discussed the frustration of the district’s cyber patrol software blocking websites that are beneficial to student learning. Other suggestions by teachers were improve the computer monitoring software, improve the WiFi capability, install charging stations for student laptops, and only purchase technology that uses the same platform. Two teachers and one student suggested that students take assessments on paper, because they found that more students cheated with online assessments.

Three students and two teachers said they had no suggestions for improvement. Most of the teachers and students who were interviewed seemed to have very positive perceptions of the one-to-one program at this high school.

Limitations

This study was limited to the 86 teachers from one urban high school in the southeastern United States who responded to an emailed survey, the 10 teachers of those 86 who offered to be interviewed at the end of the survey, and 10 students from the same high school whose parents agreed for their children to be interviewed. The 10 student participants were all students the researcher knew before the study. The researcher teaches in the same district where the study took place, so she also knew some of the teachers whom she interviewed. A disproportionate number of foreign language teachers offered to be interviewed, no doubt because the researcher is a foreign language teacher. The survey data can only be related to the high school from which the data were

gathered. The interview responses from the 10 teachers and 10 students who were interviewed may not be generalized to represent the entire faculty and student body at the site of the study, as the study was limited to the first 10 who agreed and signed permission forms to be interviewed. The findings may also be limited by the accuracy of participant responses. The adult participants were more responsive than the student participants. Students' less detailed responses limited the researcher's ability to triangulate the data in this mixed-methods study.

Recommendations for the Research Site

Based on responses to the survey and interviews, the researcher recommends the district provide technology training for teachers that is specific to their content areas and emphasizes a more constructivist learning environment while promoting student acquisition of 21st century learning skills.

Recommendations for Future Research

While collecting data for this study, it became apparent to the researcher that teachers of some subjects may promote student acquisition of 21st century skills more than others. The researcher suggests a similar study be conducted at multiple schools in which results are categorized by teacher content areas. Based on these results, school districts could better understand how to focus technology training for their teachers.

Another approach might be to interview students 4 years or more after high school graduation to ascertain whether they feel as though the one-to-one program prepared them adequately for college or careers. From this data, school districts could gauge the effectiveness of their programs and make changes accordingly.

Final Conclusions

Most teachers at this site found the one-to-one program to be beneficial –

particularly to students who would not otherwise have access to a laptop computer.

Teachers reported that most students possessed basic computer skills and were more organized with laptops. Communication between students and teachers increased with the one-to-one program. Though most teachers in this one-to-one laptop program did not describe a constructivist, student-centered learning environment, some teachers were able to use technology to effectively promote creativity, critical thinking, and collaboration. Fostering these skills in students is crucial and deserves more attention in teacher training.

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Appendix A

Teacher Survey

Dear Educator:

My name is Laura Brooks. I am a teacher in this district and a doctoral student at Gardner-Webb University. Please assist me in fulfilling the requirements for a doctor of education degree by responding to a five-minute survey about 21st century learning in a one-to-one program.

As a teacher in this district, you have first-hand knowledge of teaching in a one-to-one school. Because teachers are so integral to the implementation of a one-to-one program, I feel it is important to ask about how you perceive technology integration.

Your responses are completely confidential and anonymous. Because your responses will remain anonymous, there are no anticipated risks to responding to this survey. However, participation is completely voluntary and you may choose to opt out of the survey at any time.

If you choose not to respond to the survey, simply delete this email. If you choose to participate in the survey, please click on the link below.

Thank you for your consideration in assisting me with this important research.

INSERT WEB ADDRESS HERE

You are being asked to participate in the following survey because the researcher is interested in teachers' perceptions of 21st century learning skills, such as critical thinking, collaboration, communication, and creativity in a one-to-one environment. Your input is very valuable. As this district continues in its 5th year of laptop implementation, your feedback will guide the program and identify key successes and areas for growth.

Thank you for your time.

1. At the end of this school year, I will have ____ years of teaching experience.
 - 0-4
 - 5-9
 - 10-14
 - 15-20
 - 20+

2. I am _____.

- male
- female

3. I primarily teach:

- Agriculture
- Business
- English/language arts
- Family/Consumer science
- Foreign language
- Health/PE
- Mathematics
- JROTC
- Science
- Social studies
- Technology education
- Visual/performing arts
- Other (please specify)

- How often do you incorporate the following activities in your classroom:
(never/ rarely/ sometimes/ often/ always)

4. lecture
5. discussion
6. memorization exercises
7. drill and practice assignments
8. in-class research (using laptops)
9. in-class reading (using laptops)
10. in-class writing (using laptops)
11. problem-solving (using laptops)
12. data analysis (using laptops)
13. creating an original product (using laptops)

- How often do your students use laptops for the following activities?
(never/ rarely/ sometimes/ often/ always)

14. note-taking
15. file storage
16. homework completion
17. in-class assignment completion
18. finding information
19. other (please specify)

- Choose your opinion on the following statements:
(no opinion/ strongly disagree/ disagree/ agree/ strongly agree)

20. My students are learning basic technology skills.
 21. My students are using school-issued laptops to organize themselves.
 22. It is important for me to use technology to address different learning styles and needs.
 23. I use technology regularly to engage my students in learning.
 24. There is an adequate amount of technology in my classroom.
 25. The available technology functions adequately.
 26. I have been adequately trained to use technology in the classroom.
- How often do you utilize technology to employ the following teaching techniques with students in your classroom?
(never/ sometimes/ often/ very often/ always)
27. Communication
 28. Creative expression
 29. Working with others (collaboration)
 30. Research
 31. Analyzing and problem-solving
 32. Evaluating online resources
- How experienced are your students in using laptops for the following areas?
(no opinion/ not experienced/ somewhat experienced / experienced/ very experienced)
33. Communication
 34. Creative expression
 35. Working with others (collaboration)
 36. Research
 37. Analyzing and problem-solving
 38. Evaluating online resources
 39. Using technology skills in general
40. In what ways do you think students benefit from a one-to-one learning environment?
 41. What challenges, if any, have you experienced while implementing technology into instruction?
 42. Please provide your email address in the box below if you are willing to participate in a 15-minute interview regarding your perceptions of the 1:1 program. Your email address will NOT be associated with any of your previous responses and your anonymity will be retained in interviews, as well.

Appendix B

Teacher Interview Prompt

1. In what way(s) do you incorporate laptops into your lessons?
2. How do you think students benefit from the one-to-one program?
3. What suggestions do you have for improving the laptop program?

Appendix C

Student Interview Prompt

1. What kinds of things do your teachers ask you to do with your laptop in classes?
2. In what way(s) do you find that you benefit from having a school-issued laptop?
3. Do you have any suggestions for improving the laptop program?