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## **An Analysis of the Correlation between ACT Scores and One-to-One Computing**

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The University of Southern Mississippi

AN ANALYSIS OF THE CORRELATION BETWEEN ACT SCORES  
AND ONE-TO-ONE COMPUTING

by

Jeffrey Brian Heath

Abstract of a Dissertation  
Submitted to the Graduate School  
of The University of Southern Mississippi  
in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy

August 2015

## ABSTRACT

### AN ANALYSIS OF THE CORRELATION BETWEEN ACT SCORES AND ONE-TO-ONE COMPUTING

by Jeffrey Brian Heath

August 2015

This study examined whether a relationship exists between one-to-one computing and student achievement, specifically ACT scores. This study also examined whether relationships exist among teachers' perceptions of one-to-one computing, teachers' years of experience, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. The results of this study could help policymakers and educators with decisions regarding implementation of one-to-one computing programs.

The sample of schools for investigating the relationship between one-to-one computing and ACT scores consisted of 33 secondary public schools with one-to-one computing programs located in school districts from multiple states in the United States. There were 122 teachers from 12 secondary public schools with one-to-one computing programs located in school districts from multiple states in the United States who participated in a survey regarding teachers' perceptions of one-to-one computing.

Prior to the implementation of one-to-one computing and the corresponding tests in the same schools, the average student ACT composite scores and ACT subtest scores in English, math, and reading were not statistically different from what they are after two years of implementation. A statistically significant difference was found between the average student ACT subtest scores in science in schools one year prior to implementing

one-to-one computing and the average student ACT subtest scores in science in the same schools two years after implementing one-to-one computing. A statistically significant difference was not found between the average change in student ACT composite score and ACT subtest scores in the state and the average change in student ACT composite score and ACT subtest scores in schools with two years of experience in implementing one-to-one computing. A statistically significant relationship was not found among teachers' perceptions of one-to-one computing, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. A modest significant inverse relationship was found between teachers' perceptions of one-to-one computing and teachers' years of experience. As teachers' years of experience increase, their perceptions of one-to-one computing tend to become less positive.

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A Dissertation  
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August 2015

## DEDICATION

This work is dedicated to my parents, Gene and Brenda Huffstutler. The encouragement and support they have given me throughout my educational career and the process of completing this dissertation have been invaluable. I love you both very much.

A very special thank you goes to my wife Jennifer, and my daughters, Madelyn and Wesley Kate. Their support, patience, and understanding throughout the lengthy process of completing this dissertation were greatly appreciated. I love the three of you very much.

Finally, but most importantly, I would like to thank God. Without His strength and confidence in me, I would not have been able to complete this dissertation. I hope that this dissertation will in some way glorify His name.

## ACKNOWLEDGMENTS

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## CHAPTER I

### INTRODUCTION

The purpose of this chapter is to introduce the study and to provide the reader with information regarding the growing trend of implementing one-to-one computing programs in public schools. The chapter further introduces the use of ACT (American College Testing) (ACT) scores as a measure of student achievement for purposes of conducting this research. The chapter addresses the integration of technology into the classroom. This chapter provides the reader with information regarding the importance of teachers' perceptions of one-to-one computing. Included in this chapter are the statement of the problem, the research questions regarding average student ACT scores in schools before and after implementation of a one-to-one computing program, and the research questions regarding teachers' perceptions of one-to-one computing. Also included in this chapter are the delimitations, assumptions, definitions of terms, and justification for the study.

One purpose of this study was to examine the impact of one-to-one computing innovations on student achievement. The other purposes of this study were to investigate the relationships among teachers' perceptions of one-to-one computing, teachers' years of experience, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. The variables were average ACT composite scores and subtest scores in schools one year prior to implementing one-to-one computing, average ACT composite scores and subtest scores in the same schools two years after implementing a one-to-one computing program, teachers' years of experience, subject taught by the teacher, teachers' skill level in the use

of a computer for instruction, teachers' perceptions of one-to-one computing, and teachers' perceived changes in ACT scores. Archival data from the annual ACT Profile Report provided to high schools were used to determine average ACT scores in schools implementing one-to-one computing. A survey instrument was used to acquire demographic data and determine teachers' perceptions of one-to-one computing.

In 1983, the national student-to-computer ratio in public schools in the United States was 125:1 (Bebell & Kay, 2010). In 2002, the number of computers per student increased and the student-to-computer ratio became 4:1 (Bebell & Kay, 2010). By 2007, in at least 33 states, that ratio became 1:1 as schools adopted a practice of providing a computer to each student (Abell, 2008). Such "one-to-one computing" initiatives have been implemented in a variety of settings nationwide, including large-scale initiatives in California, Florida, Georgia, Kansas, Louisiana, Maine, Massachusetts, Michigan, New Hampshire, Pennsylvania, South Dakota, Texas, and Virginia (Bebell & Kay, 2010). In many cases, the primary goal of these one-to-one computing initiatives is to increase student achievement (Abell, 2008).

The ACT is a nationwide assessment at the secondary level considered to be a good predictor for grade point averages of college freshmen (Coyle & Pillow, 2008). It is one of the most frequently used nationwide assessments and "purports to closely parallel high school curriculum and to measure the preparedness of the test-taker for more advanced education" (Koenig, Frey, & Detterman, 2008, p. 153). The ACT is commonly used by colleges and universities in admission decisions (Atkinson & Geiser, 2009). One goal of the ACT is to "align teaching, learning, and assessment" (Atkinson & Geiser,

2009, p. 668). This study investigated the relationship between one-to-one computing and ACT scores.

It is found that “learners have simply grown accustomed to acquiring information and communicating by utilizing technology-based methods” (Devlin, Feldhaus, & Bentrem, 2013, p. 35). For example, video games “provide kids with immediate feedback, which helps them with decision making” (Trybus & November, 2013, p. 12). This is certainly not to suggest that students should play video games constantly in the classroom environment as a substitute for learning. However, technology can enhance teaching and learning (Pellegrino & Quellmalz, 2010), and teachers can learn from the fact that students are motivated by activities such as video games because students consider them “fun, challenging, and competitive” (Petkov & Rogers, 2011, p. 10). Teachers can take the strategies and qualities that motivate students to play video games and incorporate them into instruction involving the use of technology when implementing a one-to-one computing program. Students who are surrounded by technology outside of the school day are simply not motivated or engaged by a “static teacher-centered environment where the students act as receivers of information from a single source” (Sabzian, Gilakjani, & Sodouri, 2013, p. 685).

Teaching should be “based on students’ questions rather than on teachers’ knowledge” (Trybus & November, 2013, p. 10). Technology helps to promote a shift from the time-based classroom, which is a construct that bases classroom organization around the amount of time in a class period and the amount of instructional days in a school year, to the outcome-based classroom, which is a construct that bases classroom organization around student performance (Devlin et al., 2013). Technology enables

transition from a passive learning environment, which is a construct based on students receiving information from lecturing instructors and repeating that information on examinations without fully understanding the information, to the active learning environment, which is a construct based on students receiving information from multiple sources and comprehending, analyzing, and applying that information (Devlin et al., 2013). Technology further supports evolution from a teacher-centered classroom characterized by teachers delivering information while students exclusively listen, to a student-centered classroom characterized by students and teachers sharing the focus and interacting equally (Devlin et al., 2013). Technology can increase student engagement, student motivation, and lead to increased collaboration among students and teachers and to increased student achievement (Sabzian et al., 2013). Research has shown that students have greater access to information and they spend more time working on homework in digital formats than is the case when they prepare paper and pencil submissions (Devlin et al., 2013). Students only have access to their teacher during the school day, whereas they can access information any time of day or night with Internet access. Internet access gives students the ability to prepare in advance for future lessons and increases their capacity to do independent research.

Teachers also have a responsibility “to prepare students for the society in which they will work and live” (Kaufman, 2013, p. 79). In addition to providing content knowledge, teachers should also ensure that students possess information, media, and technology skills (Larson & Miller, 2011). This includes skills in digital citizenship, technology operations, and technology concepts (Larson & Miller, 2011). Many of the jobs available to students, even those considered as entry level, are in “highly

technological work environments” (Malyn-Smith & Smith, 2013, p. 35). For example, in the past, to work as a clerk in a medical office an individual would need the skills necessary to file paper records in filing cabinets. In 2014, that same position requires an individual to be able to operate a computer and navigate electronic databases. In the past, an auto mechanic worked with mechanical tools. In 2014, auto mechanics are required to also operate computer-based diagnostic systems when evaluating automobile problems.

This study also investigated teachers’ perceptions of one-to-one computing. Despite the potential benefits of technology in education, not all teachers embrace the use of technology in their classrooms (Holcomb, 2009). Some teachers avoid technology because they do not view themselves as being technologically literate. Such perceptions can affect learning and achievement in schools that are implementing one-to-one computing (Maninger & Holden, 2009). Technology sometimes “has the ability to confuse, intimidate, and frustrate teachers” (Cavanaugh, Dawson, & Ritzhaupt, 2011, p. 362). Teachers’ initial perceptions of technology are directly connected to changes in their classroom practices where technology is concerned (Maninger & Holden, 2009). A teacher’s own level of comfort with one-to-one computing, which includes whether or not a teacher feels “comfortable and confident with the technology at hand” (Holcomb, 2009, p. 53), can lead to success or failure of a school’s one-to-one computing initiative (Avidov-Ungar & Eshet-Alkay, 2011). Devlin et al. (2013) found a relationship between positive student outcomes and teachers who were viewed as “effective users of technology” (p. 36) by their students. Teachers who positively perceive computer use in the classroom tend to integrate one-to-one computing into their instruction and assignments more frequently (Maninger & Holden, 2009). Technology integration in a



school is more successful when the teacher has “the ability to use, manage, assess, and understand technology” (Devlin et al., 2013, p. 35) and he/she possesses a positive attitude towards the integration of technology into the classroom environment (Holcomb, Brown, & Lima, 2010).

### Statement of the Problem

One-to-one computing programs are becoming more popular among policymakers as there are already large-scale initiatives in California, Florida, Georgia, Kansas, Louisiana, Maine, Massachusetts, Michigan, New Hampshire, Pennsylvania, South Dakota, Texas, and Virginia (Bebell & Kay, 2010). In many cases, the successes or failures of these one-to-one computing programs are based on their relationship to student achievement (Abell, 2008). However, more research is needed to determine connections between one-to-one computing and student achievement. In addition, teachers’ perceptions of technology, specifically one-to-one computing programs, can influence the success or failure of one-to-one computing programs (Drayton, Falk, Stroud, Hobbs, & Hammerman, 2010). Research is needed to determine whether there is a relationship between teachers’ perceptions of one-to-one computing and the subjects that they teach, the number of years that they have been teaching, and their skill level in the use of computers for instruction.

### Research Questions

The following are specific research questions that were addressed by this study:

1. What are the average student ACT composite scores in schools one year prior to implementing one-to-one computing and the average student ACT

composite scores in the same schools two years after implementing one-to-one computing?

2. What are the perceptions of teachers regarding one-to-one computing programs?
3. Is there a difference between the average student ACT composite score in schools one year prior to implementing one-to-one computing and the average student ACT composite score in the same schools two years after implementing one-to-one computing?
4. Is there a difference between average student ACT subtest scores in English, mathematics, reading, and science in schools one year prior to implementing one-to-one computing and average student ACT subtest scores in English, mathematics, reading, and science in schools two years after implementing one-to-one computing?
5. Is there a difference between the average change in student ACT composite score in the state and the average change in student ACT composite score in schools with two years of experience in implementing one-to-one computing?
6. Is there a difference between the average change in student ACT subtest scores in English, mathematics, reading, and science in the state and the average change in student ACT subtest scores in English, mathematics, reading, and science in schools with two years of experience in implementing one-to-one computing?
7. Is there a relationship between teachers' perceptions of one-to-one computing and teachers' years of experience?

8. Are there differences among teachers' perceptions of one-to-one computing, depending on subject taught?
9. Is there a relationship between teachers' perceptions of one-to-one computing and teachers' skill level in the use of a computer for instruction?
10. Is there a relationship between teachers' perceptions of one-to-one computing and teachers' perceptions of changes in ACT scores?

#### Delimitations

This study was limited to a convenience sample of 33 secondary public schools with one-to-one computing programs located in school districts from multiple states in the United States. For the purpose of this study, the term one-to-one computing was delimited to the following definition: an educational initiative in which a school issues every student and teacher a computer laptop or tablet for use at school and at home every day throughout the school year. Schools selected to participate in this study had to have first implemented a one-to-one computing program no earlier than the 2003-2004 school year and no later than the 2012-2013 school year and had to have an active one-to-one computing program in the 2014-2015 school year. In addition, schools selected to participate in the study had not discontinued the one-to-one computing program at any point since it was first implemented. The researcher ascertained whether renorming of ACT scores had occurred during the implementation time frame for any participating schools and, if necessary, use adjusted scores from equating studies to ensure the use of comparable data. Student achievement was measured by average ACT scores obtained for each of the 33 participating secondary schools for the year prior to implementing a

one-to-one computing program and two years after implementing the one-to-one computing program.

Survey methodology was used to determine teachers' perceptions of one-to-one computing, using the Mitchell Institute survey instrument. Senator George Mitchell from Maine established the Mitchell Institute in 1999. The research conducted through the Mitchell Institute provides "data to inform policymakers and public opinion about college enrollment, persistence, and completion in Maine, and policies and practices that can expand Maine students' access to and success in college" (Mitchell Institute, 2014, para. 1).

#### Assumptions

Several assumptions were made in this study.

1. It is assumed that ACT scores retrieved from ACT Profile Reports provided by ACT to participating schools are accurate and complete.
2. It is assumed that school districts correctly self-identified schools with one-to-one computing programs consistent with the definition that one-to-one computing refers to an educational initiative where a school issues every student and teacher a computer laptop or tablet for use at school and at home every day throughout the school year.
3. It is assumed that the participants completed surveys accurately and honestly and that the results reflect their actual perceptions of one-to-one computing.

## Definition of Terms

The following are specific definitions that applied to this study:

*Active Learning Environment:* “Active learning is a process whereby students engage in activities, such as reading, writing, discussion, or problem solving that promote analysis, synthesis, and evaluation of class content” (Center for Research on Learning and Teaching, 2014, para. 1).

*American College Testing (ACT):* The ACT college readiness assessment is a “curriculum- and standards-based educational and career planning tool that assesses students’ academic readiness for college” (ACT, 2014, para. 1). This assessment consists of four multiple-choice tests: English, Mathematics, Reading, and Science (ACT, 2014). This assessment is a “capstone of the ACT’s College and Career Readiness System” (ACT, 2014, para. 2) and is used as an admission criterion for many colleges and universities (ACT, 2014).

*Computer:* For the purpose of this study, computer refers to a laptop computer or a tablet computer.

*Digital Citizenship:* Digital citizenship is defined as “the norms of behavior with regard to technology use” (Microsoft, 2014, para. 1). “It encompasses digital literacy, ethics, etiquette, online safety, norms, rights, culture and more” (Microsoft, 2014, para. 1).

*One-to-One Computing:* For the purpose of this study, one-to-one computing refers to an educational initiative in which a school issues every student and teacher a computer laptop or tablet for use at school and at home every day throughout the school year.

*Outcome-Based Classroom:* For the purpose of this study, outcome-based classroom refers to a classroom organized around student performance.

*Passive Learning Environment:* For the purpose of this study, passive learning refers to a process whereby students receive information from lecturing instructors without receiving any feedback and repeat that information on examinations. Students may or may not fully understand the information.

*Secondary School:* For the purpose of this study, secondary school refers to a school serving students in grades 9 through 12.

*Student Achievement:* For the purpose of this study, student achievement was measured by the ACT assessment. Specifically, this study used the average ACT composite score and average ACT subtest scores for each participating school one year prior to implementing a one-to-one computing initiative and the ACT assessment given two years after implementing a one-to-one computing initiative.

*Student-Centered Classroom:* In student-centered classrooms, “students and instructors share the focus” (Concordia University-Portland, 2014, para. 5). “Instead of listening to the teacher exclusively, students and teachers interact equally. Group work is encouraged, and students learn to collaborate and communicate with one another” (Concordia University-Portland, 2014, para. 5).

*Teacher-Centered Classroom:* In teacher-centered classrooms, “students put all of their focus on the teacher” (Concordia University-Portland, 2014, para. 2). “The teacher talks, while the students exclusively listen. During activities, students work alone, and collaboration is discouraged” (Concordia University-Portland, 2014, para. 2).

*Teachers' Perceptions of Technology:* For the purpose of this study, teachers' perceptions of technology refers to teachers' perceptions of one-to-one computing as measured by the Mitchell Institute survey instrument.

*Technology Integration:* "Technology integration is a process in which computers and other technologies are used as tools to support the task of learning" (Keengwe, Pearson, & Smart, 2009, p. 334). This process involves "establishing the best ways to incorporate education technology into the curriculum as teaching tools" (Keengwe et al., 2009, p. 334).

*Time-Based Classroom:* For the purpose of this study, time-based classroom refers to a classroom organized around the amount of time in a class period and the amount of instructional days in a school year.

#### Justification

In many cases, the primary goal of a one-to-one computing initiative is increased student achievement (Abell, 2008). This study is important because more research is needed to determine the connection between technology use, specifically one-to-one computing, and student achievement (Abell, 2008). Studies of one-to-one computing programs have addressed student achievement, but the results to date have been inconclusive (Baker, Lusk, & Neuhauser, 2012). The Berkshire Wireless Initiative sought to improve teaching and learning and enhance student achievement as measured by test data from The Massachusetts Comprehensive Assessment System (Bebell & Kay, 2010). The data showed increases in student achievement due to implementation of the Berkshire Wireless Initiative in English Language Arts and writing but not in Math (Bebell & Kay, 2010).

The goal of the Texas Technology Immersion Project was to “increase the academic progress of students by immersing campuses in technologies that are directly linked to the enterprise of teaching and learning” (Abell, 2008, p. 7). Student academic progress was measured by results from the Texas Assessment of Knowledge and Skills (TAKS) (Abell, 2008). The Texas Technology Immersion Project “had a significant effect on TAKS mathematics scores” (Abell, 2008, p. 9) and these positive effects “became stronger over time” (Abell, 2008, p. 9). However, the Texas Technology Immersion Project “had no statistically significant effects on students’ TAKS reading scores and the effects on social studies, science, and writing scores are inconclusive” (Abell, 2008, p. 9).

The Maine Learning Technology Initiative sought to “transform Maine into the premier state for utilizing technology” (Abell, 2008, p. 3). In addition, the Maine Learning Technology Initiative sought to enhance student achievement as measured by test data from the Maine Education Assessment (Abell, 2008). The test data from the Maine Education Assessment showed that, “with the exception of writing, there was no appreciable change in Maine Education Assessment (MEA) scores since the inception of the laptop program” (Abell, 2008, p. 4).

The goal of the Henrico County Public Schools iBook Teaching and Learning Initiative was to “vastly improve technology usage in the school system” and enhance student achievement as measured by test data from the Virginia Standards of Learning tests (Abell, 2008, p. 11). The test data from the Virginia Standards of Learning tests showed that “Students who used laptops the most frequently had significantly higher scores on Virginia’s Standards of Learning (SOL) tests in World History, Biology,



Reading, and Chemistry” (Abell, 2008, p. 12). However, “students who used laptops the most frequently had significantly lower scores in Algebra I & II and Writing” (Abell, 2008, p. 12).

This present study extends the existing body of knowledge by adding an investigation of one-to-one computing that includes ACT composite scores and subtest scores while also investigating teachers’ perceptions of one-to-one computing. Existing research measures the success of one-to-one computing programs by examining results on statewide assessments (Abell, 2008; Bebell & Kay, 2010). This study examined the impact of one-to-one computing innovations on student achievement as measured by results on the ACT, which is an assessment across states. In addition, parents connect ACT scores with college readiness and college scholarships and may support or oppose one-to-one computing programs depending on the relationship between ACT composite scores before and after implementation of one-to-one computing programs (Adams, 2011).

One-to-one computing programs are very expensive, and policymakers want to be sure that these programs directly enhance learning and lead directly to higher test scores (Herold, 2013b). Teachers are more likely to embrace the implementation of a one-to-one computing program if they feel that the technology enhances the instructional process and enhances student achievement (Maninger & Holden, 2009). Students are more likely to embrace the implementation of a one-to-one computing program if they believe that the technology makes their work more efficient and enhances the learning process (Sabzian et al., 2013).

## Summary

This chapter described the purposes of this study. The primary purpose of this study is to compare average ACT scores in schools one year prior to implementing a one-to-one computing program and average ACT scores in the same schools two years after implementing a one-to-one computing program. The other purposes of this study were to investigate the relationships among teachers' perceptions of one-to-one computing and teachers' years of experience, the subject taught by the teacher, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of perceived changes in ACT scores.

The national student-to-computer ratio in public schools in the United States has gone from 125:1 in 1983 to 1:1 in 33 states in 2007 (Abell, 2008; Bebell & Kay, 2010). This trend has led to one-to-one computing programs in which students and teachers have access to a school-issued computer not only at school but also at home, throughout the school year. However, further research is needed to determine the relationship between one-to-one computing and student achievement.

## CHAPTER II

### REVIEW OF RELATED LITERATURE

As the number of computers available to teachers and students in the United States increases, school districts continue to implement one-to-one computing programs (Abell, 2008; Bebell & Kay, 2010; Mason, 2013; Prettyman, Ward, Jauk, & Awad, 2012; “3 Different Ways,” 2014). Some school districts have reported successful implementation of one-to-one computing programs and increases in student achievement (Abell, 2008; Bebell & Kay, 2010; Edwards, Smith, & Wirt, 2012; Gulek & Demirtas, 2005; Silvernail, 2008). However, some school districts have reported problems with the implementation of one-to-one computing programs and inconclusive results when it comes to student achievement (Grimes, 2008; O’Donovan, 2009).

The purpose of this chapter is to provide the reader with context for the study and the theoretical framework for the study. The chapter further provides background on the history of technology in education, one-to-one computing, teachers’ perceptions of one-to-one computing, and the ACT as a measure of student achievement. This chapter also discusses implementation challenges for one-to-one computing programs and student and teacher attributes as they relate to the successful implementation of one-to-one computing programs. This chapter contains a review of literature describing one-to-one computing, teacher attributes, and student achievement.

#### Context for the Study

Superintendents and educators in general are under constant pressure to increase student achievement (Meddaugh, 2014). However, school districts are implementing more rigorous curriculum standards; and the assessment of students is becoming more

rigorous (Darling-Hammond, Wilhoit, & Pittenger, 2014; Dietel, 2012; Willhoft, 2013). These standards require higher order processes for analyzing, applying, synthesizing, and using information (Jones & King, 2012; Neuman & Roskos, 2013). There is also an increased emphasis on college and career readiness (E. Cook, 2013; Darling-Hammond et al., 2014). The ACT is one of the most frequently used nationwide assessments to measure college readiness (Koenig et al., 2008).

Some educators report that technology integration can increase student achievement. Student achievement, often measured by results on standardized tests, is addressed in the No Child Left Behind Act of 2001, which states that educators must “increase the achievement of all students” (Meddaugh, 2014, p. 147). Most school districts are choosing between a bring-your-own-device (BYOD) policy and district funded one-to-one computing when it comes to technology integration. BYOD programs are more cost-effective for school districts, because the school district is only responsible for the cost and maintenance of the infrastructure and not the devices themselves (Cristol, 2014). However, BYOD policies can potentially “widen the already significant tech gap for lower income students” (Bruder, 2014, p. 15; Warschauer et al., 2014). One-to-one computing programs are expensive, but they provide a device to every student (G. Cook, 2014; LaFee, 2012; “LAUSD Adds Six Laptops,” 2014; Livingston, 2007; McLester, 2011). Schools implementing one-to-one computing have demonstrated increased student achievement in some areas (Lowther, Ross, & Morrison, 2003; McLester, 2011; Safar, 2012; Spektor-Levy & Granot-Gilat, 2012; Rosen & Beck-Hill, 2012).

## Theoretical Framework

John Dewey's Theory of Inquiry espouses that learning should be based on experience (Bruce & Levin, 1997; Dewey, 1938; Harris, 2014; Hohn, 2013). Dewey's Theory of Inquiry involves both scientific inquiry and common-sense inquiry (Dewey, 1938; Harris, 2014). Common-sense inquiry focuses on end results, and scientific inquiry focuses on the process used to obtain end results (Dewey, 1938; Harris, 2014). This section of the literature review explores one-to-one computing as a means for inquiry and experiential learning. In addition, this section of the literature review explores teachers' perceptions of one-to-one computing as it relates to pedagogical theory. Pedagogy is "both the act of teaching and its contingent theories and debates" (Schweisfurth, 2015, p. 261). Specifically, this section of the literature review explores constructivist pedagogy.

Constructivist pedagogy is founded on the premise of creating knowledge in learning environments supported by active learning, reflective learning, creation of authentic tasks, contextual learning, and collaborative learning. Constructivist teachers view learning as an active, group-oriented process in which learners construct an understanding of knowledge that could be utilized in problem-solving situations. This pedagogical approach requires integration of various technologies with active learning while allowing teachers to act as guiding partners. (Keengwe et al., 2009, p. 335)

When utilized properly by teachers during instruction, technology can be an effective learning tool (Wang, Kinzie, & McGuire, 2010). Specifically, when computers are used by students as a learning tool, they can "enhance *how* children learn by

supporting four fundamental characteristics of learning: (a) active engagement, (b) participation in groups, (c) frequent interaction and feedback, and (d) connections to real-world contexts” (Mouza, 2008, p. 449). John Dewey proposed that the natural impulses of a child are “inquiry, communication, construction, and expression” (Lei & Zhao, 2008, p. 102). Consequently, Bertram Bruce and James Levin proposed taxonomy of technology to enhance the learning process (Lei & Zhao, 2008). This taxonomy of technology is comprised of four categories that Bruce and Levin (1997) entitled media for construction, media for expression, media for inquiry, and media for communication.

Media for construction can consist of robotic engineering, computer-aided design, and the creation of graphs and charts (Bruce & Levin, 1997). Media for expression can consist of utilizing graphic design software, utilizing animation software, and creating multimedia projects (Bruce & Levin, 1997). Media for inquiry is comprised of four sub-categories that Bruce and Levin entitled theory building, data access, data collection, and data analysis (Bruce & Levin, 1997). Theory building can consist of utilizing software to visualize information and modeling data (Bruce & Levin, 1997). Data access can consist of utilizing digital libraries and databases to obtain and organize information (Bruce & Levin, 1997). Data collection can consist of utilizing sensors to measure temperature, heart rate, etc.; recording sound and video; and creating and conducting surveys (Bruce & Levin, 1997). Data analysis can consist of utilizing spreadsheets and analyzing statistics (Bruce & Levin, 1997).

Media for communication is comprised of four sub-categories that Bruce and Levin (1997) entitled document preparation, communication, collaborative media, and teaching media. Document preparation can consist of creating outlines and utilizing

word processing software and desktop publishing software to create documents (Bruce & Levin, 1997). Communication can consist of utilizing email, video conferencing, and the Internet to communicate (Bruce & Levin, 1997). Collaborative media can consist of group decision-making and the creation of shared documents (Bruce & Levin, 1997). Teaching media can consist of utilizing tutorial programs and simulation tools (Bruce & Levin, 1997).

Lei and Zhao (2008) modified Bruce and Levin's taxonomy into the following categories:

- Laptop use for specific learning tasks with explicit learning goals
- Laptop use for communication, such as email, instant messaging, and online chatting
- Laptop use for expression, such as writing and publishing
- Laptop use for exploration, such as working on multi-media products and playing computer games (Lei & Zhao, 2008, p. 103)

Computer technologies can be used to enhance students' inquiry-based learning (Donnelly, O'Reilly, & McGarr, 2013; Johnson, 2010; Scanlon, Anastopoulou, Kerawalla, & Mulholland, 2011; Vreman-de Olde, de Jong, & Gijlers, 2013). Wang et al. (2010) suggested multiple ways that technology can enhance learning.

Technology can enrich and provide structure for problem contexts by:

- Enhancing representation richness and presenting problems in context relevant to students' everyday lives
- Supporting development of "expert thinking" in an inquiry problem domain

- Structuring complex tasks by setting learning boundaries, specifying activity procedures, and offering expert guidance
- Supporting multiple, clear, and increasingly complex presentations
- Increasing motivation and engagement levels

Technology can facilitate resource utilization by:

- Enabling access to resources of various perspectives and qualities
- Helping learners search and process multiple resources in a timely manner (e.g., using search engines)

Technology can support cognitive and metacognitive processes by:

- Automatically handling routine tasks to enable focused attention on more challenging cognitive tasks
- Individualizing learning according to learning styles, patterns, progress, etc.
- Allowing students to manipulate existing or create new visual representations
- Enabling students to conduct experiments to test hypotheses and alternate solutions
- Helping students become more aware of their own thinking
- Enabling social learning through peer collaborations (Wang et al., 2010, p. 383)

Constructivist pedagogy allows for both the teacher and the student to take part in the instructional process. Consequently, the student is not simply just the learner.

Technology integration can be an asset to the constructivist teacher (Campbell, 2013; Clarke & Dede, 2005; Keengwe et al., 2009; Niemuth, 2010). One-to-one computing is a form of technology integration. However, a teacher's willingness to adopt constructivist



pedagogy and successfully implement a one-to-one computing program in his/her classroom can be affected by variables such as years of experience, subject taught, and skill level in the use of a computer for instruction. Teachers who were not born in the digital age often assume that the methods they have always used are still effective with students born in the digital age, and these teachers are often less likely to adopt new teaching methods (Galvis, 2012; Prensky, 2001). Teachers often implement one-to-one computing in different ways and at different levels based on the subject that they teach (Hennessy, Ruthven, & Brindley, 2005; Inserra & Short, 2012). Teachers who have a higher self-perceived skill level in the use of computers for instruction tend to use computers as instructional tools more often than teachers that have a lower self-perceived skill level in the use of computers for instruction (Turel, 2014).

Dewey's Theory of Inquiry suggests that students should learn based on experience, and constructivist pedagogy suggests that students should take part in the instructional process (Dewey, 1943; Harris, 2014; Keengwe et al., 2009). In contrast to traditional teaching methods with students acting only as receivers of information, one-to-one computing programs give students a greater opportunity to participate in the learning process (Salpeter, 2010). As participants in the learning process, students are more engaged and more motivated; this can lead to increased student achievement (McLester, 2011; Mouza, 2008).

### History of Technology in Education

The history of modern computing began in 1944 with the Mark I at Harvard. The Mark I was the Automatic Sequence Controlled Calculator (ASCC) designed by Howard Aiken, a computing pioneer with a Ph.D. in physics from Harvard, and built by engineers

at Thomas Watson's International Business Machines (IBM) (Williams, 1999). The Mark I was comprised of 78 adding machines and calculators joined together, and was given as a gift to Harvard in 1944.

The Mark I was enormous, some fifty feet long and eight feet tall, filling an entire room. It had more than 750,000 parts, used 530 miles of wire, and weighed about five tons. A four-horsepower electric motor drove all the mechanical parts by a system of gears and chains, and over a thousand ball bearings kept its components moving. Howard Aiken described the Mark I as a "general arithmetic machine capable of addition, subtraction, multiplication, division, and the transfer of numbers." (Williams, 1999, p. 90)

The Mark I was also used for gunnery and ballistics calculations during World War II (Williams, 1999).

The University of Pennsylvania followed close behind in 1946 with the Electrical Numerical Integrator and Computer (ENIAC). The United States Army for the purpose of computing ballistic trajectories funded ENIAC. ENIAC was designed by John Mauchly, an American physicist, and built by a team of engineers under the direction of Presper Eckert Jr., an American electrical engineer and computing pioneer. About 18,000 vacuum tubes and 1,500 relays were used to build ENIAC, which is considered to be "the first U.S. electronic digital and general-purpose computer" (Bullyneck & De Mol, 2010, p. 123)

In 1957, the Soviet Union launched Sputnik, the first artificial Earth satellite. This historic event was a catalyst for educational reform in the United States.

The event prompted a broad response from the federal government, which made an unprecedented investment in precollegiate curriculum and teacher development. Much of that investment was made in the National Science Foundation, which supported the creation and revision of curricula in biology, chemistry, physics, and math. Efforts later spread to the social sciences. Some of the curricula, such as those that promoted the need for hands-on student experiments in science, won praise and continue to influence classroom practice. (Cavanagh, 2007, p. 33)

The educational reform prompted by the launch of Sputnik consisted, in part, of promoting the incorporation of new technology into education (Garrett, 2008; Jenlink, 2013).

The history of computers in education began in 1959 with PLATO at the University of Illinois. PLATO was “the first, large-scale project for the use of computers in education” (Molnar, 1997, “The First Computers,” para. 2). Computer supported education can be defined as “the utilization of computers as a supplementary tool for teachers to enrich and improve the quality of learning provided during educational activities” (Celik & Yesilyurt, 2013, p. 149). However, computers in education were initially used mainly as research tools. In 1963, at Dartmouth, John Kemeny and Thomas Kurtz started utilizing computers for academic purposes other than conducting research (Molnar, 1997). Kemeny and Kurtz are also credited with developing BASIC (Beginner’s All-purpose Symbolic Instruction Code), a user-friendly, high-level programming language (Molnar, 1997). BASIC replaced IBM’s more complicated, general-purpose programming language FORTRAN (The IBM Mathematical Formula

Translating System) (Molnar, 1997). BASIC's widespread use led to the development of "computer-based instructional materials for a wide variety of subjects and for all levels of education" (Molnar, 1997, "The Early Pioneers," para. 1).

In 1963, a mere 1% of secondary schools in the United States were using computers as instructional tools (Molnar, 1997). In the mid-seventies, microcomputers, or personal computers (PCs), began taking the place of larger computers (Ceruzzi, 2010; Johnson, Y. M., 2014). By 1975, 55% of the secondary schools in the United States had access to computers, and 23% of the secondary schools in the United States were using computers as instructional tools (Molnar, 1997).

In 1983, the national student-to-computer ratio was 125:1 (Bebell & Kay, 2010). The National Commission on Excellence in Education released *A Nation at Risk* in the same year. This report recommended that computer science become a high school graduation requirement (Culp, Honey, & Mandinach, 2005). By 1987, states were beginning to create administrative positions and departments to establish and maintain educational technology programs as the number of computers per student increased and the national student-to-computer ratio became approximately 30:1 (Office of Technology Assessment, 1988). However, this 30:1 ratio was being achieved in various ways. In some instances, there was one computer in each classroom of 25-30 students. In other instances, there were classrooms or libraries designated as computer labs leaving the majority of classrooms without any computers.

In 1988, the Office of Technology Assessment, an office of the United States Congress that provided technology assessment to the members of Congress during the office's existence from 1972 to 1995, released *Power On! New Tools for Teaching and*

*Learning* (Office of Technology Assessment, 1988). This report explained that certain technology could “extend teaching and learning processes” (Culp et al., 2005, p. 282). In 1995, the number of computers per student increased and the national student-to-computer ratio became approximately 9:1 (Office of Technology Assessment, 1995). In addition, 75% of public schools had some form of computer network (Office of Technology Assessment, 1995). However, only 3% of classrooms (including labs and libraries) were connected to the Internet (Office of Technology Assessment, 1995).

In 2001, the No Child Left Behind (NCLB) Act “increased the demand on school districts to provide every child with access to high-quality education and close the achievement gap” (Mouza, 2008, p. 447). The Enhancing Education through Technology program of the NCLB, in particular, sought to utilize technology to enhance K-12 teaching and learning (Mouza, 2008). In 2002, the number of computers per student increased and the national student-to-computer ratio became 4:1 (Bebell & Kay, 2010). In 2003, those who supported educational technology as well as those who did not support educational technology agreed, “the full effects of computers in school could not be fully realized until the technology was no longer a shared resource” (Bebell & Kay, 2010, p. 6). This trend led to one-to-one computing programs in education (Richardson et al., 2013; Russell, Bebell, & Higgins, 2004).

### One-to-One Computing

Lowther, Inan, Ross, and Strahl (2012) have suggested that “in order to see the impact of computer use in education, it should be used more frequently and effectively in teaching and learning” (p. 2). One-to-one computing initiatives provide the opportunity for more frequent computer use by students and teachers in schools by issuing every

student and teacher a computer laptop or tablet for use at school and at home every day throughout the school year. Shapley, Sheehan, Maloney, and Caranikas-Walker (2010) have suggested that effective implementation of a one-to-one computing program “requires a comprehensive or systematic approach that includes attention to aspects such as leadership and planning, supportive school culture, training and professional development, robust infrastructures and technical support, and access to digital content and instructional resources” (p. 10).

In 2004, one-to-one computing was being implemented in approximately 4% of the nation’s school districts (Bebell & Kay, 2010). In 2006, one-to-one computing was being implemented in approximately 25% of the nation’s school districts (Bebell & Kay, 2010). In 2008, there were at least 33 states implementing one-to-one computing (Abell, 2008). Bebell and Kay (2010) confirmed large-scale one-to-one computing initiatives in California, Florida, Georgia, Kansas, Louisiana, Maine, Massachusetts, Michigan, New Hampshire, Pennsylvania, South Dakota, and Texas. As of 2013, there were more than 2,000 schools in the United States implementing one-to-one computing programs (Herold, 2013a).

#### Research on the Effectiveness of Computers in Education

The success of one-to-one computing programs is usually determined by student achievement, and research has shown that one-to-one computing initiatives can be used effectively to enhance student achievement (Abell, 2008; Lowther, Ross, & Morrison, 2003; McLester, 2011; Norris & Soloway, 2010; Rosen & Beck-Hill, 2012; Safar, 2012; Spektor-Levy & Granot-Gilat, 2012). One-to-one computing initiatives across the United States have used a variety of assessments to compare student achievement prior to

implementation of the one-to-one computing initiative and student achievement after implementation of the one-to-one computing initiative. The Berkshire Wireless Initiative sought to improve teaching and learning and enhance student achievement as measured by test data from The Massachusetts Comprehensive Assessment System (Bebell & Kay, 2010). The Berkshire Wireless Learning Initiative (BWLI) was “a three-year pilot program across five western Massachusetts middle schools where every student and teacher was provided a laptop computer beginning in 2005” (Bebell & Kay, 2010, p. 7). In 2008, three years after the initial implementation of the Berkshire Wireless Learning Initiative, there was an increase in students’ ELA test performance and writing assessment performance on the Massachusetts Comprehensive Assessment System (MCAS) (Bebell & Kay, 2010). However, there was not a similar increase in students’ Math test performance on the MCAS (Bebell & Kay, 2010).

The Texas Immersion Project was established in 2003 by the Texas Legislature and was based on the idea that “the use of technology in Texas public schools could be achieved more effectively by immersing schools in technology rather than by introducing technology resources in a cyclical fashion over time” (Shapley et al., 2010, p. 5). Student academic progress was measured by test data from the Texas Assessment of Knowledge and Skills (TAKS) (Shapley et al., 2010). School districts were allowed to design their own technology package consisting of the following six required components:

- A wireless mobile computing device for each educator and student on an immersed campus
- Productivity, communication, and presentation software

- Online instructional resources supporting the state curriculum in language arts, mathematics, science, and social studies
- Online assessments to diagnose students' mastery of the core curriculum
- Professional development designed to help teachers integrate technology into teaching, learning, and the curriculum
- Initial and ongoing technical supports (Shapley et al., 2010, p. 6)

The Texas Immersion Project positively affected mathematics scores on the TAKS (Shapley et al., 2010). In addition, the gains in student achievement increased over time, especially in the third year after implementation of the immersion project (Shapley et al., 2010). However, the Texas Immersion Project did not positively affect reading scores on the TAKS and results on social studies, science, and writing scores on the TAKS were inconclusive (Shapley et al., 2010).

The goal of the Henrico County Public Schools iBook Teaching and Learning Initiative was established in 2001 and sought to increase daily technology usage in schools and enhance student achievement as measured by test data from the Virginia Standards of Learning tests (Mann, 2008; Zucker & McGhee, 2005). By spring 2003, the Henrico County Public School District was providing laptop computers to more than 25,000 teachers and students in grades 6 through 12 for use at school and at home “to collect information on the Internet, take notes, and create or complete assignments” (Zucker & McGhee, 2005, p. 1). At the completion of the 2007-2008 school year, test data from the Virginia Standards of Learning (SOL) tests showed that students who used laptops more frequently had higher test scores on Virginia's SOL tests in World History, Biology, Reading, and Chemistry (Mann, 2008). However, students who used laptops



more frequently had lower test scores on Virginia's SOL tests in Algebra I, Algebra II, and Writing (Mann, 2008).

The Harvest Park Middle School Laptop Immersion Program sought to provide innovative programs for students and enhance student achievement as measured by grade point averages (GPAs), results from District Writing Assessments, results of the Standardized Testing and Reporting Norm-Referenced Test, and California Standards Tests in English-language arts and mathematics (Gulek & Demirtas, 2005). All students at Harvest Park Middle School in Pleasanton, California were eligible to participate in the Harvest Park Middle School Laptop Immersion Program established in 2001. Parents either purchased laptops, or students were issued loaner laptops for the duration of the school year. The laptops were for school and home use. During the 2003-2004 school year, 259 of the 1085 students at Harvest Park Middle School participated in the laptop immersion program (Gulek & Demirtas, 2005). When compared to students that did not participate in the laptop immersion program at Harvest Park Middle School, the students who participated in the laptop immersion program had higher GPAs (Gulek & Demirtas, 2005).

Overall, a substantially higher percentage of laptop students (95% in Grade 6; 91% in grade 8) met or exceeded grade level expectations in writing compared to Harvest Park school-wide averages (84% in Grade 6; 83% in grade 8) and district-wide averages (81% in Grade 6; 84% in grade 8). (Gulek & Demirtas, 2005, p. 15)

The laptop immersion program also had a positive effect on students' scores on the Standardized Testing and Norm-Referenced Test and California Standards Tests in English-language arts and mathematics (Gulek & Demirtas, 2005).

In 2007, Mooresville Graded School District in North Carolina began implementing a one-to-one computing initiative in the form of a "Digital Conversion program, a six-year strategic plan that set clear goals for using technology in classrooms and focused on academic achievement, engagement, opportunity, and digital equity" (Edwards et al., 2012, p.12). Student achievement was measured by results from end-of-course composite exam scores and the school district's graduation rate (Edwards et al., 2012). Since 2007, the Mooresville Graded School District has issued laptops to each of their more than 5,000 students (Edwards et al., 2012). At Mooresville Middle School, end-of-course composite exam scores increased from 72% at the end of the 2006-2007 school year to 85% at the end of the 2010-2011 school year (Edwards et al., 2012). At Mooresville High School, end-of-course composite exam scores increased from 68% at the end of the 2006-2007 school year to 89% at the end of the 2010-2011 school year (Edwards et al., 2012). In addition, the Mooresville Graded School District's graduation rate increased from 77% in 2007 to 91% in 2011 (Edwards et al., 2012).

The goal of the Freedom to Learn Initiative, Michigan's statewide one-to-one program, was to improve student learning and enhance student achievement as measured by test data from the standardized MEAP (Michigan Educational Assessment Program) test (Solomon, 2005). In 2004, a total of 195 schools in Michigan received Freedom to Learn grants that were used to purchase over 20,000 laptop computers (Lowther et al., 2012). School districts were given the flexibility to design their own laptop programs.

Initially, the Freedom to Learn Initiative focused on middle school students statewide (Lowther et al., 2012). Results from January and February 2005 MEAP testing at various middle schools statewide showed increases in reading proficiency, writing proficiency, proficiency on standardized science tests, and proficiency on standardized math tests (Solomon, 2005).

In Maryland, the Talbot County Public Schools one-to-one laptop initiative began in 2005 with the graduating class of 2009 and sought to accomplish the following goals:

1. Increase student achievement
2. Provide effective use of technology for instruction
3. Increase student engagement
4. Improve educational access for at-risk students (Talbot County Public Schools, 2007, pp. 3-4)

Talbot County Public Schools sought to enhance student achievement as measured by test data from the Maryland HSA (High School Assessment) (Talbot County Public Schools, 2007). By 2006-2007, Talbot County Public Schools had issued 780 laptop computers to all ninth and tenth grade students and 46 laptop computers to teachers (Talbot County Public Schools, 2007). In 2007, a greater percentage of students in the graduating class of 2010 passed the Maryland Algebra HAS (90%) compared to students graduating in 2009 (66%) and 2008 (55%) (Talbot County Public Schools, 2007). A greater percentage of students in the graduating class of 2009 passed the Maryland English HAS (77%) compared to students graduating in 2008 (66%) (Talbot County Public Schools, 2007). A greater percentage of students in the graduating class of 2009 passed the Maryland

Biology HAS (81%) compared to students graduating in 2008 (70%) (Talbot County Public Schools, 2007).

### The ACT as a Measure of Student Achievement

Because of the assertions of educators that one-to-one computing can positively impact student performance, and because of the attending expense to districts, it is worthwhile to examine the claims that such programs accelerate achievement. This study examines such a connection, and employs the ACT as a primary achievement metric. When implementing a one-to-one computing program, districts find that there is a “need to connect a district’s technology and innovation initiatives with measurable goals” (Ash, 2013, p. S10). According to Karen Cator, a former director of the office of educational technology for the U.S. Department of Education, “if you don’t know what you’re going to measure, and carefully collect data along the way, you will not have that story to tell six or 18 months later” (Ash, 2013, p. S10).

As stated previously, the primary goal of a one-to-one computing initiative in many cases is increased student achievement (Abell, 2008; Lowther et al., 2003; McLester, 2011; Norris & Soloway, 2010; Rosen & Beck-Hill, 2012; Safar, 2012; Spektor-Levy & Granot-Gilat, 2012). The ACT, one of the most frequently used nationwide assessments, “purports to closely parallel high school curriculum and to measure the preparedness of the test-taker for more advanced education” (Koenig et al., 2008, p. 153). In an era of increased attention to college and career readiness, measuring the impact of one-to-one computing on such a metric is useful. In addition to a composite score, the ACT also measures achievement specifically for English, mathematics, reading, and science by reporting subtest scores for each discipline. There

have been some studies that have explored connections between one-to-one computing and student achievement as measured by scores on standardized tests given in individual states (Abell, 2008; Lowther et al., 2003; Rosen & Beck-Hill, 2012; Safar, 2012; Spektor-Levy & Granot-Gilat, 2012). This study explores connections between one-to-one computing and student achievement as measured by scores on the ACT, a standardized test given throughout the United States.

### Implementation Challenges for One-to-One Computing

The infrastructure of a one-to-one computing program is often large and complex, but there are a number of districts that have elected to move ahead in spite of such challenges. In 2008, the Mooresville Graded School District in North Carolina began a one-to-one computing initiative in its 5,500-student school district and has become a model for one-to-one computing initiatives (Ash, 2013). In February 2014, the Saddleback Valley Unified School District in California implemented a technology initiative that provided 6,000 iPads and iPods and 1,500 Chromebooks to pilot classrooms (Beyond the Hardware, 2014). The district planned to add 7,000 additional Chromebooks and implement a one-to-one computing program in 4<sup>th</sup> grade, 7<sup>th</sup> grade, and 10<sup>th</sup> grade by October 2014 (Beyond the Hardware, 2014). In February 2014, the Tustin Unified School District in California provided a combination of iPads and computer laptops to all 24,000 students K-12 in the district (Beyond the Hardware, 2014). Students and teachers in grades 5-12 in the Tustin Unified School District participated in a one-to-one computing program. In 2014, the Madison Metropolitan School District in Madison, Wisconsin began a one-to-one computing initiative in its 27,000-student school district (Herold, 2014b). In 2013, the Lewisville Independent School District in Texas was in the

process giving all of its 53,000 students tablets as part of an ongoing one-to-one initiative (Herold, 2013a). By 2015, the Houston Independent School District in Houston, Texas plans to have issued 65,000 laptops to all of its high school students and teachers (Herold, 2014b). In 2012, the Guilford County School District in North Carolina began a one-to-one computing initiative in its 72,500-student school district (Herold, 2014b). In 2013, the Miami-Dade County School District in Florida began a one-to-one computing initiative in its 354,000-student school district (Herold, 2014b). In 2013, the Los Angeles Unified School District began the process of issuing tablets to 660,000 students (Herold, 2013b).

There are challenges for one-to-one computing programs that can lead to ineffective implementation and a lack of positive change in instruction, student learning, and student achievement (Dunleavy, Dexter, & Heinecke, 2007; Shapley et al., 2010). A one-to-one computing program should be well planned and not rushed (D. Johnson, 2014). Shapley et al. (2010) suggest that longer periods of implementation result in greater increases in student achievement. However, the initial planning is the responsibility of school district leaders and technology specialists and not the responsibility of classroom teachers. School leaders should “implement policies and routines that allow teachers to focus on the significant tasks of integration, rather than distracting management issues” (Dunleavy et al., 2007, p. 451).

Mark A. Edwards, the superintendent of the 5,600-student Mooresville Graded School District in North Carolina, who has overseen one of the most widely acclaimed 1-to-1 student-computing initiatives in the country, says that rushing

digital devices into classrooms without an effective plan for how they will be used to improve learning does students no favors. (Herold, 2014a, p. 13)

One of the lessons learned from the Los Angeles Unified School District's Common Core Technology Project is that the goal of getting the technology into the hands of students and teachers as quickly as possible sometimes results in poor planning (Margolin et al., 2014; Mason, 2013). Challenges related to the hurried implementation included:

- Time required to set up devices for individual users
- Lack of technology readiness among schools (including insufficient technology resources, an insufficient wireless infrastructure, and staff with limited knowledge of and comfort with using technology)
- Insufficient project staffing for deployment (Margolin et al., 2014)

In addition, there was a safety breach in three high schools “where devices of 185 students were compromised by deletion of MDM software that allowed students to forgo web filtering” (Margolin et al., 2014, p. 3).

School districts are obliged to determine how one-to-one computing programs will be funded. The Los Angeles Unified School District in Los Angeles, California decided to fund its nearly half-billion-dollar one-to-one computing program as part of a highly criticized, 20-year bond initiative (Herold, 2013b; Margolin et al., 2014). In contrast, the Houston Independent School District decided to fund its one-to-one computing program with an annual cost of \$18 million without a bond initiative. This was accomplished by using general operating dollars in combination with grant funds,

federal Title I and Title II funds, and savings from current budget line items such as print textbooks and outdated software (Herold, 2014b).

In conjunction with determining funding, schools must decide on specific devices and choose vendors (Bouterse, Corn, & Halstead, 2009). As part of a proper planning process for implementation of a one-to-one computing program, school districts often try several devices to help in the selection process (Demski, 2012). Most school districts then choose one specific device to be used throughout the school district for final implementation of a one-to-one computing program (LaFee, 2012; Richardson et al., 2013). Schools that choose multiple devices for final implementation of a one-to-one computing program often experience problems in multiple areas (O'Donovan, 2009). Having a standard piece of equipment is “essential to providing equitable access and implementation, as well as delivering consistent professional development and technical support” (Herold, 2014a, p. 13).

Another lesson learned from the Los Angeles Unified School District's Common Core Technology Project is that districts should not let vendors dictate their decision making process when it comes to selecting devices and digital curriculum (Herold, 2014a). For example, during the planning process for the Los Angeles School District's Common Core Technology Project, “the bid requirements related to curriculum closely tracked with specifications suggested by Pearson during private email exchanges before the formal bidding process opened” (Herold, 2014a, p. 13). This can lead to poor financial decisions and decisions that are based on the needs or sales objectives of vendors and not the needs of students and teachers (Johnson, 2014; Severin & Capota, 2011).



A robust, dependable computer network is needed to accommodate the number of devices being used on a daily basis in a one-to-one computing program (Bouterse et al., 2009; Seavy, 2014; Tarte, 2014; Thompson, 2014). Unreliable network connections can reduce the level of implementation by teachers and disrupt learning, which can affect student achievement (Ramig, 2014).

Bandwidth is a critical concern for many districts. In a fall 2013 national survey of school district leaders by COSN and Market Data Retrieval, or MDR, and educational market-research firm based in Shelton, Conn., 99 percent of respondents indicated a need for more Internet bandwidth and connectivity. (Flanigan, 2013, p. S22)

The school district in Madison, Wisconsin included network upgrades in its plan for a one-to-one computing program (Herold, 2014b). Similarly, the budget for the one-to-one computing program in the Lewisville Independent School District included funding for adding 4,500 wireless access points, laying 265 miles of copper cable, upgrading firewalls and filters, improving bandwidth, restructuring the information technology support team, and efficiently replacing outdated school computers (Herold, 2013a).

In addition to specific issues with technology infrastructure, one-to-one computing programs bring about changes to curriculum and instructional practices (Shapley et al., 2010). Some schools implementing one-to-one computing programs do not use physical textbooks at all, while some schools use a combination of digital content and physical textbooks (Bouterse et al., 2009; Ramig, 2014). The Los Angeles Unified School District opted for pre-loaded curriculum from a major textbook company that was factored into the purchase price of the tablet (Herold, 2013b). However, “purchasing a

single digital curriculum for all grades from a lone publisher does not make sense, given the breadth and depth of digital instructional materials now available” (Herold, 2014a, p. 13). In contrast, teachers in the 12,000-student Vail Unified School District in Arizona utilized “an in-house wiki to manage its growing assortment of digital curricula and lessons” (Fairbanks, 2013, p. S24). Created and maintained by teachers, this wiki developed into Beyond Textbooks, which houses more than 20,000 digital resources for teachers (Fairbanks, 2013). In 2013, four of the top 10 school districts in the state of Arizona were using Beyond Textbooks (Fairbanks, 2013). The Houston Independent School District opted to use free, readily available resources from the World Wide Web, including Web 2.0 tools (Herold, 2014b). Web 2.0 tools consist of blogs, wikis, social networking sites, and other web applications. However, the World Wide Web and Web 2.0 tools should be used along with instructional practices that enhance and not detract from student learning (Drayton et al., 2010). Teachers in some school districts implementing one-to-one computing programs have reported “online research offered instructional challenges for them because of concerns that students might access inappropriate materials (i.e. games, pornography, etc.), or waste time with inefficient or ineffective searches” (Dunleavy et al., 2007, p. 445). In addition, teachers should be mindful that some digital resources are free initially; but they may eventually require a paid subscription (Drayton et al., 2010).

Classroom management can become an issue for teachers in schools implementing a one-to-one computing program (Zucker & McGhee, 2005). When not utilized properly, computers can unnecessarily draw attention from proper instruction and become a distraction in the classroom, which can negatively affect student learning and

student achievement (Storz & Hoffman, 2012). Some teachers report students having laptops open when they are not needed and students have been instructed to put them away (Dunleavy et al., 2007). Some teachers also report students navigating to the wrong web page (Dunleavy et al., 2007). In addition to distractions, teachers also have to manage students when they don't have access to their laptops due to repairs, dead batteries, and students accidentally or intentionally leaving their laptops at home (Donovan, Green, & Hartley, 2010; Zucker & McGhee, 2005).

School culture plays an important role in the successful implementation of a one-to-one computing program (Kitchenham, 2009; Levin & Schrum, 2014; Mundy & Kupczynski, 2013; Zhu, 2013).

School culture is a complex compound, reflecting community values as they appear in student and parent attitudes, the rhetoric and espoused values of the school or district, the deployment of resources which either is in support of the espoused values or not, and the way that different priorities within the district are balanced. (Drayton et al., 2010, p. 49)

Technology should be an integrated part of school culture (Laferrrière, Hamel, & Searson, 2013). According to Zhu (2013) the most important dimensions of school organizational culture as it relates to technology integration in schools are: “goal orientation, participative decision making, innovativeness, supportive and structured leadership, cooperative relationship, and shared vision” (p. 487). School leaders should present technology, one-to-one computing in particular, to teachers as a non-threatening tool for enhancing instruction. Otherwise, one-to-one computing programs can threaten the

stability of school culture, which can negatively affect student achievement (Levin & Schrum, 2014).

In some schools, one-to-one computing programs are tied directly to student and teacher accountability instead of improved instruction or curriculum reform (Drayton et al., 2010). This undue pressure on teachers can hinder successful implementation of one-to-one computing in their classrooms (Drayton et al., 2010). School leaders should support teachers in their efforts to implement one-to-one computing programs (Salpeter, 2010). In addition, school leaders should “encourage teachers to experiment and assure them that they will not be penalized if they try something new and it fails” (Ash, 2013, p. S10). Teachers experiencing a higher level of support from their principal implemented the one-to-one computing program at a higher level (Shapley et al., 2010).

Teachers and principals in some schools have also reported that superintendents placed too much importance on the rules and regulations of one-to-one computing programs and that some problems with the implementation of one-to-one computing programs were being unfairly linked directly to the technology itself (Drayton et al., 2010; Johnson, 2010). For example, teachers in some schools reported that they were “prevented from legitimate uses of the technology because of the security system at the school” (Drayton et al., 2010, p. 44). School districts should properly train students in digital citizenship rather than overly restrict access to digital content that can be used to enhance instruction (Ribble & Miller, 2013).

Teachers should be provided with exposure to devices and training for proper implementation of the program elements prior to full-scale implementation with students (Ramig, 2014; Ramirez, 2011; Storz & Hoffman, 2012). The budget for the one-to-one

computing program in the Lewisville Independent School District included funds for extensive staff development, student education, and parent education (Herold, 2013a). All 2,000 school staff members in the Lewisville School District attended basic training for utilizing laptops and tablets prior to implementation with the students, and some of those teachers took additional classes in the summer on the Mac operating system and the iLife software (Herold, 2013a).

Teachers should be provided with the necessary resources and ongoing technical support once full-scale implementation of the one-to-one computing program has occurred (Celik & Yesilyurt, 2013; Rosen & Beck-Hill, 2012; Storz & Hoffman, 2012).

Difficulties with ensuring adequate resources for purchasing and maintaining hardware and software-including policies that make it difficult to make particular kinds of purchases-can reduce the likelihood that teachers will use technology with students. For classrooms using wireless networks, the reliability of the network is frequently an issue and a barrier to widespread use by teachers for instruction. Further, even when access to computers and wireless connectivity is sufficient, perceptions among teachers that there is limited access to timely technical support from school-based or district staff can hinder their integration of technology into the curriculum. (Penuel, 2006, p. 334)

Ongoing professional development plays an important part in preparing a teacher for their role in the implementation of a one-to-one computing program (Claesgens et al., 2013; Fogle, 2014; Mason, 2013; Twining, Raffaghelli, Albion, & Knezek, 2013). In order to properly implement one-to-one computing in the classroom, teachers need to know how to utilize student-centered instructional practices, how to properly assess

students, and how to differentiate instruction (Gunn & Hollingsworth, 2013). One-to-one computing initiatives that have positively impacted teachers' perceptions of one-to-one computing initiatives have "provided professional development that gave teachers a framework to develop problem-based lessons, required teachers to engage in projects with students, and provided resources that supported teachers' particular content area" (Shapley et al, 2010, p. 11). With sustained professional development, teachers' "perceptions and implementations of 21<sup>st</sup> century methods become more positive and more frequent, respectively" (Gunn & Hollingsworth, 2013, p. 213).

#### Student Attributes and One-to-One Computing Initiatives

In contemporary schools, students are using technology more frequently and learning in different ways; this differentiates them from previous generations of students. These differences necessitate a change in education, specifically the instructional process, to accommodate the skills and interests of contemporary learners (Bennett, Maton, & Kervin, 2008). Contemporary learners are often referred to as digital natives. Digital natives are described as "living lives immersed in technology, surrounded by and using computers, video games, digital music players, video cameras, cell phones, and all the other toys and tools of the digital age" (Bennett et al., 2008, p. 776).

Unlike the youth of yesteryear, today's students have vastly different interests, skills, and brain functions that are not always recognized or attended to within many contemporary school systems. Consequently, it is essential that teachers and administrators be trained and informed of the benefits of information and communication technology, not only as instructional tools, but also as a means of

engaging learners academically, emotionally, and socially. (Gunn & Hollingsworth, 2013, pp. 201-202)

Traditional instructional methods consisting of teacher-centered lectures, students reading textbook assignments, and students completing textbook assignments and worksheets simply do not engage students (Petkov & Rogers, 2011). Schools implementing one-to-one computing programs have reported higher levels of student engagement (Lowther et al., 2012; McLester, 2011; Salpeter, 2010). Students who are engaged are more motivated, and students who are motivated tend to show higher levels of academic achievement (Meyer, McClure, Walkey, Weir, & McKenzie, 2009). In addition, students should be involved in one-to-one computing initiatives beyond merely being users of the digital devices. Superintendent Pamela R. Moran of the 13,200-student Albemarle County School District in Virginia suggests that students “sit on the district’s tech advisory committee, participate in surveys about the district’s strategic goals, and provide feedback about budget initiatives, virtual learning, and other strategies through a county student advisory committee” (Ash, 2013, p. S10).

#### Teacher Attributes and One-to-One Computing Initiatives

It is important to understand that enhanced teaching and learning and the success of one-to-one computing programs are based on proper implementation and level of implementation, not the device itself (Claesgens et al., 2013; Dunleavy et al., 2007). The shift to technology-based learning should begin with teachers, not students (Hammonds et al., 2013, p. 36). Therefore, the success of a one-to-one computing program should be attributed to teachers using digital resources as part of the instructional process in such a way that student learning is enhanced (Ash, 2013).

Teachers should embrace the change from traditional teacher-centered learning to the student-centered learning found in schools implementing one-to-one computing programs (Dunleavy et al., 2007; Hammonds et al., 2013; Kale & Goh, 2014). Student-centered learning includes strategies such as independent inquiry and project-based learning (Lowther et al., 2012). Laptop-based software programs can help facilitate this type of independent learning. Unfortunately, in some cases, teachers allow laptops to replace them as the classroom teacher (Dunleavy et al., 2007). One-to-one computing programs are intended to change the role of the classroom teacher but are not intended to replace the classroom teacher altogether.

Teachers' perceptions of one-to-one computing programs can affect the level of implementation of one-to-one computing in classroom instruction and can be the largest barrier to a successful one-to-one computing initiative (Fogle, 2014; Hammonds et al., 2013; Inan & Lowther, 2010; Wadmany & Kliachko, 2014).

One finding from past research that is likely to influence the implementation of one-to-one initiatives is that teachers' attitudes and beliefs about technology's role in the curriculum can influence how and when teachers integrate computers into their instruction. When teachers do not perceive that expected uses of technology are closely aligned with the curriculum, then they use it less often. Other individual teacher characteristics that are associated with technology integration levels include teachers' pedagogical approach, their confidence or feelings of preparedness to use technology, and their subject-matter expertise. (Penuel, 2006, p. 333)



Teachers tend to use technology in the classroom if it helps them to engage and motivate students, customize instruction to meet the needs of students, plan more effectively and efficiently, collaborate with other teachers, and improve communication with parents and administrators (Hammonds et al., 2013).

In addition to a teacher's perception of technology, a teacher's skill level in the use of technology can also affect how often and how successfully they implement one-to-one computing in their own classroom.

Teachers who have higher technical skills and hold positive beliefs and readiness are more likely to integrate computers into classroom instruction. More importantly, such positive beliefs are likely to lead them to have their students use computers as a production and learning tool. (Lowther et al., 2012, pp. 24-25)

In contrast, there are low levels of technology integration in classrooms when teachers do not believe they have sufficient knowledge or skills when it comes to implementing technology-based instruction (Claesgens et al., 2013; Ertmer & Ottenbreit-Leftwich, 2010; Kale & Goh, 2014; Turel, 2014).

A teacher's years of experience can also affect how often and how successfully they implement one-to-one computing in their own classroom. Veteran teachers, who are often older and often lack digital skills, are apprehensive about technology-based instruction and prefer to use traditional teaching tools and methods to newer ones like laptops and one-to-one computing programs (Galvis, 2012; Kale & Goh, 2014). Veteran teachers who are willing to change their instructional practices to include technology-based techniques need "adequate training, opportunities for daily practice, and ongoing

support” (Kale & Goh, 2014, p. 53). In addition, Herold (2014b) suggests that it takes about three years to change teachers’ perspectives about and use of technology.

The subject being taught by a teacher can affect the way a teacher implements one-to-one computing in their own classroom and how often a teacher implements one-to-one computing in their own classroom (Ertmer & Ottenbreit-Leftwich, 2010; Hennessy, Ruthven, & Brindley, 2005; Inserra & Short, 2012). Teachers in the core high school subjects of math, science, social studies, English, and foreign language often implement one-to-one computing in different ways and at different levels (Hennessy et al., 2005; Inserra & Short, 2012). For example, Inserra and Short (2012) suggest that English and Social Studies teachers utilize one-to-one computing more frequently in their classrooms than Math teachers.

### Summary

Going forward, practitioners and policymakers need to know how teachers are using one-to-one computing to improve both their instructional practices and student achievement (Dunleavy et al., 2007). Specifically, they need to know “how the 1:1 access contributes to these benefits in such a way that would not otherwise be possible with higher student to computer ratio” (Dunleavy et al., 2007, p. 441). Goodwin (2011) suggests the top three factors contributing to increased student achievement in schools that adopt one-to-one computing programs are:

1. Ensuring uniform integration of technology in every class
2. Providing time for teacher learning and collaboration (at least monthly)
3. Using technology daily for student online collaboration and cooperative learning (p. 79)

Continuing research is necessary to further explore connections between one-to-one computing and student achievement (Penuel, 2006). Cavanaugh et al. (2011) have concluded “further research is needed in order to progress from descriptions of effective laptop implementation models to the development of predictive models” (p. 375).

## CHAPTER III

### METHODOLOGY

This chapter describes the research design and methodology used to conduct the study. The chapter includes a description of the research questions and related hypotheses, the research design, the participants in the study, the instrumentation, the procedures for data collection, and the data analysis procedures. One goal of this study was to examine the impact of one-to-one computing innovations on student achievement. Additional goals of this study were to investigate the relationships among teachers' perceptions of one-to-one computing, teachers' years of experience, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores.

#### Research Questions

The following are specific research questions that were addressed by this study:

1. What are the average student ACT composite scores in schools one year prior to implementing one-to-one computing and the average student ACT composite score in the same schools two years after implementing one-to-one computing?
2. What are the perceptions of teachers regarding one-to-one computing programs?
3. Is there a difference between the average student ACT composite score in schools one year prior to implementing one-to-one computing and the average student ACT composite score in the same schools two years after implementing one-to-one computing?

4. Is there a difference between average student ACT subtest scores in English, mathematics, reading, and science in schools one year prior to implementing one-to-one computing and average student ACT subtest scores in English, mathematics, reading, and science in schools two years after implementing one-to-one computing?
5. Is there a difference between the average change in student ACT composite score in the state and the average change in student ACT composite score in schools with two years of experience in implementing one-to-one computing?
6. Is there a difference between the average change in student ACT subtest scores in English, mathematics, reading, and science in the state and the average change in student ACT subtest scores in English, mathematics, reading, and science in schools with two years of experience in implementing one-to-one computing?
7. Is there a relationship between teachers' perceptions of one-to-one computing and teachers' years of experience?
8. Are there differences among teachers' perceptions of one-to-one computing, depending on subject taught?
9. Is there a relationship between teachers' perceptions of one-to-one computing and teachers' skill level in the use of a computer for instruction?
10. Is there a relationship between teachers' perceptions of one-to-one computing and teachers' perceptions of changes in ACT scores?

The following related hypotheses, which are associated with Research Questions 3 – 10, were addressed in the study:

- H<sub>1</sub>: The average student ACT composite scores in schools two years after implementing one-to-one computing are higher than the average student ACT composite scores in the same schools one year prior to implementing one-to-one computing.
- H<sub>2</sub>: The average student ACT subtest scores in English, mathematics, reading, and science in schools two years after implementing one-to-one computing are higher than the average student ACT subtest scores in English, mathematics, reading, and science in the same schools one year prior to implementing one-to-one computing.
- H<sub>3</sub>: The average change in the student ACT composite score in schools with two years of experience in implementing one-to-one computing is greater than the average change in the student ACT composite score in the state.
- H<sub>4</sub>: The average change in the student ACT subtest scores in English, mathematics, reading, and science in schools with two years of experience in implementing one-to-one computing is greater than the average change in the student ACT subtest scores in English, mathematics, reading, and science in the state.
- H<sub>5</sub>: There is an inverse relationship between teachers' perceptions of one-to-one computing and teachers' years of experience.
- H<sub>6</sub>: There are differences among teachers' perceptions of one-to-one computing, depending on subject taught.
- H<sub>7</sub>: There is a positive relationship between teachers' perceptions of one-to-one computing and teachers' skill level in the use of a computer for instruction.

H<sub>8</sub>: There is a relationship between teachers' perceptions of one-to-one computing and teachers' perceptions of changes in ACT scores.

### Research Design

This study employed a quantitative research design and investigated the relationship between one-to-one computing and ACT scores. This study compared average ACT scores in schools one year prior to implementing a one-to-one computing program to average ACT scores in the same schools two years after implementing a one-to-one computing program. This study also compared the average change in ACT scores in the state to the average change in ACT scores in schools with two years of experience in implementing one-to-one computing. Average ACT scores included both composite scores and subtest scores. The variables included student achievement as operationalized through ACT composite and subtest scores. The variables were average ACT composite scores in schools one year prior to implementing one-to-one computing, average ACT scores in the same schools two years after implementing a one-to-one computing program, average change in ACT scores in schools with two years of experience in implementing one-to-one computing, and average change in ACT scores in the state over the same two year span.

In addition, this study investigated the relationships among teachers' perceptions of one-to-one computing, teachers' years of experience, teachers' skill level in the use of a computer for instruction and teachers' perceptions of changes in ACT scores. Finally, this research explored differences among teachers' perceptions of one-to-one computing depending on the subject taught by the teacher. The variables included teachers' perceptions of one-to-one computing, teachers' years of experience, subject taught by the

teacher, teachers' skill level in the use of a computer for instruction, and teachers' perceived changes in ACT scores. In Research Question 7, the dependent variable is teachers' perceptions of one-to-one computing; and the independent variable is teachers' years of experience. In Research Question 9, the dependent variable is teachers' perceptions of one-to-one computing; and the independent variable is teachers' skill level in the use of a computer for instruction. In Research Question 10, the dependent variable is teachers' perceptions of changes in ACT scores; and the independent variable is teachers' perceptions of one-to-one computing. Approval of the study was sought through the University of Southern Mississippi Institutional Review Board (IRB). The IRB approval form is attached as Appendix A.

### Participants

The sample of schools for investigating the relationship between one-to-one computing and ACT scores consisted of 33 secondary public schools with one-to-one computing programs located in school districts from multiple states in the United States. One-to-one computing programs are relatively new. Therefore, the researcher chose a multi-state sample over a statewide sample to ensure a sufficient number of schools meeting the criteria of having continuously implemented a one-to-one program for at least two years. The researcher tried first to locate a comprehensive list of schools meeting the criteria of implementing a one-to-one computing program for the purpose of this study by reviewing related literature, searching the Internet, and discussing the study with educational leaders in the area of one-to-one computing and leaders in the technology industry in the area of one-to-one computing. In the absence of such a list, the researcher sought information through the review of related literature and Internet



searches, employing search terms such as “one-to-one computing schools,” “1:1 computing schools,” and “laptop programs in secondary schools.” This information and contacts with educational leaders in the area of one-to-one computing and leaders in the technology industry in the area of one-to-one computing yielded a sufficient number of districts to ensure the names of at least 30 schools meeting the criteria of implementing a one-to-one computing program for the purpose of and related definition described in this study. The researcher verified that schools met the criteria of implementing a one-to-one computing program for the purpose of and related definition described in this study through information on public access school district websites. Where school district websites did not provide the information, the researcher asked school district technology personnel responsible for implementing and maintaining one-to-one computing programs for the implementation date for the one-to-one programs in their school districts’ high schools. While the absence of a central list makes a purely random selection of school districts difficult, the researcher examined basic demographic characteristics of the schools in order to describe the representativeness of schools in the final roster of participants. Superintendents were initially contacted by email to solicit permission to conduct the study using high schools in their districts. A formal letter was sent to superintendents of participating districts to obtain formal permission to use high schools in their districts to conduct the study. The letter and form for requesting superintendent permission are attached as Appendix B.

The first method of ACT data acquisition was to obtain archival data from state department of education public access ACT data websites to determine average ACT scores in schools implementing one-to-one computing. The ACT data obtained from

state department of education public access data websites were school summary information. Where state information systems did not provide the data, school counselors in schools selected to participate in the study provided archival data from the annual ACT Profile Report provided to high schools. The instrument used by the researcher to acquire archival ACT data from school counselors was sent as an email message (Appendix C). These archival data included the average ACT composite score and average ACT subtest scores for the school in which they work.

The study sample for investigating the relationships among teachers' perceptions of one-to-one computing, teachers' years of experience, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores consisted of 683 secondary public school teachers from 12 schools in the United States with one-to-one computing programs. The researcher obtained teacher email addresses from the principal or designee of each school selected to participate in the study. An email group for each school was created. Email addresses of individual group members were not visible to other group members. The group email message containing an attachment with informed consent information was sent to all teachers from the school selected for the pilot study. The email message and informed consent document are attached as Appendix D. The group email message was sent after ACT scores were obtained. By clicking "yes" at the end of the email message describing informed consent, teachers confirmed their consent to participate in the study and were directed to the online survey. Online surveys were given to all teachers implementing one-to-one computing in 12 schools in the United States with one-to-one computing programs, and all participants were volunteers in the study. Although participants were

asked to identify the state in which they teach, no other personal identifying information was solicited.

### Instrumentation

A survey instrument from the Mitchell Institute entitled Survey of PCMS/PCHS Faculty was adapted and used to determine teachers' perceptions of one-to-one computing. This survey instrument was used initially by the Mitchell Institute in a 2003 research project conducted as part of a grant to Piscataquis Community High School (PCHS) by the Great Maine Schools Project with funding from the Bill & Melinda Gates Foundation. The researcher obtained permission to use and modify the Mitchell Institute survey instrument assessment tool for laptop initiatives from Lisa Plimpton, Director of Research, at the Mitchell Institute. Permission to use and modify the instrument is attached as Appendix E. The instrument for this study is entitled Teacher Perceptions of One-to-One Computing and is attached as Appendix F.

For the purposes of this study, some items in the Teacher Perceptions of One-to-One Computing instrument were deleted from the original survey created by the Mitchell Institute. There were 12 items deleted from the original survey created by the Mitchell Institute, because the items were not applicable to this study. For example, items comparing the impact of one-to-one computing on traditional students, at-risk or low-achieving students, and high achieving students were deleted. In addition, an item related to Promising Futures, a program specific to Piscataquis High School, was deleted. Some items used for the survey instrument were added and some were modified. For example, items used to measure teachers' perceptions of one-to-one computing were consolidated into a single item including multiple elements. In addition, items were added to measure

teachers' perceptions of changes in ACT scores. As a result of the modification of the original survey, a panel of experts was assembled to evaluate the modified survey instrument in order to ensure its continued validity for the purposes of the present study. The panel of experts consisted of an assistant principal currently serving in a school implementing a one-to-one computing program, a technology specialist currently working in a school district implementing a one-to-one computing program, and a teacher currently teaching in a school implementing a one-to-one computing program. Each person on the panel of experts was given a copy of the survey instrument and a validity questionnaire. The questionnaire is attached as Appendix G. Responses from the validity questionnaire were used to further refine the survey instrument.

The Teacher Perceptions of One-to-One Computing instrument contains 6 items. Items 1-3 solicit demographic information such as the state in which the participant teaches, subject area taught, and years of experience. The skill level of the teacher in the use of a computer for instruction was obtained from Item 4 of the survey instrument.

Participants chose from the following categories:

- Novice (still learning to use the machine)
- Beginner (e.g., e-mail, word processing)
- Intermediate (e.g., assign projects, organize information, create your own class materials)
- Advanced (e.g., regularly integrate technology into curriculum, provide staff development opportunities for others)
- Expert (e.g., use technology for student assessment, develop learner-centered strategies)

In Item 5, participants are asked to rate a list of 18 elements (a – r), which are presented as statements, to ascertain teachers’ perceptions of one-to-one computing. Participants are asked to respond to these statements using response options: strongly disagree, disagree, neutral, agree, or strongly agree. For analysis purposes, strongly disagree was converted to a numerical score of 1, disagree was converted to a numerical score of 2, neutral was converted to a numerical score of 3, agree was converted to a numerical score of 4, and strongly agree was converted to a numerical score of 5. A composite score for teachers’ perceptions of one-to-one computing was derived by calculating the mean score of the 18 elements in Item 5 of the survey instrument. Elements a – j measure teachers’ perceptions of one-to-one computing as they relate to instructional practices. Elements k – n measure teachers’ perceptions of one-to-one computing as they relate to student achievement. Elements o – r measure teachers’ perceptions of one-to-one computing as they relate to school environment. Subtest scores for these three sub-areas were derived by calculating the mean score for elements a – j (instructional practice), k – n (student achievement), and o – r (school environment).

Teachers’ perceptions of changes in ACT scores were measured using Item 6 of the survey instrument. Item 6 asks teachers whether they perceive that student performance on the ACT has changed since the implementation of a one-to-one computing program at their school, and whether or not they believe that one-to-one computing impacted ACT scores.

Once the Institutional Review Board at The University of Southern Mississippi granted approval for the study (Appendix A), reliability of the instrument was established through a pilot study. The pilot study was conducted using 18 teachers from a secondary

school in the United States that met the criteria of implementing a one-to-one computing program for the purpose of this study. This school was not included in the larger study. The pilot study used to determine reliability of the instrument was conducted online, and the survey was anonymous. The researcher obtained permission (Appendix B) from the superintendent of the school district to email teachers from the selected school to solicit participation in the pilot study. The researcher obtained teacher email addresses from the principal or designee of the school. An email group for the pilot study was created. Email addresses of individual group members were not visible to other group members. The group email message containing an attachment with informed consent information (Appendix D) was sent to all teachers from the school selected for the pilot study. By clicking “yes” at the end of the email message describing informed consent, teachers confirmed their consent to participate in the study and were directed to the online survey. Email reminders were sent weekly, again as group emails, thanking those that participated while also encouraging those that had not participated to complete the survey. Email reminders were sent for two weeks. Responses from the pilot study were analyzed for reliability by determining a Cronbach’s alpha value for the elements used to determine teachers’ perceptions of one-to-one computing. It was determined that elements a – j had a Cronbach’s alpha value of .93 reported, indicating internal reliability. It was determined that elements k – n had a Cronbach’s alpha value of .84 reported, indicating internal reliability. It was determined that elements o – r had a Cronbach’s alpha value of .90 reported, indicating internal reliability.

## Data Collection

Archival data from annual ACT profile reports provided to high schools were used to determine average ACT scores in schools implementing one-to-one computing. The researcher obtained permission from the superintendent of each school district to use the archived ACT scores. ACT scores were obtained from counselors at participating schools; the instrument for this purpose is described in the previous section. The ACT score reports show five-year trends in average ACT scores at the school, state, and national levels.

The survey used to determine teachers' perceptions was conducted online, and participation in the survey was anonymous. Participants were directed to the online survey, which was conducted using Qualtrics. Email reminders were sent weekly, again as group emails, thanking those that participated while also encouraging those that had not participated to complete the survey. Email reminders were sent for two weeks. Responses from the full study were analyzed for reliability by determining a Cronbach's alpha value for the elements used to determine teachers' perceptions of one-to-one computing. It was determined that elements a – j had a Cronbach's alpha value of .88 reported, indicating internal reliability. It was determined that elements k – n had a Cronbach's alpha value of .81 reported, indicating internal reliability. It was determined that elements o – r had a Cronbach's alpha value of .83 reported, indicating internal reliability.

Only the researcher and his committee members viewed the data collected. Superintendents of participating school districts and school contact persons in participating schools were provided with the researcher's contact information in case they

had any questions or concerns. Even though their responses did not specifically identify them, survey participants were also provided with the researcher's contact information in case they had any questions, concerns, or wanted a copy of the results.

### Data Analysis

Descriptive statistics (frequency, mean, range, standard deviation) were run on all instrument items and all variables within this study. Descriptive statistics (frequency, mean, range, standard deviation) were run on ACT scores, teachers' perceptions of one-to-one computing (Item 5 of the survey instrument), teachers' perceptions of changes in ACT scores (Item 6 of the survey instrument), teachers' years of experience (Item 3 of the survey instrument), and teachers' skill level in the use of a computer for instruction (Item 4 of the survey instrument). Frequency was the only descriptive statistic run on subject taught by the teacher (Item 2 of the survey instrument).

Research questions involving differential and correlational statistics were addressed using appropriate analytical tools. For Research Question 3 and related Hypothesis 1, a dependent *t*-test was used to determine significant mean differences between the average student ACT composite score in schools one year prior to implementing one-to-one computing and the average student ACT composite score in the same schools two years after implementing one-to-one computing. For Research Question 4 and related Hypothesis 2, a repeated measures MANOVA was used to determine significant mean differences between average student ACT subtest scores in English, mathematics, reading, and science in schools one year prior to implementing one-to-one computing and average student ACT subtest scores in English, mathematics, reading, and science in schools two years after implementing one-to-one computing. For



Research Question 5 and related Hypothesis 3, an independent *t*-test was used to determine significant mean differences between the average change in student ACT composite score in the state and the average change in student ACT composite score in schools with two years of experience in implementing one-to-one computing. For Research Question 6 and related Hypothesis 4, a repeated measures MANOVA was used to determine significant mean differences between the average change in student ACT subtest scores in English, mathematics, reading, and science in the state and the average change in student ACT subtest scores in English, mathematics, reading, and science in schools with two years of experience in implementing one-to-one computing. For Research Question 7 and related Hypothesis 5, a Spearman's rho correlation was used to determine the relationship between teachers' perceptions scores and teachers' years of experience. For Research Question 8 and related Hypothesis 6, an ANOVA was used to determine significant differences among means of teachers' perceptions scores organized according to the subject taught by the teacher. For Research Question 9 and related Hypothesis 7, a Spearman's rho correlation was used to determine the relationship between teachers' perceptions scores and teachers' skill level in the use of a computer for instruction. For Research Question 10 and related Hypothesis 8, a Spearman's rho correlation was used to determine the relationship between teachers' perceptions of one-to-one computing and teachers' perceptions of changes in ACT scores.

### Summary

The use of technology, specifically one-to-one computing, in education can enhance the experience of the learner and the instructor. However, research is inconclusive as to whether one-to-one computing impacts student achievement. In

addition, the way teachers perceive one-to-one computing and its impact on student achievement can affect the implementation and success of a one-to-one computing program.

This study attempted to determine a relationship between one-to-one computing and student achievement, specifically ACT scores. The instrument in this study attempted to identify variables that can affect teachers' perceptions of one-to-one computing. The outcome of this study will hopefully lead to information that can help policymakers and educators make appropriate decisions regarding implementation of a one-to-one computing program.

## CHAPTER IV

### RESULTS

This study focused on the policy innovation of one-to-one computing. One purpose of the study was to examine the impact of such programs on student achievement. The other purposes of this study were to investigate the relationships among teachers' perceptions of one-to-one computing, teachers' years of experience, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. Student achievement was measured using average ACT composite scores and average ACT subtest scores for each participating school one year prior to implementing a one-to-one computing initiative and the same ACT scores two years after the school implemented a one-to-one computing initiative.

The Teacher Perceptions of One-to-One Computing instrument was adapted from the Mitchell Institute survey instrument entitled Survey of PCMS/PCHS Faculty and was used to determine teachers' perceptions of one-to-one computing. The survey that employed this instrument was conducted online, and participation in the survey was anonymous. Participants from 12 schools were directed to the online survey, which was conducted using Qualtrics. From a total of 683 teachers, there were 122 teachers who voluntarily participated in the online survey. This resulted in a 17.9% return rate for this survey. However, 9 of these surveys were incomplete and could not be used. This resulted in 113 responses that were usable for the analyses. The statistical analyses of these archival ACT data and these survey responses are presented in this chapter.

### Descriptive Data for Demographic and Background Questions

Archival ACT data were obtained from 33 public schools, including 7 from Alabama and 26 from North Carolina (N=33). The participants in the study consisted of 86 public school teachers from Alabama, who represented 76.1% of the participants, and 27 public school teachers from North Carolina, who represented 23.9% of the participants (N=113) (Table 1). The majority of the teachers (62.0%) were teaching English/language arts, math, science, or social studies/history. These teachers were fairly evenly distributed across those four subjects. There were 19 teachers who were teaching English/language arts; this represented 16.8% of the participants. There were 15 teachers who were teaching math; this represented 13.3% of the participants. There were 16 teachers who were teaching science; this represented 14.2% of the participants. There were 20 teachers who were teaching social studies/history; this represented 17.7% of the participants. Of the remaining participants, there were 4 art/music teachers, 8 foreign language teachers, and 31 teachers from various other disciplines (Table 2).

Table 1

*List of Frequencies and Percentages of the States in Which Respondents Were Teaching*

State	Frequency	Percentage	Cumulative Percentage
Alabama	86	76.1	76.1
North Carolina	27	23.9	100.0
Total	113	100.0	

Table 2

*List of Frequencies and Percentages of the Subjects Respondents Were Teaching*

Subject	Frequency	Percentage	Cumulative Percentage
Art/Music	4	3.5	3.5
Foreign Language	8	7.1	10.6
English/Language Arts	19	16.8	27.4
Math	15	13.3	40.7
Science	16	14.2	54.9
Social Studies/History	20	17.7	72.6
Other	31	27.4	100.0
Total	113	100.0	

The majority of these teachers (50.4% of the participants) had been teaching for either 3 years or fewer or 20 years or more. There were 31 teachers who had been teaching for 3 years or fewer; this represented 27.4% of the participants. There were 26 teachers who had been teaching for 20 years or more; this represented 23.0% of the participants (Table 3).

Table 3

*List of Frequencies and Percentages of Respondents' Years of Experience*

Years of Experience	Frequency	Percentage	Cumulative Percentage
3 or Fewer	31	27.4	27.4
4 – 6	10	8.8	36.2

Table 3 (continued).

Years of Experience	Frequency	Percentage	Cumulative Percentage
7 – 9	11	9.7	45.9
10 – 12	13	11.5	57.4
13 – 19	22	19.5	76.9
20 or More	26	23.0	100.0
Total	113	100.0	

The majority of the teachers (78.8%) rated their overall skill level in the use of a laptop computer for instruction as intermediate or advanced. There were 54 teachers who rated their overall skill level in the use of a laptop computer for instruction as intermediate; this represented 47.8% of the participants. There were 35 teachers who rated their overall skill level in the use of a laptop computer for instruction as advanced; this represented 31.0% of the participants (Table 4).

Table 4

*List of Frequencies and Percentages of Respondents' Skill Level in the Use of a Laptop Computer for Instruction*

Skill Level	Frequency	Percentage	Cumulative Percentage
Beginner	2	1.8	1.8
Intermediate	54	47.8	49.6
Advanced	35	31.0	80.6

Table 4 (continued).

Skill Level	Frequency	Percentage	Cumulative Percentage
Expert	22	19.5	100.0
Total	113	100.0	

The majority of the teachers (79.7%) perceived that ACT scores in their school either stayed the same or were not sure whether there was a change in ACT scores. There were 69 teachers who were not sure whether there was a change in ACT scores; this represented 61.1% of the participants. There were 21 teachers who perceived that ACT scores in their school stayed the same; this represented 18.6% of the participants (Table 5). In addition, the majority of the teachers (54.0%) were not sure whether one-to-one computing had an impact on ACT scores in their respective schools (Table 6).

Table 5

*List of Frequencies and Percentages of Respondents' Perceptions of Changes in ACT Scores*

Perceived Changes in ACT Scores	Frequency	Percentage	Cumulative Percentage
Improved	14	12.4	12.4
Declined	9	8.0	20.4
Stayed the Same	21	18.6	39.0
Not Sure	69	61.1	100.0
Total	113	100.0	

Table 6

*List of Frequencies and Percentages of Respondents' Perceptions of the Impact of One-to-One Computing on ACT Scores*

Impact of One-to-One Computing on ACT Scores	Frequency	Percentage	Cumulative Percentage
Had an Impact	27	23.9	23.9
Had No Impact	25	22.1	46.0
Not Sure	61	54.0	100.0
Total	113	100.0	

#### Findings for Research Questions and Related Hypotheses

The research questions in this study were designed to measure if, after two years of implementation, one-to-one computing innovations impacted student achievement, specifically student achievement on the ACT assessment. The research questions in this study were also designed to determine if there were relationships among teachers' perceptions of one-to-one computing, teachers' years of experience, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. The results of the statistical analysis for each of the research questions are presented in this section.

#### *Research Question 1*

Research Question 1 was constructed as follows: What are the average student ACT composite scores in schools one year prior to implementing one-to-one computing and the average student ACT composite scores in the same schools two years after implementing one-to-one computing?



The ACT has established a scale for the reporting of student performance. The ACT composite score ranges from 1 (low) to 36 (high) (ACT, 2014). Average ACT scores were available for 33 of the 38 schools that participated in the study. The mean for the average student ACT composite scores in participating schools one year prior to implementing one-to-one computing was 17.82, a standard deviation of 2.74. The mean for the average ACT composite scores in the same schools two years after implementing one-to-one computing was 18.07, with a standard deviation of 3.05. The mean for the average student ACT composite scores in the state one year prior to participating schools implementing one-to-one computing was 18.65, with a standard deviation of 0.87. The mean for the average ACT composite scores in the state two years after implementing one-to-one computing was 18.95, with a standard deviation of 0.87 (Table 7). The ACT composite score is also the average of the four ACT subtest scores in English, mathematics, reading, and science (Table 8).

Table 7

*Descriptive Statistics for Average Student ACT Composite Scores*

Average Student ACT Composite Scores	Minimum	Maximum	Mean	Standard Deviation
One Year Before Implementation (Schools in Study)	12.2	23.8	17.82	2.74
Two Years After Implementation (Schools in Study)	12.7	24.4	18.07	3.05
One Year Before Implementation (All Schools in State)	18.2	20.3	18.65	0.87

Table 7 (continued).

Average Student ACT Composite Scores	Minimum	Maximum	Mean	Standard Deviation
Two Years After Implementation (All Schools in State)	18.5	20.6	18.95	0.87

Table 8

*Descriptive Statistics for Average Student ACT Subtest Scores*

Average Student ACT Subtest Scores	Minimum	Maximum	Mean	Standard Deviation
English (One Year Before Implementation) (Schools in Study)	9.2	23.7	16.23	3.46
English (Two Years After Implementation) (Schools in Study)	10.0	24.5	16.62	3.76
Math (One Year Before Implementation) (Schools in Study)	14.2	23.5	18.69	2.24
Math (Two Years After Implementation) (Schools in Study)	15.0	23.8	18.58	2.45
Reading (One Year Before Implementation) (Schools in Study)	12.2	24.0	17.86	2.90

Table 8 (continued).

Average Student ACT Subtest Scores	Minimum	Maximum	Mean	Standard Deviation
Reading (Two Years After Implementation) (Schools in Study)	12.0	25.0	18.22	3.29
Science (One Year Before Implementation) (Schools in Study)	12.8	23.3	17.92	2.48
Science (Two Years After Implementation) (Schools in Study)	13.0	23.9	18.31	2.81
English (One Year Before Implementation) (All Schools in State)	16.4	20.3	17.23	1.62
English (Two Years After Implementation) (All Schools in State)	17.0	20.7	17.79	1.54
Math (One Year Before Implementation) (All Schools in State)	19.3	19.6	19.36	0.12

Table 8 (continued).

Average Student ACT Subtest Scores	Minimum	Maximum	Mean	Standard Deviation
Math (Two Years After Implementation) (All Schools in State)	19.2	19.5	19.26	0.12
Reading (One Year Before Implementation) (All Schools in State)	18.3	20.7	18.81	1.00
Reading (Two Years After Implementation) (All Schools in State)	18.7	21.3	19.25	1.08
Science (One Year Before Implementation) (All Schools in State)	18.3	20.1	18.68	0.75
Science (Two Years After Implementation) (All Schools in State)	18.6	20.4	18.98	0.75

### *Research Question 2*

Research Question 2 was constructed as follows: What are the perceptions of teachers regarding one-to-one computing programs?

This question was addressed using a 5-point Likert scale (Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5) on 18 elements that asked respondents to what extent they agreed or disagreed with a statement about their perceptions of one-to-one computing. The points for each element were added together and divided by the total number of elements in order to calculate an average score for each participant. The average score was 3.43 with a standard deviation of 0.67 (Table 9). This corresponds to an overall rating of Neutral by participants regarding their perceptions of one-to-one computing.

Table 9

*Descriptive Statistics for Respondents' Perceptions of One-to-One Computing*

Variable	N	Minimum	Maximum	Mean	Standard Deviation
Teachers' Perceptions of One-to-One Computing	113	1.39	5.00	3.43	0.67

Likert Scale: 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree

*Research Question 3*

Research Question 3 was constructed as follows: Is there a difference between the average student ACT composite score in schools one year prior to implementing one-to-one computing and the average student ACT composite score in the same schools two years after implementing one-to-one computing? Hypothesis 1 was associated with this research question and was stated as follows: The average student ACT composite scores in schools two years after implementing one-to-one computing are higher than the

average student ACT composite scores in the same schools one year prior to implementing one-to-one computing.

To address this hypothesis, a paired-samples  $t$ -test was calculated to compare the mean of the average student ACT composite scores in participating schools one year prior to implementing one-to-one computing to the mean of the average student ACT composite scores in the same schools two years after implementing one-to-one computing. No significant difference was found between the average student ACT composite scores in schools one year prior to implementing one-to-one computing and the average student ACT composite scores in the same schools two years after implementing one-to-one computing ( $t(32)=1.496, p=.145$ ). Thus, the hypothesis was not accepted.

#### *Research Question 4*

Research Question 4 was constructed as follows: Is there a difference between average student ACT subtest scores in English, mathematics, reading, and science in schools one year prior to implementing one-to-one computing and average student ACT subtest scores in English, mathematics, reading, and science in schools two years after implementing one-to-one computing? Hypothesis 2 was associated with this research question and was stated as follows: The average student ACT subtest scores in English, mathematics, reading, and science in schools two years after implementing one-to-one computing are higher than the average student ACT subtest scores in English, mathematics, reading, and science in the same schools one year prior to implementing one-to-one computing.

To address this hypothesis, a repeated measures MANOVA was calculated to examine the effect of time (one year prior to implementing one-to-one computing or two years after implementing one-to-one computing) on average student ACT subtest scores in English, mathematics, reading, and science in participating schools. A significant effect was found ( $F(4,29)=4.378, p=.007$ ). Follow-up univariate ANOVAs indicated that average student ACT subtest scores in science significantly improved two years after implementing one-to-one computing ( $F(1,32)=4.225, p=.048$ ). Average student ACT subtest scores in English did improve, but they were not significantly improved two years after implementing one-to-one computing ( $F(1,32)=2.893, p=.099$ ). Average student ACT subtest scores in math declined, but they did not decline significantly two years after implementing one-to-one computing ( $F(1,32)=.634, p=.432$ ). Average student ACT subtest scores in reading improved, but they were not significantly improved two years after implementing one-to-one computing ( $F(1,32)=3.791, p=.060$ ). Thus, the hypothesis was accepted for ACT subtest scores in science. However, the hypothesis was not accepted for ACT subtest scores in English, math, and reading.

#### *Research Question 5*

Research Question 5 was constructed as follows: Is there a difference between the average change in student ACT composite score in the state and the average change in student ACT composite score in schools with two years of experience in implementing one-to-one computing? Hypothesis 3 was associated with this research question and was stated as follows: The average change in the student ACT composite score in schools with two years of experience in implementing one-to-one computing is greater than the average change in the student ACT composite score in the state.

To address this hypothesis, a paired-samples  $t$ -test was calculated to compare the mean of the average changes in student ACT composite score in the state to the mean of the average changes in student ACT composite score in schools with two years of experience in implementing one-to-one computing. The mean of the average change in student ACT composite score in the state was .300 ( $sd=.000$ ), and the mean of the average change in student ACT composite score in schools with two years of experience in implementing one-to-one computing was .255 ( $sd=.978$ ). No significant difference was found between the average change in student ACT composite score in the state and the average change in student ACT composite score in schools with two years of experience in implementing one-to-one computing ( $t(32)=.267, p=.791$ ). Thus, the hypothesis was not accepted.

#### *Research Question 6*

Research Question 6 was constructed as follows: Is there a difference between the average change in student ACT subtest scores in English, mathematics, reading, and science in the state and the average change in student ACT subtest scores in English, mathematics, reading, and science in schools with two years of experience in implementing one-to-one computing? Hypothesis 4 was associated with this research question and was stated as follows: The average change in the student ACT subtest scores in English, mathematics, reading, and science in schools with two years of experience in implementing one-to-one computing are greater than the average change in the student ACT subtest scores in English, mathematics, reading, and science in the state.

To address this hypothesis, a repeated measures MANOVA was calculated to determine significant mean differences between the average change in student ACT



subtest scores in English, mathematics, reading, and science in the state and the average change in student ACT subtest scores in English, mathematics, reading, and science in schools with two years of experience in implementing one-to-one computing (Table 10). A significant effect was found ( $F(4,29)=4.95, p=.004$ ). However, follow-up univariate ANOVAs indicated that there were no significant mean differences between the average change in student ACT subtest scores in English, mathematics, reading, and science in the state and the average change in student ACT subtest scores in English, mathematics, reading, and science in schools with two years of experience in implementing one-to-one computing. ACT subtest scores in English improved in both the state and the schools. The average change in student ACT subtest score in English in the state was greater than the average change in student ACT subtest score in English in schools with two years of experience in implementing one-to-one computing, but not significantly greater ( $F(1,32)=.562, p=.459$ ). ACT subtest scores in math declined in both the state and the schools. The average change in student ACT subtest score in math in the state was less than the average change in student ACT subtest score in math in schools with two years of experience in implementing one-to-one computing, but not significantly less ( $F(1,32)=.007, p=.932$ ). ACT subtest scores in reading improved in both the state and the schools. The average change in student ACT subtest score in reading in the state was greater than the average change in student ACT subtest score in reading in schools with two years of experience in implementing one-to-one computing, but not significantly greater ( $F(1,32)=.056, p=.815$ ). ACT subtest scores in science improved in both the state and the schools. The average change in student ACT subtest score in science in the state was less than the average change in student ACT subtest score in science in schools with

two years of experience in implementing one-to-one computing, but not significantly less ( $F(1,32)=.205, p=.663$ ). Thus, the hypothesis was not accepted.

Table 10

*Descriptive Statistics for the Average Change in Student ACT Subtest Scores*

Average Change in Student ACT Subtest Scores	Mean	Standard Deviation
English (School)	0.39	1.31
English (State)	0.56	0.08
Math (School)	-0.11	0.81
Math (State)	-0.10	0.00
Reading (School)	0.39	1.310
Reading (State)	0.44	0.08
Science (School)	0.38	1.08
Science (State)	0.30	0.00

*Research Question 7*

Research Question 7 was constructed as follows: Is there a relationship between teachers' perceptions of one-to-one computing and teachers' years of experience?

Hypothesis 5 was associated with this research question and was stated as follows: There is an inverse relationship between teachers' perceptions of one-to-one computing and teachers' years of experience.

To address this hypothesis, a Spearman's  $\rho$  correlation coefficient was calculated for the relationship between teachers' perceptions of one-to-one computing and teachers' years of experience. A modest, but statistically significant negative

correlation was found ( $\rho(113) = -.191, p = .043$ ) between the two variables. As a teacher's years of experience increase, their perceptions of one-to-one computing tend to become less positive. Thus, the hypothesis was accepted.

#### *Research Question 8*

Research Question 8 was constructed as follows: Are there differences among teachers' perceptions of one-to-one computing, depending on subject taught? Hypothesis 6 was associated with this research question and was stated as follows: There are differences among teachers' perceptions of one-to-one computing, depending on subject taught.

To address this hypothesis, an ANOVA was calculated to compare the means of teachers' perceptions scores organized according to the subject taught by the teacher. No significant difference was found ( $F(6,106) = 1.353, p = .241$ ). Teachers' perceptions of one-to-one computing do not differ significantly depending on subject taught. Thus, the hypothesis was not accepted.

#### *Research Question 9*

Research Question 9 was constructed as follows: Is there a relationship between teachers' perceptions of one-to-one computing and teachers' skill level in the use of a computer for instruction? Hypothesis 7 was associated with this research question and was stated as follows: There is a positive relationship between teachers' perceptions of one-to-one computing and teachers' skill level in the use of a computer for instruction.

To address this hypothesis, a Spearman's  $\rho$  correlation coefficient was calculated for the relationship between teachers' perceptions of one-to-one computing and teachers' skill level in the use of a computer for instruction. A weak correlation that

was not significant was found ( $\rho(113)=.144, p=.127$ ). Teachers' perceptions of one-to-one computing are not related to teachers' skill level in the use of a computer for instruction. Thus, the hypothesis was not accepted.

#### *Research Question 10*

Research Question 10 was constructed as follows: Is there a relationship between teachers' perceptions of one-to-one computing and teachers' perceptions of changes in ACT scores? Hypothesis 8 was associated with this research question and was stated as follows: There is a relationship between teachers' perceptions of one-to-one computing and teachers' perceptions of changes in ACT scores.

To address this hypothesis, a Spearman's  $\rho$  correlation coefficient was calculated for the relationship between teachers' perceptions of one-to-one computing and teachers' perceptions of changes in ACT scores. A weak correlation that was not significant was found ( $\rho(113)= -.096, p=.313$ ). Teachers' perceptions of one-to-one computing are not related to teachers' perceptions of changes in ACT scores. Thus, the hypothesis was not accepted.

#### Summary

There were statistically significant findings in this study as well as findings that were not statistically significant. A statistically significant difference was not found between the average student ACT composite scores and ACT subtest scores in English, math, and reading in schools one year prior to implementing one-to-one computing and the average student ACT composite scores and ACT subtest scores in English, math, and reading in the same schools two years after implementing one-to-one computing. However, a statistically significant difference was found between the average student

ACT subtest scores in science in schools one year prior to implementing one-to-one computing and the average student ACT subtest scores in science in the same schools two years after implementing one-to-one computing. Although average student ACT scores improved in both the schools and the states, a statistically significant difference was not found between the average change in student ACT composite score and ACT subtest scores in the state and the average change in student ACT composite score and ACT subtest scores in schools with two years of experience in implementing one-to-one computing.

A statistically significant relationship was not found among teachers' perceptions of one-to-one computing, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. However, as hypothesized, a statistically modest significant inverse relationship was found between teachers' perceptions of one-to-one computing and teachers' years of experience. As a teacher's years of experience increase, their perceptions of one-to-one computing tend to become less positive. A discussion of these findings, along with related conclusions and recommendations for further study, are be presented in the next chapter.

## CHAPTER V

### DISCUSSION

This study examined whether a relationship exists between one-to-one computing and student achievement, specifically ACT scores. This study also examined whether relationships exist among teachers' perceptions of one-to-one computing, teachers' years of experience, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. This chapter includes a summary of the findings of this study, a discussion of the hypotheses related to this study, links between the findings of this study and literature related to this study, limitations of this study, and suggestions for future practice and research.

#### Summary of the Findings

The researcher analyzed ACT data from the 33 participating schools from Alabama and North Carolina and obtained results for this study. The average student ACT composite scores in participating schools increased from 17.82 one year prior to implementing one-to-one computing to 18.07 in the same schools two years after implementing one-to-one computing (Table 7). The average student ACT composite scores in the state increased from 18.65 one year prior to participating schools implementing one-to-one computing to 18.95 two years after participating schools implemented one-to-one computing (Table 7). The average student ACT subtest scores for English, reading, and science increased in the participating schools and in the state. However, the average student ACT subtest scores for math decreased in the participating schools and in the state.

There was not a statistically significant difference between the average student ACT composite scores in schools one year prior to implementing one-to-one computing and the average student ACT composite scores in the same schools two years after implementing one-to-one computing. In addition, there was no statistically significant difference between the average change in student ACT composite score in the state and the average change in student ACT composite score in schools with two years of experience in implementing one-to-one computing. There was no statistically significant difference found between the average student ACT subtest scores in English, mathematics, and reading in schools one year prior to implementing one-to-one computing and average student ACT subtest scores in English, mathematics, and reading in the same schools two years after implementing one-to-one computing. However, average student ACT subtest scores in science did significantly improve two years after implementing one-to-one computing. There was no statistically significant difference between the average change in student ACT subtest scores in English, mathematics, reading, and science in the state and the average change in student ACT subtest scores in English, mathematics, reading, and science in schools with two years of experience in implementing one-to-one computing.

The researcher analyzed perceptions from the 113 participating teachers from Alabama and North Carolina and obtained results for this study. The majority of the teachers (62.0% of the participants) were teaching English/language arts, math, science, or social studies/history (Table 2). The majority of the teachers (50.4%) had been teaching for either 3 years or fewer or 20 years or more (Table 3). The majority of the teachers (78.8%) rated their overall skill level in the use of a laptop computer for

instruction as intermediate or advanced (Table 4). The majority of the teachers (61.1%) were not sure whether there was a change in ACT scores since the implementation of one-to-one computing (Table 5). In addition, the majority of the teachers (54%) were not sure whether one-to-one computing had an impact on ACT scores in their respective schools (Table 6).

There was no statistically significant correlation found among teachers' perceptions of one-to-one computing, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. However, there was a statistically modest significant inverse relationship between teachers' perceptions of one-to-one computing and teachers' years of experience. As a teacher's years of experience increase, their perceptions of one-to-one computing tend to decrease.

### Discussion

In addition to the statistically significant improvement of ACT subtest scores in science two years after implementing one-to-one computing and the statistically modest significant inverse relationship between teachers' perceptions of one-to-one computing and teachers' years of experience, there were other interesting findings in this study. Observations related to respondents' perceptions of one-to-one computing are discussed in this section. Further commentary on teachers' perceptions about the impact of one-to-one computing is also provided. In addition, a discussion of the hypotheses related to this study and links between the findings of this study and relevant extant literature are included in this section.



### *Respondents' Perceptions of One-to-One Computing*

Respondents' perceptions of one-to-one computing were measured using a 5-point Likert scale (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree) on 18 elements asking respondents to what extent they agreed or disagreed with a statement about their perceptions of one-to-one computing. The average score was 3.43 (sd=0.67), which corresponds to an overall rating of Neutral by participants regarding their perceptions of one-to-one computing (Table 9). Participants on average did not strongly agree with any of the 18 elements. However, the only 2 elements participants on average agreed with were the elements stating that access to educational resources had improved for teachers and students since the implementation of one-to-one computing. The results of this study related to teachers' perceptions of increased access to educational resources for teachers and students are consistent with those found in the literature. Experts have indicated that teachers and students in schools with one-to-one computing have increased access to educational resources (Bouterse et al., 2009; Fairbanks, 2013; Herold, 2014b; Ramig, 2014).

The majority of teachers were not sure whether there was a change in ACT scores in their schools since the implementation of one-to-one computing. In addition, the majority of teachers were not sure whether one-to-one computing had an impact on ACT scores in their respective schools. This is likely a result of classroom teachers having limited direct knowledge of the impact of one-to-one computing on ACT scores. Prior research is limited in the area of teachers' perceptions of changes in ACT scores in schools implementing one-to-one computing.

### *Discussion of Hypotheses*

Hypothesis 1 was stated as follows: The average student ACT composite scores in schools two years after implementing one-to-one computing are higher than the average student ACT composite scores in the same schools one year prior to implementing one-to-one computing. As was stated previously, a statistically significant difference was not found between the average student ACT composite scores in schools one year prior to implementing one-to-one computing and the average student ACT composite scores in the same schools two years after implementing one-to-one computing. As a result, this hypothesis was not accepted. The results of this study related to the impact of one-to-one computing innovations on student achievement seem to contradict the related literature. Experts have indicated that one-to-one computing initiatives can be used effectively to enhance student achievement (Abell, 2008; Lowther et al., 2003; McLester, 2011; Norris & Soloway, 2010; Rosen & Beck-Hill, 2012; Safar, 2012; Spektor-Levy & Granot-Gilat, 2012).

The average student ACT composite scores in participating schools one year prior to implementing one-to-one computing had a mean of 17.82 and a standard deviation of 2.74 (Table 7). This indicates that approximately 95% of the average student ACT composite scores in schools one year prior to implementing one-to-one computing ranged from 12.3 to 23.3. The average student ACT composite scores in the same schools two years after implementing one-to-one computing had a mean of 18.07 and a standard deviation of 3.05. This indicates that approximately 95% of the average student ACT composite scores in the same schools two years after implementing one-to-one

computing ranged from 12.0 to 24.1. The wide range of scores indicates a diverse sample in which there could be other variables impacting average student ACT composite scores other than one-to-one computing innovations. More research is needed to examine impact of one-to-one computing innovations on average student ACT composite scores in relationship to the impact of other variables on average student ACT composite scores.

Hypothesis 2 was stated as follows: The average student ACT subtest scores in English, mathematics, reading, and science in schools two years after implementing one-to-one computing are higher than the average student ACT subtest scores in English, mathematics, reading, and science in the same schools one year prior to implementing one-to-one computing. As was stated previously, there was no statistically significant difference found between the average student ACT subtest scores in English, math, and reading in schools one year prior to implementing one-to-one computing and average student ACT subtest scores in English, math, and reading in the same schools two years after implementing one-to-one computing. As a result, this hypothesis was not accepted for ACT subtest scores in English, math, and reading. The results of this study related to the impact of one-to-one computing innovations on student achievement in English, math, and reading (measured by average ACT subtest scores in English, math, and reading) seem to contradict the related literature. Again, experts have indicated that one-to-one computing initiatives can be used effectively to enhance student achievement (Abell, 2008; Lowther et al., 2003; McLester, 2011; Norris & Soloway, 2010; Rosen & Beck-Hill, 2012; Safar, 2012; Spektor-Levy & Granot-Gilat, 2012). Similar to the findings related to ACT composite scores, there was a wide range of ACT subtest scores in this study. More research is needed to examine impact of one-to-one computing

innovations on average student ACT subtest scores in English, math, and reading in relationship to the impact of other variables on average student ACT subtest scores in English, math, and reading.

As was described previously, average student ACT subtest scores in science did significantly improve two years after implementing one-to-one computing. As a result, this hypothesis was accepted for ACT subtest scores in science. The results of this study related to the impact of one-to-one computing innovations on student achievement in science (measured by average student ACT subtest scores in science) are consistent with those found in the literature. Prior research has shown that one-to-one computing initiatives can be used effectively to increase proficiency on standardized science tests (Solomon, 2005). More research is needed to determine why ACT subtest scores in science improved significantly even though there was a diverse sample in which there could be other variables impacting average student ACT subtest scores in science other than one-to-one computing innovations.

Hypothesis 3 was stated as follows: The average change in the student ACT composite score in schools with two years of experience in implementing one-to-one computing is greater than the average change in the student ACT composite score in the state. There was no statistically significant difference found between the average change in student ACT composite score in the state and the average change in student ACT composite score in schools with two years of experience in implementing one-to-one computing. As a result, this hypothesis was not accepted. The results of this study related to the impact of one-to-one computing innovations on student achievement seem to contradict the related literature. Again, experts have indicated that one-to-one

computing initiatives can be used effectively to enhance student achievement (Abell, 2008; Lowther et al., 2003; McLester, 2011; Norris & Soloway, 2010; Rosen & Beck-Hill, 2012; Safar, 2012; Spektor-Levy & Granot-Gilat, 2012).

Hypothesis 4 was stated as follows: The average change in the student ACT subtest scores in English, mathematics, reading, and science in schools with two years of experience in implementing one-to-one computing is greater than the average change in the student ACT subtest scores in English, mathematics, reading, and science in the state. There was no statistically significance found between the average change in the student ACT subtest scores in English, math, reading, and science in schools with two years of experience in implementing one-to-one computing and the average change in the student ACT subtest scores in English, mathematics, reading, and science in the state. As a result, this hypothesis was not accepted. The results of this study related to the impact of one-to-one computing innovations on student achievement seem to contradict the related literature. Again, experts have indicated that one-to-one computing initiatives can be used effectively to enhance student achievement (Abell, 2008; Lowther et al., 2003; McLester, 2011; Norris & Soloway, 2010; Rosen & Beck-Hill, 2012; Safar, 2012; Spektor-Levy & Granot-Gilat, 2012).

There was limited variability in the average change in student ACT composite score in the state and limited variability in the average change in student ACT subtest scores in the state. This is likely a result of the researcher using a convenience sample including schools from only two states, Alabama and North Carolina. As more school districts implement one-to-one computing programs throughout the United States, further research can include schools from a larger number of states.

Hypothesis 5 was stated as follows: There is an inverse relationship between teachers' perceptions of one-to-one computing and teachers' years of experience. As was noted previously, a statistically modest significant inverse relationship was found between teachers' perceptions of one-to-one computing and teachers' years of experience. As a result, this hypothesis was accepted. The results for this study related to the investigation of the relationship between teachers' perceptions of one-to-one computing and teachers' years of experience are consistent with those found in the literature. Experts have indicated that a teacher's years of experience can affect a teacher's perceptions of one-to-one computing and how often and how successfully a teacher implements one-to-one computing in their own classroom (Galvis, 2012; Kale & Goh, 2014). According to the results of this study, teachers' perceptions of one-to-one computing tend to decrease as teacher's years of experience increase. This could indicate that teachers who have been teaching for a long period of time prefer more traditional teaching methods and are resistant to newer concepts such as one-to-one computing.

Hypothesis 6 was stated as follows: There are differences among teachers' perceptions of one-to-one computing, depending on subject taught. There were no statistically significant differences found among teachers' perceptions of one-to-one computing, depending on subject taught. As a result, this hypothesis was not accepted. The results for this study related to the investigation of the relationship between teachers' perceptions of one-to-one computing and subjects taught by teachers seem to contradict the related literature. Experts have indicated that the subject being taught by a teacher can affect a teacher's perceptions of one-to-one computing, the way a teacher implements one-to-one computing in their own classroom, and how often a teacher implements one-

to-one computing in their own classroom (Ertmer & Ottenbreit-Leftwich, 2010; Hennessy et al., 2005; Inserra & Short, 2012).

Hypothesis 7 was stated as follows: There is a positive relationship between teachers' perceptions of one-to-one computing and teachers' skill level in the use of a computer for instruction. Although teachers' perceptions of one-to-one computing and teachers' skill level in the use of a computer for instruction were positively correlated, this study found no statistically significant relationship between teachers' perceptions of one-to-one computing and teachers' skill level in the use of a computer for instruction. As a result, this hypothesis was not accepted. The results for this study related to the investigation of the relationship between teachers' perceptions of one-to-one computing and teachers' skill level in the use of a computer for instruction seem to contradict the related literature. Experts have indicated that a teacher's skill level in the use of a computer for instruction can affect a teacher's perceptions of one-to-one computing and how often and how successfully a teacher implements one-to-one computing in their own classroom (Claesgens et al., 2013; Ertmer & Ottenbreit-Leftwich, 2010; Kale & Goh, 2014; Lowther, 2012; Turel, 2014). The majority of the teachers in this study (78.8%) rated their overall skill level in the use of a laptop computer for instruction as intermediate or advanced. However, teachers self-reported their overall skill level in the use of a laptop computer for instruction. Further research could include a survey instrument for measuring teachers' skill level in the use of a laptop computer for instruction.

Hypothesis 8 was stated as follows: There is a relationship between teachers' perceptions of one-to-one computing and teachers' perceptions of changes in ACT

scores. As was stated previously, a statistically significant relationship was not found between teachers' perceptions of one-to-one computing and teachers' perceptions of changes in ACT scores. As a result, this hypothesis was not accepted. The majority of the teachers (61.1% of the participants) were not sure whether ACT performance at their school improved, declined, or stayed the same. Again, past research is limited in the area of teachers' perceptions of changes in ACT scores in schools implementing one-to-one computing. Further research could include participants such as school counselors, who have more direct knowledge of the impact of one-to-one computing on ACT scores.

#### *Importance to the Field of Education*

This study is important because more research is needed to determine the connection between technology use, specifically one-to-one computing, and student achievement (Abell, 2008). One-to-one computing programs are very expensive, and policymakers want to be sure that these programs directly enhance learning and lead directly to higher test scores (Herold, 2013b). Studies of one-to-one computing programs have addressed student achievement, but the results to date have been inconclusive (Baker et al., 2012). The results of this study related to the impact of one-to-one computing innovations on student achievement are also inconclusive. Average student ACT subtest scores in science did significantly improve two years after implementing one-to-one computing. However, ACT composite scores and ACT subtest scores (in English, math, and reading) did not significantly improve two years after implementing one-to-one computing.

The study is also important because teachers are more likely to embrace the implementation of a one-to-one computing program if they believe that the technology



enhances the instructional process and enhances student achievement (Maninger & Holden, 2009). The only 2 elements from the survey instrument with which participants on average agreed with were the element stating that access to educational resources had improved for teachers since the implementation of one-to-one computing and the element stating that access to educational resources had improved for students since the implementation of one-to-one computing. In addition, a teacher's years of experience can affect a teacher's perceptions of one-to-one computing and how often and how successfully a teacher implements one-to-one computing in his/her own classroom (Galvis, 2012; Kale & Goh, 2014). According to the results of this study, teachers' perceptions of one-to-one computing tend to become less positive as teacher's years of experience increase.

#### Limitations

The following limitations were present in this study:

1. The study was limited to public school teachers from Alabama and North Carolina who participated in the voluntary online survey.
2. Teachers from 12 schools were the potential subjects for participation in the voluntary online survey. However, it was not feasible or appropriate to monitor the schools of the actual respondents. Thus, respondents may or may not represent all schools and may not be representative of the perspectives across the participating schools.
3. Participation in this study was voluntary and results may be biased based on respondents' self-reporting of their overall skill level in the use of a laptop

computer for instruction, their perceptions of one-to-one computing, and their perceptions of the impact of these initiatives.

4. Teachers self-reported their overall skill level in the use of a laptop computer for instruction.
5. Teachers were asked for their perceptions of changes in ACT scores.

However, these teachers may not have had direct knowledge of the impact of one-to-one computing on ACT scores.

#### Recommendations for Future Practice

There was a statistically significant difference found between the average student ACT subtest scores in science in schools one year prior to implementing one-to-one computing and the average student ACT subtest scores in science in the same schools two years after implementing one-to-one computing. In addition, ACT composite scores and ACT subtest scores (in English, reading, and science) increased, although not significantly, in schools two years after implementing a one-to-one computing program. School leaders could examine the correlation between student achievement in science and one-to-one computing and try to determine if there are instructional methods used in science classes that could be used in other subjects. School leaders should also develop policy regarding the need for research on the impact of one-to-one computing on student achievement prior to implementing a one-to-one computing program.

A statistically modest significant inverse relationship was found between teachers' perceptions of one-to-one computing and teachers' years of experience. As a teacher's years of experience increase, their perceptions of one-to-one computing tend to become less positive. Experts have indicated that teachers' perceptions of one-to-one

computing programs can affect the level of implementation of one-to-one computing in classroom instruction and can be the largest barrier to a successful one-to-one computing initiative (Fogle, 2014; Hammonds et al., 2013; Inan & Lowther, 2010; Wadmany & Kliachko, 2014). School leaders should provide adequate professional development showing teachers how one-to-one computing can help them to engage and motivate students, customize instruction to meet the needs of students, plan more effectively and efficiently, collaborate with other teachers, and improve communication with parents and administrators.

#### Recommendations for Future Studies

The results of this study provide opportunities for further research. The following list suggests improvements for this study:

1. Further research could include schools from multiple states, including or not including Alabama and North Carolina.
2. Teachers could be evaluated on their skill level in the use of a laptop computer for instruction instead of self-reporting their skill level. The ratings from these evaluations could be used to investigate the relationship between teachers' perceptions of one-to-one computing and teachers' skill level in the use of a computer for instruction.
3. Further research could include the impact of one-to-one computing on student discipline.
4. Further research could include the impact of other variables, such as socioeconomic factors, on the implementation of one-to-one computing.

5. Further research could include counselors, administrators, and other educators with more direct knowledge of the impact of one-to-one computing on ACT scores.

### Summary

This study sought to examine the impact of one-to-one computing innovations on student achievement. The other purposes of this study were to investigate the relationships among teachers' perceptions of one-to-one computing, teachers' years of experience, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. This study could help policymakers and educators make appropriate decisions regarding implementation of a one-to-one computing program. This study could also help enhance professional development for teachers in schools implementing one-to-one computing.

There were statistically significant findings in this study as well as findings that were not statistically significant. A statistically significant difference was not found between the average student ACT composite scores and ACT subtest scores in English, math, and reading in schools one year prior to implementing one-to-one computing and the average student ACT composite scores and ACT subtest scores in English, math, and reading in the same schools two years after implementing one-to-one computing. A statistically significant difference was found between the average student ACT subtest scores in science in schools one year prior to implementing one-to-one computing and the average student ACT subtest scores in science in the same schools two years after implementing one-to-one computing. A statistically significant difference was not found between the average change in student ACT composite score and ACT subtest scores in

the state and the average change in student ACT composite score and ACT subtest scores in schools with two years of experience in implementing one-to-one computing. A statistically significant relationship was not found among teachers' perceptions of one-to-one computing, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. A statistically modest significant inverse relationship was found between teachers' perceptions of one-to-one computing and teachers' years of experience.

## APPENDIX A

## INSTITUTIONAL REVIEW BOARD NOTICE OF COMMITTEE ACTION



THE UNIVERSITY OF  
SOUTHERN MISSISSIPPI

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**INSTITUTIONAL REVIEW BOARD**

118 College Drive #5147 | Hattiesburg, MS 39406-0001

Phone: 601.266.5997 | Fax: 601.266.4377 | [www.usm.edu/research/institutional.review.board](http://www.usm.edu/research/institutional.review.board)

**NOTICE OF COMMITTEE ACTION**

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.  
Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 15031001

PROJECT TITLE: An Analysis of the Correlation between ACT Scores and One-to-One Computing

PROJECT TYPE: New Project

RESEARCHER(S): Jeff Heath

COLLEGE/DIVISION: College of Education and Psychology

DEPARTMENT: Educational Leadership and School Counseling

FUNDING AGENCY/SPONSOR: N/A

IRB COMMITTEE ACTION: Expedited Review Approval

PERIOD OF APPROVAL: 03/19/2015 to 03/18/2016

**Lawrence A. Hosman, Ph.D.**

**Institutional Review Board**

## APPENDIX B

## MESSAGE TO THE SUPERINTENDENT

Date  
Name of Superintendent  
Name of School District  
Address

RE: Permission to conduct research study

Dear Superintendent \_\_\_\_\_:

My name is Jeff Heath, and I am currently enrolled in the doctoral program at The University of Southern Mississippi. As part of my degree program in educational leadership, I am required to survey educators in the area of my research topic. One purpose of my study will be to examine the relationships among teachers' perceptions of one-to-one computing, teachers' years of experience, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. The goal of my survey is to collect information regarding high school teachers' perceptions of one-to-one computing.

This study will also examine the impact of one-to-one computing on student achievement. Student achievement will be measured using average ACT composite scores and average ACT sub-scores in participating schools. Individual student ACT composite scores and sub-scores will not be solicited or used in this study. The information I gather through my research will hopefully provide information that can help policymakers and educators make appropriate decisions regarding implementation of a one-to-one computing program.

The purpose of this letter is to kindly request your permission to conduct my survey among the high school teachers in your district and collect the necessary ACT data from high school counselors in your district. Again, the ACT data requested will be school summary information and will not identify individual students in any way. If you agree to allow me to conduct my survey and collect the necessary ACT data, the information gathered will be compiled with information provided by other high school teachers and counselors in other school districts across the United States. Please be assured that your district and your district's teachers and counselors will not be identified anywhere in my research.

Participants will be surveyed via an online questionnaire. An email group for each high school will be created, and an email will be sent to all teachers containing a link to the online survey. The survey will take place in April 2015. Participation in this study is completely voluntary and confidential. Your approval to conduct this survey within your district will be greatly appreciated. Feel free to contact me if you have questions or concerns at 601-863-9289 or [jheath@madison-schools.com](mailto:jheath@madison-schools.com). My committee chair is Dr.

Thelma J. Roberson, and she can be contacted at [thelma.roberson@usm.edu](mailto:thelma.roberson@usm.edu) or at (601) 266-4580.

If you agree to my request, please copy the attached consent form to your district's letterhead, sign it, and scan the signed document and email it to me at [jheath@madison-schools.com](mailto:jheath@madison-schools.com).

Sincerely,

Jeff Heath  
Doctoral Candidate, The University of Southern Mississippi



Enclosures  
Consent Form

By signing and returning this form, I give Jeff Heath, a doctoral candidate at The University of Southern Mississippi, permission to conduct a research study in the \_\_\_\_\_ School District. I acknowledge that Mr. Heath may contact my district's high school building administrators to identify the contact person who will provide email addresses for teachers and counselors.

Approved by:

---

Please print your name and title above

---

Superintendent's signature

---

Date

## APPENDIX C

## MESSAGE TO THE COUNSELOR

Date  
Name of Counselor  
Name of High School  
Address

RE: Request for archival ACT data

Dear \_\_\_\_\_:

I am a doctoral candidate at the University of Southern Mississippi. I am conducting a research study that examines the impact of one-to-one computing innovations on student achievement, specifically ACT scores. I have attached permission from your school district's superintendent to use average ACT composite scores and average ACT sub-scores for \_\_\_\_\_ High School from the \_\_\_\_\_ ACT Profile Report. I only need the page(s) from the executive summary section that show(s) five year trends for ACT composite and sub-scores for the school (see attached example). You may scan the information and send it in a reply to this email, or you may fax it to 601-859-0372. If you have any questions, please don't hesitate to ask. Thanks in advance for your help with collecting these data.

Sincerely,

Jeff Heath  
Doctoral Candidate, The University of Southern Mississippi

## APPENDIX D

## PARTICIPANT COVER MESSAGE

Dear Participant,

I am a doctoral candidate at the University of Southern Mississippi. I am conducting a research study on the impact of one-to-one computing programs on student achievement and the relationships among teachers' perceptions of one-to-one computing, teachers' years of experience, subjects taught by teachers, teachers' skill level in the use of a computer for instruction, and teachers' perceptions of changes in ACT scores. I am interested in your opinions regarding implementation of the one-to-one computing program in your school. Please take a few moments of your time to complete the online survey. The survey should take no more than 15 minutes to complete. The survey contains 6 items. Item 1 asks for demographic information about you. Items 2 – 4 ask for the subject you teach, your years of experience, and your skill level in the use of a computer for instruction. Item 5 asks for information regarding your perceptions of one-to-one computing. Item 6 asks for your perceptions of changes in ACT scores. Your responses will reflect your perceptions about one-to-one computing programs. Upon receipt of all participants' responses aggregated information from all participants will be shared with my dissertation committee.

The data collected from the completed online surveys will be compiled and analyzed. All data collected will be anonymous. All information gathered will be kept completely confidential and reported in aggregated form. To ensure confidentiality of teachers, no one will be identified by name. Upon completion of this research study, I will permanently delete all surveys. This email message contains an attachment with informed consent information. By clicking "yes" at the end of this email message, you will be confirming consent and will be directed to the online survey. As the researcher, I am very appreciative of your participation. However, you have the option to decline to participate if you so wish. If you decide to withdraw from participation at any time there is no penalty or risk of negative consequence.

I will use the data you provide to inform and strengthen the research in the area of teachers' perceptions of one-to-one computing programs. Should you have any questions please feel free to contact me: Jeff Heath, email: [jheath@madison-schools.com](mailto:jheath@madison-schools.com); phone: 601-863-9289. The research is being conducted under the supervision of Dr. Thelma J. Roberson, The University of Southern Mississippi, email: [thelma.roberson@usm.edu](mailto:thelma.roberson@usm.edu); phone: (601) 266-4580.

This research project has been reviewed and approved by the Human Subjects Protection Review Committee, which ensures that all research fits the federal guidelines for research involving human subjects. Any questions or concerns about the rights of a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601)-266-5997.

Thank you for your participation.

Sincerely,

Jeff Heath

## INFORMED CONSENT INFORMATION

**The University of Southern Mississippi  
118 College Drive #5147  
Hattiesburg, Mississippi 39406-0001  
(601) 266-5997**

**Consent to participate in a Research Study**

**Date: March 19, 2015**

**Title of Study: An Analysis of the Correlation Between ACT Scores and One-to-One Computing**

**Research will be conducted by: Jeff Heath**

**Phone Number: (601) 863-9289 Email Address: [jheath@madison-schools.com](mailto:jheath@madison-schools.com)**

**Faculty Advisor: Dr. Thelma J. Roberson**

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**What are some general things you should know about research studies?**

Classroom teachers currently employed in selected public high schools in the United States are being asked to take part in a research study. Participating in this study is voluntary. You may refuse to take part, or you may withdraw your consent to be in the study, for any reason, without penalty.

Research studies are designed with the intent to obtain new knowledge. This new information may help people in the future. You may not receive any direct benefit from being in this study. There also may be risks to being in research studies. For this particular research, the risks are very minimal and are described in this document.

Details about this study are discussed below. It is important that you understand this information so that you can make an informed decision about being in this research study.

**What is the purpose of this study?**

One purpose of this study is to determine high school teachers' perceptions of one-to-one computing programs. The other purpose of this study is to determine the impact of one-to-one computing programs on student achievement. The goal of this research is to provide information that can help policymakers and educators make appropriate decisions regarding implementation of a one-to-one computing program.

**How many people will take part in this study?**

If you decide to be in this study, you will be one of approximately 900 participants.

**How long will your part in this study last?**

If you chose to participate, you will receive a link to an online survey that will take you no longer than 15 minutes to complete. A consent form will also be provided online for you to read prior to completing the survey. Your name or identity will not be asked for within the survey, nor will your personal information be reflected anywhere within this research. A report of my findings will be made available upon request at the conclusion of this study; simply email me at [jheath@madison-schools.com](mailto:jheath@madison-schools.com).

**What will happen if you take part in the study?**

High school teachers willing to participate in this research will be asked to read a consent form online, indicate consent to participate, and complete an online survey. A group email message containing an attachment with informed consent information will be sent to all teachers from schools selected for this study. By clicking “yes” at the end of the email message containing consent, teachers will be confirming consent and will be directed to the online survey. The researcher will collect data from the survey. The survey will be permanently deleted upon completion of this project.

**What are the possible benefits from being in this study?**

While there are no personal benefits related to your participation in the study, findings are intended to help policymakers and educators make appropriate decisions regarding implementation of a one-to-one computing program. The results of this study could also potentially play a vital role by providing valuable insight that can be shared with persons involved in the educational system, including students, parents, teachers, administrators, educational professionals and policymakers. These insights could potentially bridge gaps in understanding teachers’ perceptions of one-to-one computing, thus resulting in enlightenment of administrators/policymakers regarding the needs of classroom teachers.

**What are the possible risks or discomforts involved from being in this study?**

The risks that may be involved in this study are minimal. They include the possibility that the participant may not feel comfortable providing feedback pertaining to his/her personal views regarding his/her own perceptions of the one-to-one computing program being implemented in his/her school. These concerns may be allayed by the assurances of confidentiality for respondents that will be provided. Only the researcher and faculty advisors will view the participant responses. All responses will be stored securely online. The researcher will be the only person with access to the password needed to view responses. Surveys will be permanently deleted after one year.

**How will your privacy be protected?**

Participants will not indicate their identities on the survey. They will not be identified in any report or publication about this study. Only the researcher and his university faculty advisors will have access to participant responses. All responses will be stored securely online. The researcher will be the only person with access to the password needed to view responses. Additionally, surveys will be permanently deleted after one year.

**What if you have questions about this study?**

You have the right to ask, and have answered, any questions you may have about this research. If you have questions, or concerns, you should contact the researcher listed on the first page of this form.

**What if you have questions about your rights as a research participant?**

This project has been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to the chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-5997.

## APPENDIX E

Hi Jeff,  
Your study sounds well-designed. You have our permission to use the survey questions. I hope it goes well!  
It's nice to get your message the day after reading an article about how education researchers don't replicate one another's work enough.  
Take care,  
Lisa

Lisa Plimpton  
Research Director  
Senator George J. Mitchell Scholarship Research Institute  
22 Monument Square  
Portland, ME 04101  
Main: (207) 773-7700 \* Direct: (207) 358-7735  
Fax: (207) 773-1133  
www.mitchellinstitute.org

-----Original Message-----  
From: Heath, Jeff [mailto:jheath@madison-schools.com]  
Sent: Tuesday, September 23, 2014 1:55 PM  
To: Lisa Plimpton  
Cc: Heath, Jeff  
Subject: Great Maine Schools Project

Mrs. Plimpton-

Good afternoon. My name is Jeff Heath. I am currently an administrator in the Madison County School District in Madison, MS. I am also working on my Doctoral Degree in Educational Leadership at the University of Southern Mississippi.

My dissertation and the corresponding study will investigate the relationship between one-to-one computing initiatives and ACT scores. The purpose of this study will be to compare average ACT scores in schools one year prior to implementing a one-to-one computing program and average ACT scores in the same schools three years after implementing a one-to-one computing program. Average ACT scores will include both composite scores and sub-scores. In addition, this study will investigate the relationship between teacher perception of one-to-one computing and teacher years of experience, the relationship between teacher perception of one-to-one computing and subject taught by the teacher, and the relationship between teacher perception of one-to-one computing and teacher skill level in the use of a computer for instruction.

For the purpose of investigating teacher perception of one-to-one computing, I am seeking permission to use the attached survey from the Mitchell Institute that was used in the Piscataquis Community High School Study Final Report from February 2004. I do not plan to use all 19 items on the survey, but I will not be modifying any items.

Please don't hesitate to contact me if you need me to provide any further information.

Thanks in advance for your time and consideration,

Jeff Heath  
Assistant Principal, Madison Career & Technical Center Madison County School District  
142 Calhoun Parkway  
Madison, MS 39110  
601-859-6847

From: lplimpton@mitchellinstitute.org  
Subject: RE: Great Maine Schools Project  
Date: September 30, 2014 at 9:40 AM  
To: Heath, Jeff jheath@madison-schools.com



Yes, absolutely, Jeff, you have our permission to modify the survey questions.  
Take care,  
Lisa

-----Original Message-----

From: Heath, Jeff [mailto:jheath@madison-schools.com]  
Sent: Tuesday, September 30, 2014 10:39 AM  
To: Lisa Plimpton  
Subject: Re: Great Maine Schools Project

Lisa-

I'm very sorry to bother you again, and I promise not to take any more of your time than necessary. In working with the survey (and getting ready for the pilot study), I have determined that I may need to modify a few items under section 11 of the attached survey. I would like to change the term "changed" to "improved" in a few places. For example, I would like to modify "The school climate has changed" to become "The school climate has improved." Therefore, I want to be sure that I have your permission to use and modify the survey to fit my study.

Thanks (again) in advance,

Jeff Heath  
Assistant Principal, Madison Career & Technical Center Madison County School District  
142 Calhoun Parkway  
Madison, MS 39110  
601-859-6847



APPENDIX F  
SURVEY INSTRUMENT

Teacher Perceptions of One-to-One Computing

1. In which state do you currently teach?

\_\_\_\_\_

2. Which subject(s) do you teach? (Check all that apply)

- |                                       |   |  |
|---------------------------------------|---|--|
| <input type="checkbox"/> Art, Music   | <input type="checkbox"/> Foreign Language | <input type="checkbox"/> Language Arts/English   |
| <input type="checkbox"/> Math         | <input type="checkbox"/> Science          | <input type="checkbox"/> Social Studies, History |
| <input type="checkbox"/> Other: _____ |   |  |

3. For how many years have you been teaching?

- |                                     |                                     |                              |                                |
|-------------------------------------|-------------------------------------|------------------------------|--------------------------------|
| <input type="checkbox"/> 3 or fewer | <input type="checkbox"/> 4-6        | <input type="checkbox"/> 7-9 | <input type="checkbox"/> 10-12 |
| <input type="checkbox"/> 13-19      | <input type="checkbox"/> 20 or more |                              |                                |

4. How would you rate your overall skill level in the use of a laptop computer for instruction?

- Novice (still learning to use the machine)
- Beginner (e.g., e-mail, word processing)
- Intermediate (e.g., assign projects, organize information, create your own class materials)
- Advanced (e.g., regularly integrate technology into curriculum, provide staff development opportunities for others)
- Expert (e.g., use technology for student assessment, develop learner-centered strategies)

5. Please indicate the degree to which you agree with each of the following statements.

<b>Since the one-to-one computing program began:</b>	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
<b><u>Instructional Practices</u></b>					
a. My goals for students have improved.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. My role in the classroom is more focused on student-centered learning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. My understanding of how people learn has improved.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. My beliefs about teaching and learning have been enhanced.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. I have had adequate professional development opportunities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. My computer skills have improved.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. My access to educational resources has improved.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. My lesson planning has been enhanced, and I have become more efficient with the time I spend planning lessons.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. The curriculum in my classes has improved.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. I have been able to better manage student data to monitor progress and guide instruction.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>Student Achievement</u></b>					
k. Student achievement in my classes has improved.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l. Students' computer literacy has improved.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
m. There have been more personalized learning opportunities for each student.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
n. Students' access to educational resources has improved.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>School Environment</u></b>					
o. The school climate has improved.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
p. The school has a reliable computer network that can accommodate the number of devices being used on a daily basis in the one-to-one computing program.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
q. Teachers and students have access to reliable technical support.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
r. The school has developed effective policies and procedures for the one-to-one computing program.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. Please check the statement that matches your perception in the following two statements:

a. Since implementation of the one-to-one computing program, ACT performance in my school has:

- Improved
- Declined
- Stayed the same
- Not sure

b. I believe that the one-to-one computing program:

- Had an impact on ACT scores in my school.
- Had no impact on ACT scores in my school.
- Not sure

## APPENDIX G

## VALIDITY QUESTIONNAIRE

**Teacher Perceptions of One-to-One Computing  
Validity Questionnaire**

Thank you for taking the time to review this instrument. I appreciate your willingness to give your expertise and assistance in the development of this instrument that will be used to gather data for this study. Your input is very important and will be used to make any necessary changes in order to more effectively meet the goal of the study.

The purpose of the instrument that you are evaluating is to gather data from high school teachers regarding their perceptions of one-to-one computing programs in their schools. I hope this data will provide information that can help policymakers and educators make appropriate decisions regarding implementation of a one-to-one computing program.

Please take your time and critique the attached questionnaire by answering either “Yes” or “No” to the questions below. Please provide feedback as well as your reasoning(s) behind any responses that receive a “No” on the lines provided.

1. Has the survey been developed with language that is easy to understand by the participants in this study?                      Yes \_\_\_\_\_                      No \_\_\_\_\_

Comments:

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2. Does the survey address suitable issues that will allow the researcher to obtain pertinent information related to teachers’ perceptions of one-to-one computing?

Yes \_\_\_\_\_                      No \_\_\_\_\_

Comments:

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3. Are there any particular items within the survey that you would modify? If so, how would you modify it?

Yes \_\_\_\_\_ No \_\_\_\_\_ (please identify item number(s) if you selected a “Yes” response)

Add any recommendations in the comment section below.

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4. Do you believe any of the survey items can be potentially offensive or invasive to the participant? Could the item be modified so that it is not offensive or invasive?

Yes \_\_\_\_\_ No \_\_\_\_\_ (please identify item number(s) and suggested modification if you selected a “Yes” response)

Add any recommendations in the comment section below.

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5. Are there any items in the survey that you feel should be excluded?

Yes \_\_\_\_\_ No \_\_\_\_\_ (please identify item number(s) and reasoning if you selected a “Yes” response)

Add any recommendations in the comment section below.

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6. Are there any survey items that you feel should be included that are **not** included in the attached questionnaire? Yes \_\_\_\_\_ No \_\_\_\_\_ (If you selected “Yes”, please write your suggested statement(s) below)

Add any recommendations in the comment section below.

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