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A Laptop-Learning Initiative: Relationships With Student Achievement, Technology Proficiency, and Attitude Towards Technology

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A LAPTOP-LEARNING INITIATIVE: RELATIONSHIPS WITH STUDENT ACHIEVEMENT, TECHNOLOGY PROFICIENCY, AND ATTITUDE TOWARDS TECHNOLOGY

by

Kevin Scott Nicholas

A Dissertation
Submitted to the Graduate Studies Office
of The University of Southern Mississippi
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ABSTRACT

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The purpose of this study was to investigate the relationships between a laptop-learning initiative, student achievement, technology proficiency, and attitude towards technology. The initiative, Project One-on-One, was designed to provide teachers with the ability to teach technology integrated lessons in classrooms with a student-to-computer ratio of 1:1. This was accomplished by utilizing two mobile laptop labs that were financed through a national grant competition. The variables that were examined in the study were three years of eighth grade student achievement scores from the criterion referenced Louisiana Educational Assessment Program (LEAP) test and the Louisiana Center for Educational Technology's Technology Proficiency Self Assessment Instrument for Students. The 2004 level of the independent variable year provided baseline information; while the 2005 and 2006 levels reflected the technology implementation outcomes. The results from the LEAP and the proficiency self-assessment were treated as the dependent variables. In the study, it was concluded that there was no significant relationship between the one-to-one computing provided by the laptop-learning initiative and the achievement of the test subjects as measured by the LEAP over a three-year period. However, the results indicated that there was a significant relationship in the improvement of student technology proficiency as indicated by the

three years of accumulated student self-assessment surveys. The study also revealed that there was a significant relationship between the laptop-learning project and the positive attitudes towards technology and its use in the classroom. Additional findings indicated that there might have been significant relationships between the initiative and the movement of students from lower levels of achievement on the LEAP assessment to higher levels of achievement. Educational leaders may find the results of this study useful in formulating their own plans for assisting schools in meeting the *No Child Left Behind Act of 2001* (NCLB) requirement that schools make "adequate yearly progress" (AYP) towards the goal that all schools improve student achievement in reading and math by the year 2014.

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CHAPTER I

INTRODUCTION

Background

This study examined a laptop initiative that provided for one-to-one computing within the classroom when teachers plan and implement technology-integrated lessons. This approach to integrating technology differed from other initiatives in that it did not offer ubiquitous computing for all students within the school. However, it did allow for a student-to-computer ratio of 1:1 in the classrooms where the teacher was using the mobile lab. This approach offers schools a less expensive method in using technology as a tool to satisfy the concerns of educational policy makers.

In recent history, federal, state, and local decision makers have become more concerned with educational outcomes such as student achievement and teaching and learning (Bracewell, Breuleux, Laferriere, Benoit, & Abdous, 1998). This interest and scrutiny of educational decisions has led to increased accountability that has been amplified even more with the No Child Left Behind (NCLB) legislation. Of immense interest is the influence technology tools have on student achievement.

Educational technology has been available in many classrooms and schools for several decades. With the introduction of computers to the school and classroom settings, educators began attempting to justify its use as an educational tool by demonstrating that it could be used to improve student achievement. Idaho and West Virginia were two of the first states to implement technology-learning initiatives focused on improving student achievement through test scores (Idaho Council for Technology in Learning, 2000; Mann, Shakeshaft, Becker, & Kottkamp, 1998). Even though these initiatives were successful, the high cost associated with equipping schools and classrooms with computers was prohibitive for many districts and schools. With the advent of laptop computing, education institutions were presented with a device that was less expensive than a desktop computer and more mobile. School officials saw the laptop computer as not only a means of increasing mobility, but also as a possible way to improve the student-to-computer ratios in schools and increase student access. With the passage of time, the price of the laptop computer decreased and laptop computing became a viable option for schools looking for means to improve student achievement (Penuel, 2006; Russell & Plati, 2001).

Many schools have initiated laptop-learning programs. As early as 1996, Microsoft Corporation and Toshiba America Information Systems were studying the effects of "anytime, anywhere" learning in 53 different schools (Rockman ET AL, 1997, p. 8). Since then, several schools and school districts have implemented some form of laptop-learning programs. Saul Rockman (2003) called laptop-learning initiatives the "most compelling school-change interventions we have seen in decades" (p. 25). Rockman also pointed out that laptop-learning initiatives were not about the computers and the technology, but rather about what the students are capable of doing when they were provided one-to-one access with the same tools that are found in real world work places. In a review of existing research, Gulek and Demirtas (2005) found that students who were provided their own computer were more apt to work in cooperative settings, participate in inquiry/project-based lessons, and conduct research and compose quality writings. These students were also more likely to be critical-thinking, self-directed learners, capable of utilizing a variety of different learning strategies, and have flexible technical skills when presented with opportunities to use different technologies – all characteristics and skills of successful professionals in the 21^{st} century.

Early educational technology initiatives involved placing computers in laboratory settings or classrooms within schools (Casey, 2000). However, with the laptop's flexibility, the possibilities for one-to-one computing can be varied. Laptop-learning initiatives can take the form of mobile labs available for check out by the teacher, classroom sets of laptops, or laptops checked out to students for use at school and home (Rockman ET AL, 1997). In the spring of 2002, Maine implemented the first statewide laptop-learning initiative that provided a laptop for every individual student (Muir, Knezek, & Christensen, 2004b). The state of Maine is currently monitoring the effects of its initiative.

However, with the implementation of many such learning programs since the late 1990s, the amount of research on their effects is considered nominal (Valdez, McNabb, Foertsch, Anderson, Hawkes, & Raack, 2000). In regards to student achievement, researchers have consistently found that laptop-learning initiatives have had considerable effects on teachers and teaching, and on student learning. However, researchers have had difficulty connecting full-time access to laptops to student achievement on standardized tests (Rockman, 2003). Many researchers attribute this to the many unique initiatives and their varying goals.

Problem Statement

The purpose of this study was to determine if there was a relationship between eighth grade students' achievement, technology proficiency and attitude towards technology in 2004, compared to eighth grade students in 2005 and 2006 after the implementation of a laptop-learning initiative. Throughout this study the pseudonym, Sieur de Bienville Middle School, was used in referring to the Louisiana middle school involved in the laptop-learning initiative called Project One-on-One. This pseudonym was used in an effort to further protect the identities of the students and the school. Project One-on-One was designed to reduce the student-to-computer ratio to 1:1 for classroom technology-integrated lessons. The configuration of the initiative was in the form of two mobile labs that could be checked out for use in the teachers' classrooms.

Before and during the implementation of the laptop-learning initiative, the faculty of Sieur de Bienville Middle School received training in:

- equipment operation,
- safe Internet searching,
- Galenet Infotrac databases and World Book Online,
- effective classroom technology integration strategies, and
- software trainings in Inspiration 7.5 and TimeLiner 5.0.
- Louisiana Integrating Technology Professional Development (INTECH) K-6, 7-12, INTECH 2 Social Studies, INTECH 2 Science,
- INTECH 2 Follow-up trainings,
- Integration in the Palm of Your Hand, and
- i-Safe.

The results of this study may assist school stakeholders and educational policy makers in their efforts to demonstrate continual school improvement. The data this study produced can be used to justify the decisions made regarding the purchase of laptop computers and their use as tools for improving student achievement and technology proficiency. NCLB requires that schools show improved student achievement and average yearly progress in school improvement (No Child Left Behind Act of 2001, § 6301, 2002), and that that all students be technologically proficient by the end of the eighth grade (No Child Left Behind Act of 2001, § 2402, 2002). Additionally, this study's data may also be used to determine the type of laptop configuration (a laptop for every child versus one or more mobile labs) that could be best implemented with the funds available to schools or districts.

Research Questions

This study lent itself to three research questions:

- "Is there a significant difference in English Language Arts, math, science, and social studies achievement scores when comparing students who participated in a laptop-learning initiative's 1:1 student-to-computer ratio and those who did not?"
- "Is there a significant difference in technology proficiency when comparing students who participated in a laptop-learning initiative's 1:1 student-to-computer ratio and those who did not?"
- "Is there a significant difference in student attitude towards technology when comparing students who participated in a laptop-learning initiative's 1:1 student-to-computer ratio and those who did not?"

Definitions

The following terms are defined according to how they relate to this study:

Educational technology. A theory that discerns how problems in human learning are identified and solved utilizing technology.

Laptop computer. A portable computer that comes with software applications, a battery charger, and wireless communication capabilities.

Laptop-learning. The use of laptop computers within the classroom in an effort to provide students one-to-one computing.

Middle school. A school composed of grades 6, 7, and 8.

Student achievement. The measure of student performance on the Louisiana Educational Assessment Program for the Twenty-first Century (LEAP 21) criterion referenced tests.

Student attitude. The impact that the use of technology has on students' perceptions of school and technology based on four questions from the Louisiana Center for Educational Technology's (LCET) Technology Proficiency Self Assessment Instrument for Students (Louisiana Center for Educational Technology, 2004):

1. I enjoy school more when I get to use technology for my assignments.
2. I am more interested in my class assignments when they involve using technology.
3. Technology makes my life better.
4. Technology makes it easier to complete my assignments.

Technology-integrated lessons. Lessons that are designed to effectively use technology to teach classroom content while at the same time discreetly teaching students real world computer skills.

Technology integration. The effective combination of hardware, software, and content curriculum in the effort to support the learning of classroom content while discreetly teaching students real world computer skills.

Delimitations

The following list describes the voluntary limitations that were taken to limit the scope of this study:

- Research that will be conducted will involve the data from only one school, Sieur de Bienville Middle School, over a three-year period.
- The student data that will be gathered will compare the LEAP test results of the 2004 eighth grade student to the results of the 2005 and 2006 eighth grade students. This comparison is similar to the comparisons required by the *No Child Left Behind Act of 2001*, that schools show average yearly progress towards improvement.
- Only the data of regular education students who completed both the Louisiana Educational Assessment Program (LEAP) test and the Louisiana Center for Educational Technology (LCET) Technology Proficiency Self Assessment Instrument for Students will be used.

Assumptions

The following assumptions were made in the completion of this study:

- Teachers understood how to effectively design and implement technology integrated lessons.
- Teachers taught technology-integrated lessons on a weekly basis.
- Teachers received assistance in planning and implementing technology integrated lessons when required.
- Student responses on the LCET Technology Proficiency Self Assessment Instrument for Students were honest reflections of student abilities.

Justification

Since the advent of the computer, educators have researched ways that this technological tool could improve learning. With the development of learning software, the Internet, and mobile technology, policy makers have implemented various technology learning initiatives involving desktop computers, laptop computers, handheld computers, and most recently iPod® music and video players. Many of theses initiatives have had similar goals: improving pedagogical practices of teachers, improving student achievement, increasing access and improving equity.

During the spring of 2004, Sieur de Bienville Middle School implemented a laptop-learning initiative in an effort to improve the student-to-computer ratio and improve student achievement. The laptop-learning initiative, called Project One-on-One, was funded through a national grant competition and provided technology equipment in the form of 30 laptop computers, 2 mobile carts, 2 laser printers, 2 projectors, 2 wireless hubs, 6 digital cameras, 30 mice, and 30 laptop backpacks. These wireless mobile labs were available for teachers to check out to use in combination with the desktop computers in their classrooms or to be used in combination with the desktop computers in the computer lab, effectively reducing the student-to-computer ratio to 1:1 for technology-integrated lessons. The study of the effects of a laptop-learning initiative with a configuration that involves fewer computers, thus lowering implementation expenses, can provide useful conclusions regarding cost effective approaches for reducing the student-to-computer ratio in an attempt to improve student achievement.

This study examined a laptop initiative that provided for one-to-one computing within the classroom when teachers plan and implement technology-integrated lessons.

The differences found in student achievement, technology proficiency, and attitude towards technology between students who participated in the initiative and students who did not participate in the initiative can be used to assist educational policy makers in determining which laptop deployment configuration is best suited for the school, its students, the discretionary funds available, and the desired outcomes. Not all states, districts, or schools can afford multi-million dollar laptop initiatives that deploy thousands of laptop computers to be placed in the students' hands for ubiquitous one-to-one computing. Providing one-to-one computing within the classroom for technology-integrated lessons through the deployment of mobile laptop labs could be a low cost, efficient, solution for providing one-to-one student-to-computer ratios in the classroom. These mobile labs can be purchased in stages over two to three years and expanded as funds become available. Adopting similar configurations can help improve the student-to-computer ratio as schools look to meet the requirement of the *No Child Left Behind Act of 2001* (NCLB) that they demonstrate "adequate yearly progress".

NCLB requires that each state establish a definition for "adequate yearly progress" in order to determine the achievement of each district and school. In Louisiana, schools must show improvement by meeting a growth target established by the state department of education. This target represents the yearly progress that a school must make in order to reach the state established School Performance Score (SPS) of 120 by the year 2014. A school's SPS is composed of four indicators: the Louisiana Educational Assessment Program (LEAP) test results, the Iowa Test of Basic Skills (ITBS) results, attendance, and dropout rates. When schools meet their SPS then they receive monetary awards and recognition. When schools do not meet their SPS, they are placed in either

Academic Assistance or School Improvement status by the state and then are monitored closely while receiving assistance.

CHAPTER II

REVIEW OF LITERATURE

Theory of Educational Technology

In *Experience and Education*, John Dewey (1938) suggested that education is a process based on experience arising from the interaction of two principles – continuity and interaction. He defined continuity as being where the past and future have to be "taken into account at every stage of the educational process" (Dewey, 1938, p. 47), with both having an impact on the present, and interaction in education as being a social process where knowledge is gained through social discourse and collaboration (Dewey, 1938). This discourse in the classroom is similar to what takes place in the world and prepares children to be informed, contributing members of society. One premise in Lev Semenovich Vygotsky's theoretical framework on human development was very similar to Dewey's interaction principle; that is, mental development and higher order thinking skills are derived from social interactions. Vygotsky called this influence of social interaction on mental development the zone of proximal development (Vygotsky, 1998). The influence of Dewey's and Vygotsky's reasoning is apparent in today's classrooms when students work under the facilitation of a teacher or in cooperative groups to achieve a task that they may not be able to achieve by themselves.

The theory of educational technology is grounded in the beliefs of Dewey and Vygotsky and is distinguished by a creative organization of learning resources. The theory of educational technology discerns how problems in human learning are identified and solved utilizing technology (Ely, 1996). According to Ely, Charles F. Hoban is considered one of the first researchers to recognize that educational technology was composed of many elements: systems concepts, communication theory, learning psychology, and instructional psychology. When considered together, these elements can promote authentic learning experiences in social contexts and experiences that involve the student constructing his/her own knowledge (Petraglia, 1998). In 1977, The Association for Educational Communications and Technology defined educational technology as a "theory about how problems in human learning are identified and solved" (Ely, 1996, p. 3). Often confused with educational technology, instructional technology is considered as a subordinate part of educational technology. Instructional technology is the process of integrating people, technology, and ideas in learning (Ely, 1996). Ivor Davies divided educational technology into three categories: number one, characterized by the use of technology hardware as a tool for learning; number two, characterized by the use of technology software in supporting student learning; and number three, an integration of both educational technology one and two (Ely, 1996). The third category of educational technology requires that the teacher knows how to diagnose the desired results, plan the learning activities that influence positive student achievement, differentiate the processes available in achieving the learning outcomes, and possess the necessary skills needed to implement the technology.

Petraglia (1998) noted that educational technology movements in the 1960s and 1970s, such as computer-assisted instruction and instructional design, kept the learner as a passive participant in a teacher-centered learning environment. Today, however, educational technology has embraced another learning theory – constructivism. Developed by Piaget (1973), the constructivist approach to learning theorizes that learners construct their knowledge by building upon their existing knowledge through active involvement, such as the interactions with other students and experts in the classroom. Bransford, Brown, and Cocking (2000) suggested that effective learning environments have four essential qualities: they are learner centered, knowledge centered, assessment centered, and community centered – building upon the interactions between students. Technology in the classroom can assist in creating such learning environments. Jonassen (as cited in Petraglia, 1998) provided guidelines for a technology-integrated classroom organized in the constructivist fashion:

- provide multiple representations of reality;
- focus on knowledge construction, not reproduction;
- present authentic tasks;
- provide real-world, case-based learning environments;
- foster reflective practice;
- enable context and content dependent knowledge construction; and
- support collaborative construction of knowledge through social cooperation. (p. 80)

In addition, Rakes, Flowers, Casey, and Santana (1999) suggested two more instructional practices: learning through exploration where students generate questions about learning topics and then conduct research to find the answers, and the use of authentic assessment methods such as using rubrics and checklists.

Computer technology integrated into the classroom curriculum also allows teachers to address a fourth learning theory. The theory of multiple intelligences, developed by Howard Gardner (1993, p. 15), is "a set of abilities, talents, or mental skills" that all individuals possess in varying degrees and combinations. Gardner maintained that learners utilized a combination of seven intelligences that were inherent in all learners. He originally identified seven original intelligences: musical, bodily kinesthetic, logical-mathematical, linguistic, visual, interpersonal, and intrapersonal. According to Gardner, each learner acquires knowledge utilizing the different intelligences. Technology can allow teachers multiple means for addressing their students' varying needs by providing the support that teachers need in adjusting the learning goals for their students, by exposing teachers to multiple teaching methods and flexible materials, and by providing multiple assessment methods that are accessible to different kinds of learners (Center for Applied Special Technology, 2006). The Center for Applied Special Technology (CAST) maintained that computer technology can be used by teachers to assist in teaching to the strengths and learning orientations of the students in their classrooms and thus accommodate all learners more effectively. These accommodations (CAST, 2006, p. 2) can allow:

- multiple means of representation, where learners are provided various ways of acquiring information and knowledge,
- multiple means of expression, where learners are provided alternatives for demonstrating what they know, and
- multiple means of engagement, where the learners' interests are tapped, learners are offered challenges, and their motivation is increased.

Teachers who address multiple intelligences while utilizing constructivist approaches create learning environments that lend themselves to collaborative learning and cognitive apprenticeships. Supported by Dewey, but rejected by traditional educators, collaborative learning "induces a social order similar to that which we find in the world around us" (Petraglia, 1998, p. 75). Cognitive apprenticeships allow for students in classrooms to communicate with peers and experts in the gathering and reporting of data, and the sharing of ideas. In the cognitive apprenticeship, the computer can allow the teacher to provide the necessary scaffolding tools in order to guide the learners in the completion of their tasks. The computer can also allow the use of multimedia, communication, and interactivity with peers or experts from around the world thus simulating the real-world activities that an apprentice would complete.

Marzano, Pickering, and Pollock (2001) recommended effective instructional strategies that could be used to assist in scaffolding the learning of students in the classroom. The authors recommended tools such as graphic organizers for identifying similarities and differences, summary frames, and webbing for summarizing and note taking, graphic organizers for nonlinguistic representations and the implementation of cooperative learning. In Johnson and Johnson's *Cooperation and the Use of Technology* (1996), the authors found that when using computers in the cooperative learning environment, students exhibit higher daily achievement, and greater success in problem solving. Using these strategies can allow teachers to create technology-integrated tools to scaffold their students' learning, ultimately allowing their students to construct their knowledge.

In the report *Computer-Based Technology and Learning: Evolving Uses and Expectations*, Valdez et al. (2000) suggested several factors that should be considered if technology is to have an impact on education. Of those, three are specific to teacher training and perceptions:

1. the success or failure of technology is more dependent on human factors such as the pedagogy required in designing meaningful learning activities, rather than on the technology itself,
2. relevant training for teachers in how to use computers to support learning can determine whether or not technology has a positive impact on achievement, and
3. many teachers believe that computers have improved the classroom climate, especially their students' motivation in subjects where computers are used. (¶ 8)

Teaching and Learning

In the U.S. Department of Education's report *The Condition of Education 2001* (2001), the writers recognized the impact technology could have on teaching and learning. Many factors influence students' learning, such as the number of students in the classroom, the quality of teachers, and the quality of the lessons that are taught. However, for students to learn technology skills and be proficient, their teachers need to be proficient. Regardless of how technologically advanced students are, only one-third of teachers in 1999 reported that they felt prepared for teaching with the Internet (U.S. Department of Education, 2001). Linda Darling-Hammond (2002, p. 10) noted that "of the school variables that can be measured, what teachers know and can do is being found repeatedly to be the single most important detriment of what children can learn."

Research has shown that for the use of technology to be successful, teachers have to be skilled in the knowledge of how to maximize its use for varied learning activities that are connected to real world issues, active in nature, social in design, and reflective in process (Driscoll, 2002). In *How Are Teachers Using Computers in Instruction?*, Becker (2001, p. 26) found that the factors determining if a teacher will use computers within the classroom are:

1. the teacher's own technical expertise and professional experience in using computer applications,
2. the number of computers in their own classroom, and
3. their personal involvement in their profession, both within their school building and beyond.

Putting computers in classrooms, offering teachers training, and mandating the use of the computers does not necessarily mean that teachers will use them. In *Teachers' Tools for the 21st Century: A Report on Teachers' Use of Technology*, researchers found that teacher use of technology in the classroom was directly related to their professional development and whether or not teachers used technology for lesson planning and record keeping (Smerdon et al., 2001). Teaching is a difficult job and teachers have to be encouraged to take chances and change their methods of instruction. In *How Teachers Learn Technology Best*, Jamie McKenzie (1999) provided twelve strategies that administrators could implement that would encourage teachers to grow in their use of technology in the classroom:

1. outline the journey or develop a professional growth plan,
2. implement study groups,
3. identify technology coaches/experts,
4. assign technology mentors,

5. organize work place visits for connecting technology use to real world applications,
6. organize short tutorial, or "how to" lessons,
7. identify student aides for help in the classroom,
8. provide telephone help lines,
9. organize invention sessions (time for planning),
10. allow for at home alone learning (access),
11. summer/weekend reading about technology integration in the classroom, and
12. distance learning. (pp. 91-96)

McKenzie noted that by just offering professional development, schools would not necessarily make the transition required for the successful integration of technology into daily classroom lessons. For a successful changeover to occur, a culture of learning has to be established and be a part of the daily routine. Other studies have been conducted, which support McKenzie's suggestions. Zhao, Pugh, Sheldon, and Byers (2002) found that guidance in the form of a mentor could help teachers in implementing technology in the classroom. Mentors are other education professionals who can facilitate a teacher in the use of technologies in the classroom. Mentors can assist in the planning of technology-integrated lessons, and model the delivery of classroom lessons and classroom management skills. These mentors, sometimes called facilitators or technology leaders, are essential in ensuring the success of technology integration. In addition to the suggestions provided by McKenzie, Zhao et al. (2002) also suggested dedicating time and training to pre-service teachers as they complete their practicum in student teaching, thus allowing them to begin practicing effectively integrating technology before entering the classroom.

The effective use of technology within the classroom can provide the association required for students to make real-world connections to what they are learning and how they accomplish it. Real-world connections exist between the technology hardware and software the students use, the learning processes they go through, and the final products that they create. When teachers effectively integrate technology, they can provide a way for learners to manipulate their own learning by providing them access to simulations, sensing probes for laboratory investigations, and unlimited resources in the form of databases, primary documents, maps, and learning websites.

Valdez et al. (2000) asserted that the failure or success of technology integration in the classroom involves the users believing that the technology hardware and software are tools with a purpose, which can be used in improving student achievement. For example, in today's classrooms, technology can assist teachers in providing a social framework for learning and a medium for reflection by allowing communication through the publishing of learning experiences. Teachers and students can use the accouterments provided by technology to publish works and ideas to websites, email, chat room forums, and newsgroups for sharing with other students, teachers, parents, and experts in varying fields of study. In an analysis of nine case studies of schools where technology was used to support constructivist, project-based lessons, Means and Olson (1997) found that technology integration involved teachers redesigning what they teach and adjusting their curriculum to accommodate the use of technology. In the *Report of a Laptop Program Pilot* (Rockman ET AL, 1997) for Microsoft Corporation and Toshiba America, researchers found that the most dramatic change in teachers' teaching styles was an increase of project-based teaching.

Project-based teaching modes are closely associated with the constructivist method, where students construct their knowledge based on the relationship between what they already know, and what they learn. Within the constructivist classroom, the teacher's role changes from that of a giver of knowledge, to that of a guide or facilitator. A facilitator assists students in testing their current knowledge, provides learning opportunities for correcting their knowledge, and engages students in their learning. In many constructivist classrooms, the instruction is centered on real world tasks. These tasks challenge the students to be creative in their thinking and solutions (Means & Olson, 1997). When teachers integrate technology into the classroom-learning environment, the technology can be the impetus for implementing constructivist teaching practices (Rakes et al., 1999). In a study of 435 K-12 teachers conducted by Rakes et al., the researchers questioned teachers on how they used technology in their classrooms. They found that when the amount of technology increased, the use of the technology and the skills required to operate it increased, as did the constructivist teaching practices.

Bracewell, Breuleux, Laferriere, Benoit, and Abdous (1998) reported similar results when technology is utilized as a part of the pedagogical practices in the classroom. Bracewell et al. (1998) and Means and Olson (1997) found that students exhibited more interest and motivation when it came to completing learning tasks. According to Boser, Palmer, and Daugherty (1998), when students have positive experiences in technology programs, they tend to develop positive attitudes towards technology and its uses. In addition, Means and Olson also reported that teachers indicated that their students' technical proficiency also improved. Studies have also shown that there can be improvements in student achievement. In 26 studies that were conducted between 1992 and 2000, researchers found significant means sizes in favor of students who composed their writings on the computer. These students produced works that were longer (d=.50, n=14) and of greater quality (d=.41, n=15) than those students who used pencil and paper (Goldberg, Russell, & Cook, 2003). Students composing their writings on the computer are also more engaged in the steps of the writing process and more motivated when it comes time to write. With current graphic organizing and word processing software, students can complete the entire writing process on the computer.

Increasing student access to computer technology also increases student access to the Internet and the wealth of information available. Early computer learning programs, such as computer-assisted instruction, provided remediation in the form of drill and practice. Bracewell et al. (1998) found that when computers are used with the Internet, students are provided a place where they can investigate questions by questioning peers and experts, collecting data from online databases, and then reporting their results in the form of products that demonstrate the knowledge they have gained.

Based on surveys conducted by the Educational Testing Service, the CEO Forum on Education and Technology found that technology has the greatest impact on learning and achievement when it is integrated into the classroom content to assist students in achieving the lesson objectives (CEO Forum on Education and Technology, 2001). Technology tools available to students in today's classrooms include the Internet and a plethora of software applications that can be used to document the attainment of educational objectives and student achievement. Computer software applications can also help students in making connections between graphics to the information they represent (Kozma, 1991) and allow users to create and manipulate mental models to help in the comprehension of different concepts.

Wenglinsky (as cited in Bracewell et al., 1998) found that the use of technology in classrooms has the effect of improved student attitudes when learning math. Utilizing technology-integrated lessons allows students to conduct research, collaborate with peers and experts around the world, and share their learning with a global audience. The documentation of student learning can take the form of elaborate multimedia presentations, Microsoft PowerPoint and HyperStudio presentations, brochures, newsletters, graphs, charts, webpages, timelines, graphic organizers, and much more. Couple these products with the power of the Internet and its access to information, and teachers can connect the objectives of a classroom lesson to issues in the real world. Follansbee, Hughes, Pisha, and Stahl (as cited in Bracewell et al., 1998) found that after students participated in online collaboration, they generally performed better on assessments used to measure their abilities in information management and the communication and presentation of ideas than students who had not participated. Most importantly, when technology is integrated into the classroom, students practice 21^{st}-century skills that are valued in the world outside of the school. These skills include learning independently, collaborating with their peers to achieve desired goals, and communicating the results of their efforts (Rockman, 2003).

Accountability and Technology Spending

In his book *In Praise of Education*, John Goodlad (1997) discussed the various reform movements in the history of the American education system and pointed out how they were the endeavors for the private good and not necessarily the public good. The major reform movements arose out of fear that America was losing in the race towards technological and economic supremacy. The educational establishment was the logical scapegoat, not the policies of corporate America. Therefore, what had been "the right of passage for children" became the "enterprise of adults," (Goodlad, 1997, p. 89) as America began several cycles of educational reform. Reform movements and the improvement of education became the political platforms for candidates seeking public office (Goodlad, 1997).

Goodlad pointed out that the first major reform movement in education in the United States was in response to the launching of a Soviet piece of technology called Sputnik. Society blamed the education establishment, and not private industry, for America's technological inferiority. Society called for a back to basics movement focusing on rigorous math and science standards. In addition, the Civil Rights movement, and the decision in the court case Brown v. Board of Education, all played a part in the development of Lyndon B. Johnson's Great Society plan in 1965. As part of that plan, the Elementary and Secondary Education Act was passed. Until this time, education had always been a state and local concern. This legislation was the first federal education law that gave the federal government a foothold in education by allocating federal funds to states to be spent on specific educational programs such as professional development, instructional materials, resources for educational programs, and the promotion of parent involvement.

The second reform movement began in the 1980s because of the fallout from the publication of the report, *A Nation at Risk* (Goodlad, 1997). This report blamed the educational establishment for the poor performance of the United States in the global economy, and found that schools in the American educational system offered diluted content, low expectations, ineffective use of time, and under-qualified, poorly trained teachers (National Commission on Excellence in Education, 1983). In response to *A Nation at Risk*, President Bush implemented America 2000, an unfunded initiative focusing on the school readiness of children and the improvement of American students' performance in math and science (Goodlad, 1997). America 2000 was ineffective and replaced in 1992 by President Clinton with his educational policy, Goals 2000, a series of goals dedicated to improving the teaching profession and increasing student performance (U.S. Department of Education, 1998).

In research conducted by Bracewell et al. (1998), the authors identified three educational trends that concern educational policy makers: the first being student achievement; the second, school and community relations; and the third, improving teaching and learning. With the signing of the *No Child Left Behind Act of 2001* by President George W. Bush, on January 8, 2002, the act became the "largest nationalization of education policy in the history of the United States" (Elmore, 2003, p. 6) and took into consideration the three major concerns of educational policy makers. July 1, 2002, marked the date that NCLB replaced the Elementary and Secondary Education Act and provided incentives for student achievement and school improvement, while using federal funding as the incentive to coax states and districts to adopt the NCLB mandates. Student achievement is currently a high priority set forth by NCLB legislation. When NCLB became law it set the standards that all students demonstrate achievement, and that schools demonstrate improvement in increments each year (No

Child Left Behind Act of 2001, § 6301, 2002). The law also mandated that local educational agencies provide sanctions and rewards for schools to insure that adequate yearly progress would be made in achieving those goals according to the state's definition. NCLB legislation also required that educators address the major factors that significantly affect the academic achievement of students. Therefore, federal, state, and local policy makers became more concerned with educational spending, especially with the amount of funds that had been dedicated to technology spending.

The amount of research available concerning the effects of technology on student achievement has been criticized as being small with very few "quantitative studies of quality" and difficult to conduct because of the changing goals for its uses (Valdez et al., 2000, p. 2). In 2004, the U.S. Department of Education's Office of Educational Technology awarded $15 million in grants, some of which were appropriated towards the study of how technology affects education (Reynolds, 2004). Regardless of the amount of research, since 1977 schools have spent increasing amounts of money on computer technology and the support personnel required to maintain the equipment and provide training in its use. Until the 1990s, most district technology budgeting, nearly two-thirds of all technology investments, was dedicated to technology hardware, such as computers and networking. In the mid-1990s technology budgeting changed and the focus shifted towards Internet access (Anderson & Becker, 2001). As a result, in 1998 the ratio of students to instructional computers with Internet access in public schools was 12.1:1. By 2003, the ratio had been reduced to 4.4:1 (Parsad & Jones, 2005). Additional studies conducted by the U.S. Department of Education, National Center for Education Statistics (2005) indicated that nearly all U.S. public schools have computers with Internet access and that by the time students reach high school 97% of them have used computers in their coursework. With improved Internet access, states, districts, and individual schools began placing more computers into the classroom setting. Because of the expansion of technology in classrooms, researchers have found that technology has greatly influenced teaching and learning, "yet we continue to have difficulty tying full-time access to computers to the outcomes of standardized tests. Computers don't provide content, they offer the tools to access, manipulate, and organize content" (Rockman, 2003, pp. 24, 25).

According to Market Data Retrieval (MDR) (2006), 52% of school districts in the United States spent anywhere from $70,000 to $749,000 on technology. This spending included all desktop and laptop computers, network infrastructure, hardware, software and subscription services, and professional development. In addition, 70% of the districts expected that their spending would remain the same or increase for the next year. MDR also reported that one-third of the districts reported that they used the Windows XP operating system, while another third reported that they used the Windows98 operating system. Most importantly, MDR reported that in 2004 the student to laptop computer ratio in the United States was 24:1 while in 2005, the ratio had dropped to 19:1. In Maine, the student to laptop ratio in 2005 was 2.6:1, a result of the state's laptop-learning initiative, the Maine Learning Technology Initiative (MLTI). Laptop computers offer the possibility of wireless computing, and in 2001, only 10% of the districts in the U.S. reported that they had a wireless network. In 2005, that percentage had grown to 45% of the schools in the U.S. used wireless networks.

Technology Learning Initiatives

In the book *The Saber-Tooth Curriculum*, J. Abner Peddiwell satired the education establishment for using tools, with very little purpose or benefit: "they monkey with the rocks in various ways, but they don't do anything with them for the good of the tribe" (Peddiwell, 1939, p. 135). Like the cavemen in Peddiwell's book, many school districts in the past three decades have placed computers in the classroom, but never articulated a vision for what learning should be like with them, or identified a goal for their use in the classroom. For educators today, the most important issue may be how technology can be used effectively to improve student achievement (Reynolds, 2004).

The experimentation of using computers to contribute to student learning began through the practice of placing them in computer labs within schools. According to Casey (2000), this practice weakened the most important aspect of the computer, "its ability to cut across traditional subject boundaries as a practical and useful tool" (p. 102). When in a lab configuration, the computer becomes a part of another curriculum, the technology curriculum. Smerdon et al. (2001) found that 38% of the teachers surveyed indicated that the greatest barrier to their using computers in the classroom was the number of available computers. The results of the study also revealed that teachers were most apt to make use of computers if they were in the classroom rather than in a computer lab. Placing computers in the classroom and then integrating them into the content areas allows students to use them as tools to solve real world problems (Casey, 2000). The cost associated with placing computers in the classroom to allow for technology integration into the curriculum has led education policy makers to question if this integration influences student achievement.

Valdez et al. (2000) noted that the amount of research that exists detailing the effects of technology on student achievement is minimal. In 1998, the state of Idaho began collecting data from student surveys that detailed the technology exposure students received prior to taking the Iowa Test of Basic Skills (ITBS). The survey was given to the same students again in 2000. Results indicated that there was a substantial increase in the number of students using technology within Idaho's classrooms. In measuring student achievement, Idaho used the ITBS scores for fourth and eighth grade students and the Test of Achievement and Proficiency (TAP) exam scores for eleventh grade students. The results of the eighth grade students who had a high exposure to technology integration demonstrated measurable gains in student achievement in the areas of language arts, mathematics, and reading. These scores ranged from .19 to .24 over students who reported low exposure to technology. The results for the eleventh grade students were similar (Idaho Council for Technology in Learning, 2000).

In 1998, another analysis of a statewide initiative on technology integration occurred in West Virginia. In this initiative, a software program was used to tutor students in basic grade level skills, along with using the computers in technology-integrated lessons. Similar to the results of the Idaho initiative, the West Virginia Basic Skills/Computer Education technology implementation program showed that students experienced significant gains in reading, writing, and math (Mann, Shakeshaft, Becker, & Kottkamp, 1998). The researchers' analysis indicated that test scores improved in a one-year period between the 1996-97 school year and the 1997-98 school year and that 11% of the improvement in student achievement was a result of the implementation program (Mann et al., 1998). In addition, the results indicated that in schools where computers were distributed in classrooms rather than labs, the students performed significantly better.

The No Child Left Behind Act of 2001 (NCLB) set the national goal that all students be technologically proficient by the end of the eighth grade (No Child Left Behind Act of 2001, § 2402, 2002). The section commonly referred to as the Enhancing Education Through Technology Act establishes the goal of improving student achievement in the nation's schools through effective technology integration in the classrooms. Besides improving student achievement, meeting this goal also ensures that the work force for the next century will possess the skills required to be productive in a global economy (Maier & Warren, 2000). For many schools, this goal is not an easy target to reach. Anderson and Becker (2001) reported that the technology integration costs for schools are not equal. Some schools are in older facilities that require wiring updates, while other schools exist in low-income communities and do not have the financial resources to purchase the required technology equipment and the personnel needed to provide support for the upkeep and use of the equipment. These same schools are also more likely to have students without technology access at home. To provide technology access to large numbers of students at one time, many schools created computer labs with enough computers for one-to-one access. However, when this strategy is used, computer usage can be treated as a reward or "special event" (Russell & Plati, 2001, ¶ 3). Other school systems have placed anywhere from one to four computers in each classroom to bring the student-to-computer ratio down to a lower ratio of 4:1 or 5:1, which research has shown is the necessary ratio if students are expected to show academic improvement (Valdez et al., 2000). With this student-to-computer configuration, teachers have the ability to use the computers for technology-integrated lessons if they possess the integration skills and knowledge. However, there is the belief that for real achievement to occur, students need to experience student-to-computer ratios of 1:1 (Muir et al., 2004b). With advances in computer technology and increased Internet access, the cost of purchasing additional computers or computing devices has become less of a burden for many schools. Many schools and districts have purchased laptop computers in the effort to provide all students one-to-one technology access (Penuel, 2006; Russell & Plati, 2001). However, configurations can differ from one initiative to the next. According to Warschauer, Grant, Del Real, and Rousseau (2004), depending on funding, some schools opt for purchasing one or two mobile labs of laptops. These mobile labs contain anywhere from 15 to 30 laptops in a cart which can be rolled into a classroom when needed, thus offering ubiquitous computing. Other schools may be able to purchase a laptop for every child within a grade level, eventually expanding the initiative to other grade levels in successive years. This gradual implementation can provide time for providing teacher training in how to use and implement the laptops, as well as provide time for the development of technology maintenance and support services (Rockman, 2003).

One of the most widely publicized laptop-learning initiatives began in the fall of 1996 in an effort to show educators that laptop computers could be beneficial as educational tools in the classroom. The initiative, *Learning with Laptops*, was a collaborative partnership between Microsoft Corporation and Toshiba America Information Systems. *Learning with Laptops* is now known by the moniker *Anytime Anywhere Learning by Microsoft Corporation* and *Notebooks for Schools by Toshiba*

America Information Systems (Rockman ET AL, 1997). The project involved a combination of 53 public and private elementary, middle, and high schools that varied in size from 19 to 510 students. Data collected by the researchers came from questionnaires completed by 400 teachers involved in the project, interviews with the teachers, and school site and classroom visits. The researchers focused on the impact on teaching and learning, such as perceptions of the effectiveness of the laptops, and the effects on pedagogical practices (Rockman ET AL, 1997). However, the study did not focus on student achievement and improved standardized test scores results. One area that teachers did report that student skills improved was that of writing. Teachers noted that students were more motivated to participate in the steps of the writing process such as writing rough drafts, proofing, and editing (Rockman ET AL, 1997).

In South Carolina, the Beaufort County School District began a laptop-learning initiative during the same school year. In order to maximize student access, the school district opted to provide its 300 sixth grade students with laptop computers. These laptops were distributed with the intent that the students would be in possession of them at all times – at school and home. The purpose of the initiative was to "expand and enhance student learning opportunities; improve student achievement, creativity, and motivation; further integrate advanced computer technology into classroom instruction and learning at home; and better prepare students for a lifetime of success in a technology-rich world" (Stevenson, 1999b, ¶ 2). The evaluation of the Beaufort County School District project focused on the attitudes and perceptions of students, parents, and teachers through pre-assessment and post-assessment surveys. The results indicated that the students believed that the laptops contributed to improving their writing, math, and reading skills. The student perceptions were also supported by the parent and teacher survey results and with results from the Metropolitan Achievement Tests (MAT7), which significantly showed that laptop users outperformed non-laptop users when controlling for socio-economic status according to free and reduced lunch status, and controlling for race (Stevenson, 1999a). Additional results indicated that students and teachers believed that the laptops helped to provide a means for increased communication among students within the classroom, thus improving the facilitation of a collaborative learning environment (Stevenson, 1999b). However, Stevenson noted that although teachers had students use the laptop computers for normal classroom tasks such as taking notes, completing assignments, and for writing, there was very little technology integration into the school curriculum and very little project-based or inquiry-learning taking place.

The results presented by Stevenson have been disputed by McKenzie (2002). In "After Laptop," McKenzie maintained that findings such as the ones presented above, which noted the use of the laptops in classrooms, are indicators that there may be serious problems with the laptop initiative. These uses do not maximize the use of the technology, nor do they effectively address the goals that were identified in the initiative. McKenzie also cautioned that before districts begin such large scale, expensive one-to-one laptop-learning initiatives, they might want to consider smaller scale programs that implement mobile labs and sharing laptops for integrated lessons when needed.

Lewis (2004) investigated the relationship between full-time laptop computer access and student achievement and student attitudes in a laptop-learning initiative in Florida. Conducted between the 1998-1999 and 2000-2001 school years, the study encompassed two groups of children, a sample size of 74 students. The experimental group was assigned laptops for ubiquitous use at school and home. The comparison group was not provided access to laptops. In the study, Lewis found that the laptop initiative in the school did not have an effect on the student achievement between the two groups of students. However, Lewis did find that the students who participated in the laptop initiative indicated they were more motivated to do their schoolwork.

In March 2000, the state of Maine began the Maine Learning Technology Initiative (MLTI). It was the first statewide laptop initiative in the United States. After the 2002 implementation of the laptops in nine of the state's middle schools, Muir, Knezek, and Christensen (2004a) reported that the pilot schools experienced a decline in behavioral problems, students were more focused on classroom work, and they exhibited a more positive attitude towards school. Subsequent reports which analyzed teacher and student surveys found that the laptop-learning initiative positively affected student motivation and engagement (Silvernail & Lane, 2004). The preliminary results of the Maine initiative indicated success in regards to full time one-to-one computing and student achievement. At the end of the second year, 2003, the students in the MLTI program scored better on the Maine Education Assessment (MEA) science ($p < .0005$) and math ($p < .05$) assessments than students not in the MLTI program (Silvernail, Harris, Lane, Fairman, Gravelle, Smith, Sargent, & McIntire, 2003). After three years of the state's standardized test, data indicated that there were significant increases in the scores for math, science, and the visual/performing arts at the nine pilot middle schools compared to the rest of the middle schools in the state (Muir et al., 2004a). Muir et al. also noted that before the implementation of the laptops, the students at the same schools had scored no better than the rest of the state's middle school students.

Laptop-learning initiatives have not only occurred within the United States. Canada has also implemented such programs. In February 2002, Peace River North School District in British Columbia initiated a pilot program for the Wireless Writing Project (WWP) using laptops in five classrooms. The project has been evaluated on an ongoing yearly basis since its inception. The goals of the program were to improve student achievement, chiefly written expression, in grades six and seven (Jeroski, 2003). Evaluation of the 18-month pilot program showed that 92% of students met the expectations of the British Columbia Performance Standards compared to the 70% of the students on the pre-test. Improvement was also made in the category of exceeding expectations – an increase from 0% to 18% (Jeroski, 2003). With the success of the pilot program, the full initiative was implemented in the fall of 2003. It involved fulltime ubiquitous computing for 1,150 students and 37 teachers in 17 schools (Jeroski, 2004). In the first year of the program, Jeroski noted that the gains were almost double in the classrooms of teachers who had participated in the pilot program compared to the gains made by students in classrooms where teachers just beginning to integrating the technology into the curriculum. In addition, Peace River students in grade seven made substantial improvements with 14% exceeding expectations. By the end of the third year, Jeroski (2005) reported that the WWP students continued to improve their achievement levels in writing with 88% of the students meeting grade level expectations. The collected data also indicated that the achievement gap between boys and girls had disappeared with boys and girls scoring 89% and 88% respectively (Jeroski, 2005).

The Michigan Freedom to Learn (FTL) program was initiated in 2001. With the beginning of the 2002-2003 school year, the state awarded $7,500,000 through a grant process to 15 school districts for the implementation of a one-to-one wireless laptop-learning initiative, resulting in laptops in the hands of 7,256 students in 93 different buildings. Each district was able to design how to implement the laptop-learning initiative varying the grade levels addressed, and type of equipment (Ferris State University, 2006). Regardless of the design of the program, the objective for all programs was to engage the state's K-12 students and their teachers in improving student achievement in core academic subjects (Urban-Lurain & Zhao, 2004). Survey results from the implementation period were encouraging and showed that 66% of the teachers believed that students spent more time on their homework and that 82% indicated that they thought the program would be helpful in transitioning students to become more independent learners. In regards to improving student achievement, a majority of the teachers believed that the FTL program would improve academic performance in reading, writing, and math (Urban-Lurain & Zhao, 2004).

In the fall of 2003, Michigan adopted a uniform program and expanded the focus of the FTL program to include middle school students. To qualify for the FTL program schools must now qualify for federal funding by being identified as having a high poverty population and not meeting the "average yearly progress" set forth in NCLB (Ferris State University, 2006). The Center for Research in Educational Policy conducted the 2004-2005 evaluation of the Freedom to Learn in an effort to evaluate the goals of the intervention program that provided laptops to middle school students. According to Lowther, Ross, Strahl, Inan, and Pollard (2005) the evaluation was structured to measure the five goals of the program. Goal 1 dealt with student achievement, which was to "enhance student learning and achievement in core academic subjects with an emphasis on developing the knowledge and skills requisite to the establishment of a 21st century workforce in Michigan" (p. 3). The authors reported that the data required for these analyses were not yet available from the Michigan Department of Education. Lowther et al. (2005) planned to conduct a multivariate analysis of variance on student-level scores from the Michigan Educational Assessment Program (MEAP) compared to the control schools in 2003-2004 and the pilot schools in 2002-2003.

The researchers were able to conduct a survey of 4,245 students and found that student attitudes concerning technology were generally positive. Of the students surveyed, 85.3% indicated they were glad that they had the laptops and 87.9% wanted them again the next school year. The students (61.1%) also reported that using the laptops had increased their interest in learning and 59.9% reported that the laptops made schoolwork easier to do (Lowther et al., 2005).

Harvest Park Middle School, in Pleasanton, California, a highly educated, high-income community, established a laptop-learning initiative in 2001 through a partnership with the community's technology businesses. In a study conducted by Gulek and Demirtas (2005), the researchers examined the effects of laptops on the learning of 295 students in three cohorts. In their study, Gulek and Demirtas (2005, p. 7) asked four questions in regards to student achievement:

1. Does the laptop program have an impact on students' grade point average?
2. Does the laptop program have an impact on students' end-of course grades?
3. Does the laptop program have an impact on students' essay writing skills?

4. Does the laptop program have an impact on students' standardized test scores?

The researchers analyzed each cohort and found that enrollment in the laptop program had a significant effect on achievement in almost all of the measures after one year in the program. Results from the researchers' cross-sectional analyses of the second and third years supported the results obtained in the first year. On the California Achievement Test Survey Form, Sixth Edition (California's norm referenced test)) laptop students showed significantly higher achievement in language arts (F=9.84, p< .005) and mathematics (F=13.89, p<.001). On California's criterion referenced test, the California Standards Tests (CST), students in the laptop program scored higher in language arts than those students not in the program at the end of the first year (F=10.68, p< .005), second year (F=6.87, p< .01), and third year (F=6.88, p< .01). The results in math were not as encouraging. The difference between those students with laptops and those students without laptops in CST math performance was significant in the first year (F=8.57, p< .005), but not significant in the second and third years. It is interesting to note that in Becker's study, he found that school computer use differs between content area classes. In math, social studies, and English classes, teachers in schools with students from low socio-economic background used computers more often than schools at any other socio-economic level (Becker, 2001). In addition, in surveys conducted by the Maine Education Policy Research Institute (Silvernail et al., 2003) for evaluating the Maine Laptop Learning Initiative, it was revealed that only 64% of the students surveyed indicated that they used their laptops in mathematics. The only classes that the students indicated that they spent less time using computers were art, music, and classes identified as "other."

However, as stated earlier, analysis results indicated that student achievement in math was positive.

In 2001, Mandeville High School in Mandeville, Louisiana began a laptop-learning initiative with its ninth grade students in an effort to improve writing skills and lifelong technology skills (Styron & Disher, 2003). The project, titled CREATE (Careers, Research and Exploration, Application, and Technology Education) focused on career research and technology education from the standpoint of the writing process. The project was implemented with two mobile labs of laptop carts, each containing 16 laptops, a printer, and a teacher station, and involved seven ninth grade English instructors. Styron and Disher (2003) maintained that the test results from the Iowa Test of Educational Development showed that scores increased an average of 2%, while scores on the "sources of information" section of the test increased by 3.9 points. Styron and Disher also found that students were also successful in demonstrating proficiency in completing computer application skills.

The Eastern Townships School Board in Magog, Quebec, Canada, implemented a laptop-learning initiative in a partnership with Apple Computers in 2003. The program, implemented in stages, eventually provided 5,600 wireless laptops (iBooks) to students in grades 3 through 12. The project, called *Enhanced Learning Strategy*, was started in an effort to provide teachers with a teaching tool that could be integrated into the curriculum, improve student achievement, and reduce failure rates and dropout rates (Eastern Townships School Board, 2003). At the 2005 National School Board Association Conference in Denver, Colorado, presenters from the Eastern Townships School Board presented preliminary findings from the initiative. District officials reported seeing changes in pedagogy that were reflected in students who were engaged in the learning process and collaborative work (Canuel, 2005). However, the preliminary findings did not reveal any quantitative correlations to student achievement.

During the spring of 2004, Sieur de Bienville Middle School implemented a laptop-learning initiative in an effort to decrease the student-to-computer ratio and improve student achievement. The laptop-learning initiative, called Project One-on-One, was funded through a national grant competition. The goals of the grant were to increase technology integration within the content areas and decrease the student-to-computer ratio, and improve student achievement.

For the laptop-learning initiative to be successful, it was important for the teachers to have an understanding of the technology and how to effectively integrate it into their classroom lessons. To accomplish this, the teachers were trained in the use of laptop computers and the software that would be loaded on them. The teachers were also provided training in research-based practices that support student learning and were provided ongoing support in their endeavors by having technology facilitators assist in planning, teaching and implementing those lessons. The teachers also received assistance in developing technology-integrated lessons, templates, Internet resources, and technology connected activities for their curriculum (Zeno, 2004).

Discussion

With the implementation of NCLB and accountability, many educators and policy makers have become more concerned with student achievement and improving teaching and learning (Bracewell et al., 1998). The effective use of technology within the classroom can support the pedagogical practices advocated by educational learning theorists such as Dewey, Vygotsky, and Piaget. Implementing the practices of educational technology can assist teachers in encouraging collaborative behaviors, cooperative and constructivist learning, and in motivating students to learn while addressing the NCLB mandates of improved student academic achievement and technology proficiency. Many of the lessons that were created, modeled, or facilitated by the onsite technology support personnel were designed to help differentiate instruction, encourage collaboration, facilitate cooperation, and support constructivist learning.

Currently, some of the most common goals for laptop-learning initiatives are improving pedagogical practices, improving student achievement, increasing access and improving equity, and providing workforce skills for the 21^{st} century. Penuel (2006) and Valdez et al. (2000) have documented that the amount of research available concerning the effects of one-to-one laptop-learning initiatives on student achievement is modest. Penuel also maintained that many of the early studies that were completed did not indicate the degree to which the initiatives were actually effective because they were based on weak methodologies. However, many researchers agree that the success of a laptop-learning initiative hinges on two factors. The first is that teachers should be provided with the necessary professional development in pedagogical practices, hardware and software use, technology integration, and a source of technical and curriculum support (Becker, 2001; Driscoll, 2002; McKenzie, 1999; Smerdon et al., 2001; Zhao et al., 2002). Technical and curriculum support can come in the form of mentors, technology leaders, or facilitators who model technology integration strategies, classroom management, and effective instructional approaches. During the implementation of Project One-on-One, Sieur de Bienville Middle School and the school district provided both technical and curriculum assistance throughout the three years that this study examined. The district provided an individual certified as a technology facilitator, a content leader, a technology site coordinator, and a technology site assistant. The second factor influencing the success of a laptop-learning initiative is that the users need to believe that the technology is a tool that can actually be used for improving student achievement (Valdez et al., 2000).

The amount of research documenting the effects of laptop-learning initiatives on student achievement, as measured by standardized tests, may be small and in some cases disputable. There is much evidence that laptops and the ubiquitous approach to computing that they offer can be used to improve student writing, and that in general they do improve student attitudes towards technology. Many configuration models can be used for implementing laptop-learning initiatives. One model is the full-scale ubiquitous program, similar to the Maine Learning Technology Initiative. These initiatives can be very expensive, costing millions of dollars, and can be implemented in incremental stages across grades at the school, district, or even state level in an effort to spread out the setup and maintenance costs. These full-scale initiatives can pose challenges in planning, teacher professional development, maintenance, and funding. Such large-scale initiatives require huge amounts of labor. Consideration must be given to initial and ongoing professional development of the teachers involved, technical support for the equipment, and the hiring of personnel required to facilitate the entire process. In addition, legal consideration must be given to the development of user agreements for both teachers and students since the computers will become similar to textbooks and travel back and forth between school and home.

Other less expensive configuration models are easier to implement, manage, and monitor. Classroom sets and mobile labs of laptops can provide some of the same benefits while minimizing some of the challenges. For example, a fewer number of technicians are required, the professional development of teachers is less cumbersome, and an onsite facilitator can be easier to provide since fewer classrooms will be using the computer. Mobile labs also have their drawbacks, one being the scheduling of the mobile labs (Penuel, 2006), and students do not have access to full time computing.

The laptop-learning initiative examined in this study provided a less expensive and more economical approach to providing students with one-to-one computing. Project One-on-One afforded an on demand, one-to-one computing approach within the classroom. The teachers at Sieur de Bienville Middle were able to schedule the use of the mobile labs, using them in combination with their classroom computers or the computer lab, thus resulting in lessons where the student to computer ratio was 1:1.

CHAPTER III

METHODOLOGY

Overview

This study used the archival test data from the Louisiana Educational Assessment Program (LEAP) and the Louisiana Technology Proficiency Survey data of the 2004, 2005, and 2006 eighth grade students from Sieur de Bienville Middle School. This study was conducted in an attempt to determine if there was a relationship between a laptop-learning initiative and student achievement, technology proficiency, and student attitude. Sieur de Bienville Middle School is a suburban public school located on the banks of the Mississippi River in one of five parishes in the metropolitan area of New Orleans, Louisiana.

Research Design

During the fall of 2004, at the beginning of the laptop-learning initiative, the faculty of Sieur de Bienville Middle School received the following training:

- equipment operation,
- safe Internet searching,
- Galenet Infotrac databases and World Book Online,
- effective classroom technology integration strategies, and
- software trainings in Inspiration 7.5 and TimeLiner 5.0.

Between the fall of 2004 and the spring of 2006, 16 faculty members also participated in district-provided technology training in the Louisiana Integrating Technology Professional Development (INTECH) K-6, 7-12, INTECH 2 Social Studies, INTECH 2

Science, INTECH 2 Follow-up trainings, Integration in the Palm of Your Hand, and i-Safe.

Variables that were examined in the study were the eighth grade student achievement scores on the Louisiana Educational Assessment Program (LEAP) test and the eighth grade student results from the Louisiana Center for Educational Technology's (LCET) Technology Proficiency Self Assessment Instrument for Students. The 2004 level of the independent variable year provided baseline information, whereas the 2005 and 2006 levels reflected the technology implementation outcomes. The results from both instruments were treated as the dependent variables in this study.

Participants

Sieur de Bienville Middle School is comprised of grades six, seven, and eight. When the laptop-learning initiative began, the total 2004 student enrollment was 308 students, of which approximately 67% of the students qualified for the National Lunch Program. The school was, and is currently, comprised of the following ethnicities: 1% Asian, 1% American Indian, 5% Hispanic/Latino, 52% Black or African American, and 41% White or Caucasian. The LEAP test was administered in March of 2004, 2005, and 2006, while the proficiency assessment was administered in May of the same years. Two hundred sixteen regular education students participated in both the March test and the May survey. In 2004, 68 eighth grade students completed both instruments; in 2005, 77 students completed both instruments; and in 2006, 71 students completed both instruments.

Instruments

The Louisiana state criterion referenced test, LEAP, was taken in the spring of 2004, 2005, and 2006 by Sieur de Bienville Middle School's eighth grade students. The test is given at the fourth and eighth grade levels and is designed to measure how well students have learned the content standards in language arts, math, science, and social studies. The LEAP is a high stakes test and is used for the promotion and remediation of students. Results are reported according to five ratings: advanced, mastery, basic, approaching basic, and unsatisfactory. Scores for each content area are scaled scores between 100 and 500 but are not comparable across the content areas (Louisiana Department of Education, 2003). Table 1 lists the achievement levels and associated scaled scores for each content area.

Table 1

LEAP Scaled Scores

Achievement	English Language Arts	Math	Science	Social Studies
Advanced	402-500	398-500	400-500	404-500
Mastery	356-401	376-397	345-399	350-403
Basic	315-355	321-375	305-344	297-349
Approaching Basic	269-314	296-320	267-304	263-296
Unsatisfactory	100-268	100-295	100-266	100-262

The Louisiana State Department of Education's Louisiana Center for Educational Technology's (LCET) Technology Proficiency Self Assessment Instrument for Students is a technology survey composed of 58 questions. The first 54 questions relate to the six National Education Technology Standards (NETS) for Students:

1. basic operations and concepts,
2. social, ethical, and human issues,
3. technology productivity tools,
4. technology communications tools,
5. technology research tools,
6. technology problem-solving and decision-making tools (International Society for Technology Education, 2000).

Each standard has nine corresponding questions on the survey. Students answer the questions by selecting statements from a verbal frequency scale. Based on the students' responses, the scores are categorized into one of two categories: "Proficient" or "Not Yet Proficient" for each standard. At the end of the survey, the students are provided with a feedback page identifying each standard and their proficiency rating for that standard. To be considered technology proficient, a student must have received a "Proficient" rating for each standard.

Embedded in the technology proficiency survey are four questions regarding student attitudes towards the use of technology. These questions and the student responses are in line with how Petty and Wegener (1997) defined attitudes, "commonly viewed as summary evaluations of objects (e.g. oneself, other people, issues, etc) along a dimension ranging from positive to negative" (p. 611). As the students completed the survey, they selected "Never," "Seldom," "Sometimes," "Frequently," or "Almost Always" in answering each of the following questions (Louisiana Center for Educational Technology, 2004):

1. I enjoy school more when I get to use technology for my assignments.
2. I am more interested in my class assignments when they involve using technology.
3. Technology makes my life better.
4. Technology makes it easier to complete my assignments.

As a way of evaluating differences in student attitudes after the implementation of the initiative, a summed score for these four items was used to compare the scores of the 2005 and 2006 students to the scores of the 2004 students.

Procedures

The primary means of data collection for this study involved the retrieval of archival data. Eighth grade students in Louisiana take the LEAP statewide assessment the fourth week of March each year. This data are released to the school site administrator and the executive director of curriculum the second week of May. Student achievement data from the LEAP assessment was collected from district records. These digitally formatted confidential records were maintained by the district executive director of curriculum, and released for publication in this manuscript August 24, 2006.

District eighth grade students complete the LCET Technology Proficiency Self Assessment Instrument the first week of May. Students are provided a password to access the online instrument where they login and complete the survey under the supervision of the classroom teacher. This data is released to the school site administrator and the director of instructional technology the third week of May. The students' technology proficiency results from the survey were collected from the online survey website. Access to these confidential records was maintained by the director of instructional technology and was made available for access by the district director of instructional technology August 24, 2006.

Consent to use the student data was obtained from the superintendent of schools on August 12, 2005, under the condition that the names of students or other personally identifiable information from the school would not be used. The superintendent of schools granted permission to use the technology survey results from 2004, 2005, and 2006, and the eighth grade LEAP test scores from 2004, 2005, and 2006. A copy of the permissions letter is in Appendix A.

Limitations

There were four significant threats to this study. In August of 2005, the New Orleans metropolitan area suffered the devastating effects of Hurricane Katrina. Sieur de Bienville Middle School suffered minor damage and was able to reopen its doors to students within two weeks of the hurricane. However, some students who had attended Sieur de Bienville Middle were forced to relocate to other cities. In addition, Sieur de Bienville Middle also took in students who had been displaced from other schools in the area. This change in the student body resulted in the loss of students who had been participating in the laptop-learning initiative while providing an influx of students who may have never experienced student to computer ratios of 1:1 during technology-integrated lessons.

In addition, the Louisiana State Department of Education suspended the high-stakes testing requirement after Hurricane Katrina. In 2006, the state's high-stakes testing policy required that students score at least a combination of "Basic" and "Approaching Basic" in math and Language Arts in order to be promoted to the 9th grade (Louisiana Department of Education, 2006).

A second limitation was that eighth grade students in 2005 were able to experience 1:1 student-to-computer ratios for one year only, while students in the eighth grade in 2006 were able to experience 1:1 student-to-computer ratios for two full years (as both seventh and eighth grade students). The longer exposure may have influenced student achievement scores, technology proficiency, and student attitudes towards technology.

During the spring semester of 2006, a Palm© Handheld Computer mobile lab containing 18 handheld computers was added to the technology inventory of the school. This resulted in increasing the number of mobile labs to three, thus allowing a possible increase in the number of technology-integrated lessons being taught in the classrooms of Sieur de Bienville Middle School and leading to more student exposure to technology.

Data Analysis

There were three research questions in this study:

- Question 1, "Is there a significant difference in English Language Arts, math, science, and social studies achievement scores when comparing students who participated in a laptop-learning initiative's 1:1 student-to-computer ratio and those who did not?"

- Question 2, "Is there a significant difference in technology proficiency when comparing students who participated in a laptop-learning initiative's 1:1 student-to-computer ratio and those who did not?"
- Question 3, "Is there a significant difference in student attitude towards technology when comparing students who participated in a laptop-learning initiative's 1:1 student-to-computer ratio and those who did not?"

For Question 1, MANOVA was used to compare the three years of data from each content area category: English Language Arts, math, science, and social studies to determine if there was a difference between the two groups with regard to student achievements. To analyze the results for Question 2, a Chi-Square was conducted to compare the results of the 2005 and 2006 survey results, which were gathered at the end of the first and second year of the implementation of the program, to the 2004 results, which were gathered before the implementation of the laptop program. The test was conducted to determine if there was a relationship in technology proficiency based on students experiencing technology-integrated lessons in classrooms with a 1:1 student-to-computer ratio. In analyzing Question 3, the results from the four attitude questions imbedded in the technology proficiency survey were summed, which created an overall attitude score that was then used as the dependent variable in a *t*-test.

CHAPTER IV

RESULTS

Introduction

To answer the three research questions in this study, two instruments were used to gather data: the Louisiana Educational Assessment Program (LEAP) test and the Louisiana Center for Educational Technology's (LCET) Technology Proficiency Self Assessment Instrument for Students. The LEAP test was administered in March of 2004, 2005, and 2006, while the proficiency assessment was administered in May of the same years. In 2004, 68 eighth grade students completed both instruments; in 2005, 77 students completed both instruments; and in 2006, 71 students completed both instruments, resulting in 216 sets of test scores and surveys.

Descriptive

Of the 216 students who completed both instruments, 51.4% were female and 48.6% were male. The ethnic composition included 52.3% black students, 39.8% white, 5.6% Hispanic, and 2.3% Asian Pacific Islander, Alaskan Native or American Indian. Of the 216 students, 62.5% were qualified to receive free or reduced lunches.

Statistical

Research Question 1 asked, "Is there a significant difference in English Language Arts, math, science, and social studies achievement scores when comparing students who participated in a laptop-learning initiative's 1:1 student-to-computer ratio and those who did not?" In order to compare students who participated in the 1:1 laptop-learning initiative with those who did not, year was used as the factor (2004, 2005, and 2006). In

2004, there was no laptop-learning initiative, while in 2005 and 2006; students were able to experience 1:1 student-to-computer ratios within the classroom.

In order to address Question 1, a MANOVA was conducted using the academic school year (2004, 2005, and 2006) as the factor. English Language Arts, math, science, and social studies scaled scores were the multiple dependent variables. Box's Test revealed that there was a violation of homogeneity of variance (p = .005) but that the consequences of using Pillai's Trace statistics versus Wilk's Lambda were similar. Specifically, MANOVA results indicated that there was no significant difference in the collective scaled scores based on the year factor, Pillai's Trace Λ = .050, $F(8, 422)$ = 1.340, p = .221. Neither were any of the LEAP content area scaled scores individually different based on year. Table 2 lists the means and standard deviations of the LEAP content area scaled scores for the three years of the study.

Table 2

Means and Standard Deviations for LEAP Content Area Scaled Scores

Dependent Variable	2004 *M(SD)*	2005 *M(SD)*	2006 *M(SD)*
English Language Arts	325.132(3.742)	324.026(3.517)	325.056(3.662)
Math	338.971(3.759)	340.753(3.532)	338.085(3.679)
Science	310.706(4.785)	308.182(4.497)	314.408(4.683)
Social Studies	307.221(4.653)	308.844(4.372)	301.732(4.553)

Research Question 2 asked, "Is there a significant difference in technology proficiency when comparing students who participated in a laptop-learning initiative's

1:1 student-to-computer ratio and those who did not?" To analyze the results for Question 2, a two-way Chi-Square contingency table analysis was conducted. The two variables were the school years with two levels (2004 and 2005/2006) and proficiency with two levels (proficient and not yet proficient). This allowed an analysis to be completed of the results from the 2005 and 2006 surveys, which were gathered at the end of the first and second year of the implementation of the program, and the 2004 results, which were gathered before the implementation of the laptop program. Pearson Chi-Square indicated that there was a significant relationship between technology proficiency and technology-integrated lessons in classrooms with a 1:1 student-to-computer ratio, Pearson $\chi^2(1, N = 216) = 36.365, p < .05$. The proficiency results are listed in Table 3. Figure 1 depicts the percentage of students in 2004 and 2005/2006 who were rated as technology proficient by the LCET Technology Proficiency Self Assessment Instrument for Students.

Table 3

Proficiency Results of Pearson Chi-Square

Year	Proficient	Not Yet Proficient	Total
2004			
Count	18	50	68
% within 2004	26.5%	73.5%	100.0%
2005/2006			
Count	104	44	148
% within 2005/2006	70.3%	29.7%	100.0%
Total Count	122	94	216

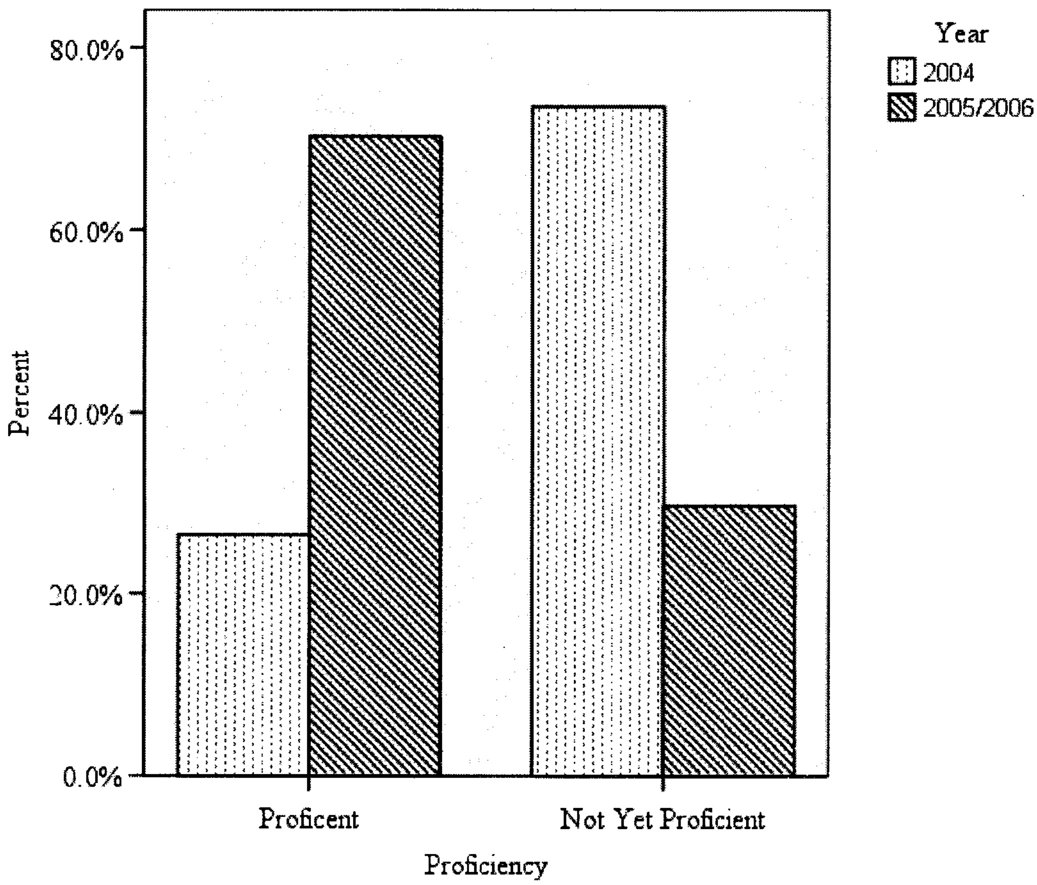

Figure 1. Clustered bar graph of proficiency percentages for 2004, and 2005/2006.

Research Question 3 asked, "Is there a significant difference in student attitude towards technology when comparing students who participated in a laptop-learning initiative's 1:1 student-to-computer ratio and those who did not?" In analyzing Question 3, the results from the four attitude questions imbedded in the technology proficiency survey were summed to create an overall attitude score, which was then used as the dependent variable in a *t*-test. The four questions were (Louisiana Center for Educational Technology, 2004):

1. I enjoy school more when I get to use technology for my assignments.

2. I am more interested in my class assignments when they involve using technology.
3. Technology makes my life better.
4. Technology makes it easier to complete my assignments.

Students answered each question with the terms "Never," "Seldom," "Sometimes," "Frequently," or "Almost Always."

An independent-samples *t*-test was conducted to determine if there was a significant difference in student attitudes towards technology based on year (2004, 2005/2006). Although there was a violation of the assumption of homogeneity of variances, the test was significant, $t(82.848) = -4.358$, $p < .001$. Students in 2004 ($M = 16.79$, $SD = 6.369$) exhibited less positive attitudes towards technology than students in 2005 and 2006 ($M = 18.83$, $SD = 1.793$). Tables 4 and 5 identify the percentage of students who selected each response in the years 2004 and 2005/2006.

Table 4

Student Responses to Attitude Questions in 2004

Question	Never	Seldom	Sometimes	Frequently	Almost Always
1.	11.8%	0%	14.7%	20.6%	52.9%
2.	4.4%	7.4%	19.1%	16.3%	52.9%
3.	2.9%	1.5%	17.6%	19.1%	58.8%
4.	2.9%	4.4%	11.8%	10.3%	70.6%

Table 5

Student Responses to Attitude Questions in 2005/2006

Question	Never	Seldom	Sometimes	Frequently	Almost Always
1.	0.7%	2.1%	9.7%	13.8%	73.8%
2.	0%	0%	8.9%	13.7%	77.4%
3.	0%	3.4%	3.4%	17.1%	76.0%
4.	0%	0%	2.0%	6.8%	91.2%

Figures 2, 3, 4, and 5 illustrate comparisons between student responses for the years 2004 and 2005/2006.

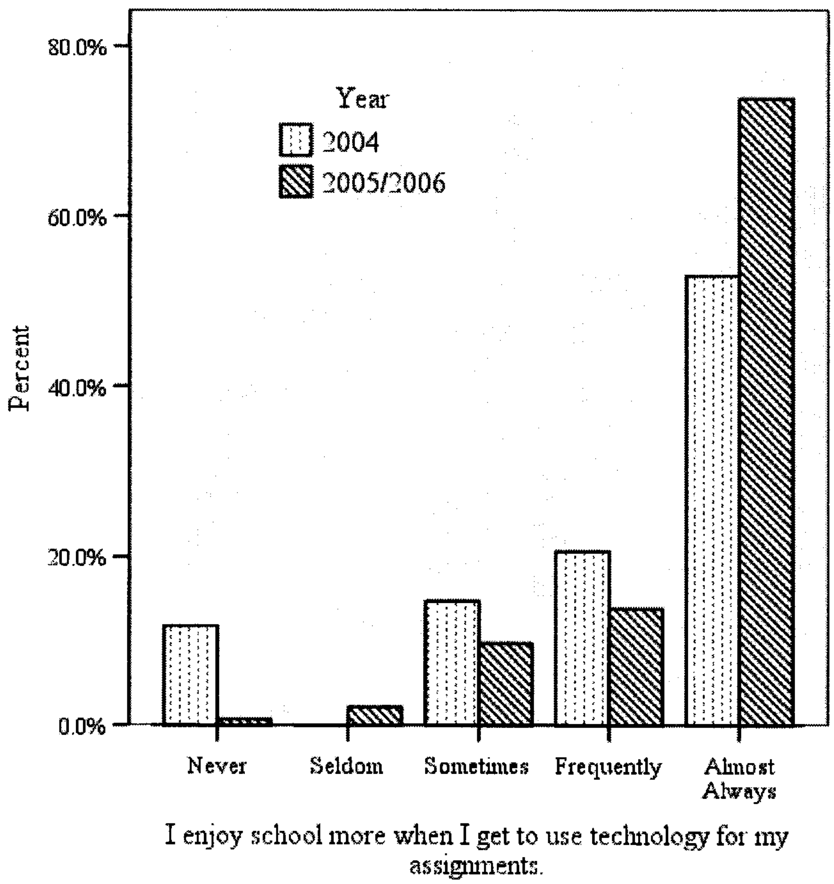

Figure 2. Clustered bar graph illustrating percentages of students responding to the question, "I enjoy school more when I get to use technology for my assignments."

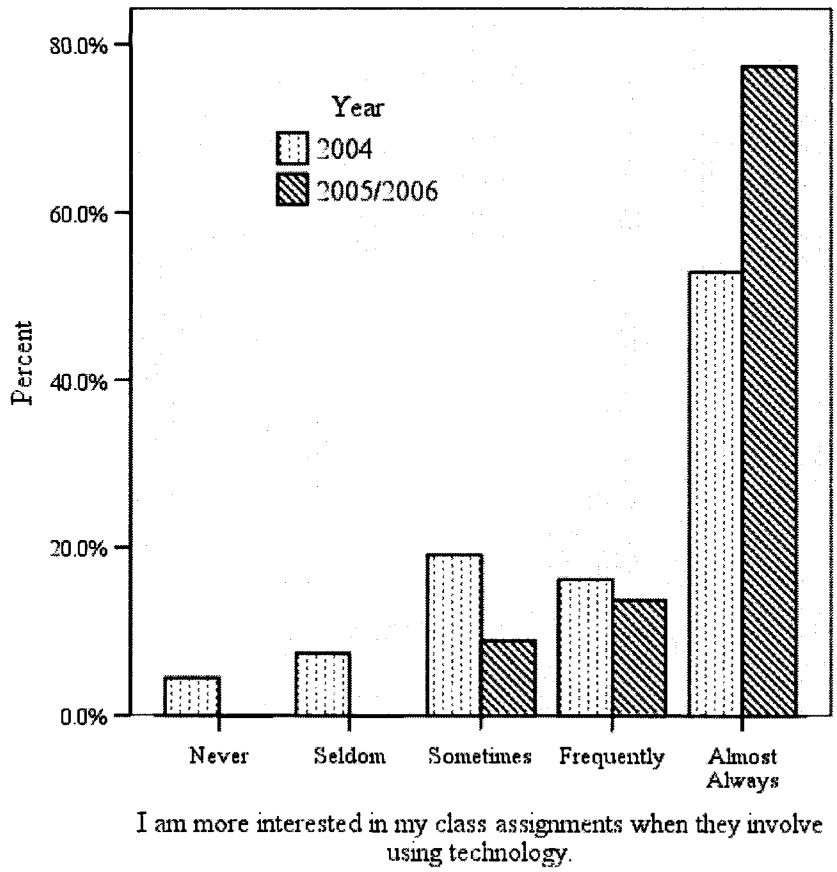

Figure 3. Clustered bar graph illustrating percentages of students responding to the question, "I am more interested in my class assignments when they involving using technology."

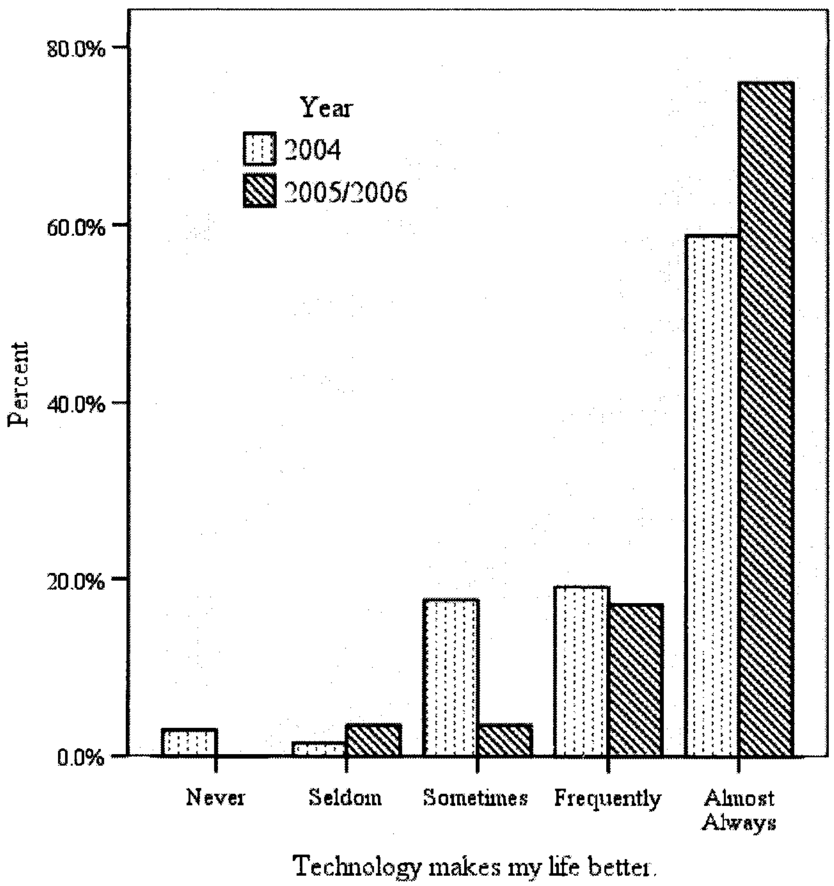

Figure 4. Clustered bar graph illustrating percentages of students responding to the question, "Technology makes my life better."

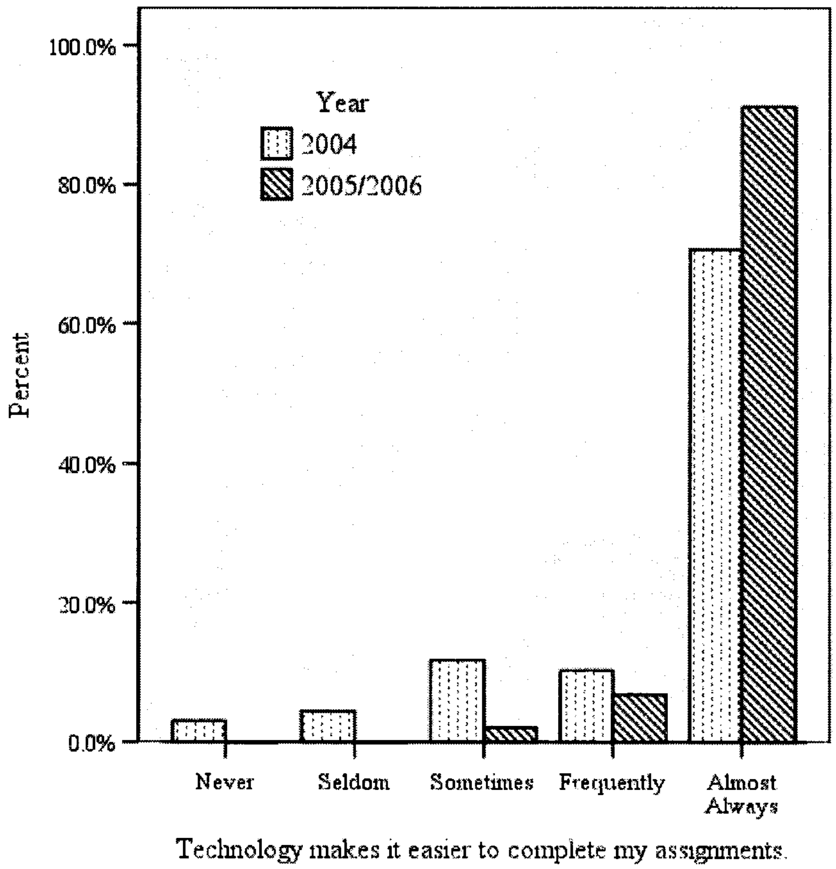

Figure 5. Clustered bar graph illustrating percentages of students responding to the question, "Technology makes it easier to complete my assignments."

Ancillary Findings

When evaluating the content area scaled scores, it was noted that there was an increase in the minimum and maximum scaled scores for science each year of the study. In addition, the maximum scaled scores for English Language Arts and social studies increased as well. Science scaled scores ranging from 100-266 are rated "Unsatisfactory" on the LEAP test. Scores ranging from 400-500 are rated as "Advanced." It is the goal of Louisiana educators to reduce the number of students performing at the lower achievement levels and increase the number of students performing at the "Basic" and above achievement levels. Table 6 lists the minimum and maximum scaled scores for the content areas each year of the initiative.

Table 6

Minimum and Maximum LEAP Content Area Scaled Scores

Content Area		Minimum	Maximum
English Language Arts			
	2004	222	385
	2005	189	393
	2006	234	397
Math			
	2004	272	411
	2005	242	434
	2006	256	419
Science			
	2004	194	380
	2005	223	387
	2006	233	462
Social Studies			
	2004	175	401
	2005	182	408
	2006	175	413

When the implementation years were examined in relation to the achievement levels rather than the scaled scores, a different picture emerged, Table 7.

Table 7

Percentage of Students at each Achievement Level

Content Area		Achievement Levels				
		Unsatisfactory	Approaching Basic	Basic	Mastery	Advanced
English Language Arts						
	2004	4.4%	25%	61.8%	8.8%	.0%
	2005	5.2%	36.4%	37.7%	20.8%	.0%
	2006	2.8%	22.5%	60.6%	14.1%	.0%
Math						
	2004	4.4%	14.7%	69.1%	10.3%	1.5%
	2005	5.2%	23.4%	54.5%	14.3%	2.6%
	2006	7.0%	15.5%	64.8%	8.5%	4.2%
Science						
	2004	7.4%	29.4%	48.5%	14.7%	.0%
	2005	14.3%	27.3%	40.3%	18.2%	.0%
	2006	7.0%	31.0%	42.3%	12.7%	7.0%
Social Studies						
	2004	5.9%	25.0%	67.6%	1.5%	.0%
	2005	9.1%	31.2%	42.9%	15.6%	1.3%
	2006	12.7%	36.6%	35.2%	14.1%	1.4%

In both English Language Arts and science, the relationship between the implementation year and the laptop-learning initiative, while not statistically significant, suggested that the initiative may be related achievement levels (p = .054 and p = .057, respectively). In social studies the relationship was significant, p = .003.

CHAPTER V

DISCUSSION

Summary

The purpose of this study was to investigate the relationships between a laptop-learning initiative, student achievement, technology proficiency, and attitude towards technology. The initiative, Project One-on-One, was designed to provide teachers with the ability to teach technology integrated lessons in classrooms with a student-to-computer ratio of 1:1. To accomplish this ratio, two mobile laptop labs and the necessary peripheral equipment were available for checkout. The variables that were examined in the study were three years of eighth grade student achievement scores from the Louisiana state criterion referenced test and the results from a technology proficiency self assessment completed by the students. The 2004, 2005, and 2006 academic school years were treated as the independent variable; the 2004 academic year provided baseline information, while the 2005 and 2006 years reflected the technology implementation outcomes. The results from both instruments were treated as the dependent variables in this study.

The sample was comprised of 216 students from the 2004, 2005, and 2006 school years. Students completed both the Louisiana Educational Assessment Program (LEAP), which was used to determine if a relationship existed between the initiative and student achievement; and the Louisiana Center for Educational Technology's (LCET) Technology Proficiency Self Assessment Instrument for Students, which was used to determine student technology proficiency and attitude towards technology.

Conclusions and Discussion

When the *No Child Left Behind Act of 2001* (NCLB) became law, it set the standards that all students demonstrate achievement, and that schools demonstrate improvement in increments each year. One way that schools are required to show improvement is by measuring student performance on norm and criterion referenced tests. To show growth and improvement, schools are expected to show student improvement on these tests each year. This results in comparing one group of students' performances to another group of students' performances. This study was set up in the same method, that is the 2005 and 2006 criterion referenced test scores that were obtained after the initiative began were compared to the 2004 scores, which were from before the initiative began.

On Sunday morning, August 28, 2005, the New Orleans metropolitan area began to brace itself for a category 5 hurricane churning in the waters of the Gulf of Mexico. Predictions were that the eye would move over the eastern side of the city. On Monday morning, at 6:10 A.M. Hurricane Katrina made landfall at Buras, Louisiana, a small town in Plaquemines, Parish, south of the metro area. As a category 3 storm, Katrina's force was strong enough to devastate Buras and the other small communities at the mouth of the Mississippi River. As Katrina continued moving, her storm surge grew, flooding the metropolitan suburb of Chalmette and its surrounding communities. Soon the storm surge hit the Industrial Canal levees of New Orleans, soon overtopping them and flooding the Lower Ninth Ward of the city, followed very soon by the complete failure of the Industrial Canal levees. By 10:30 A.M., the storm surge in Lake Pontchartrain had exerted enough force on the London Avenue Canal and the 17th Street Canal to cause both of their floodwalls to fail. Eighty-seven percent of New Orleans was flooded (van Heerden & Bryan, 2006).

According to van Heerden and Bryan, the destruction caused by Hurricane Katrina was responsible for the evacuation of 75% of the 1.3 million metropolitan residents and an estimated 1,100 deaths. Twenty-six days later, Hurricane Rita devastated southwest Louisiana displacing even more students. Davis (2006) reported that states that provided safe haven for students who evacuated or fled Katrina's and Rita's damage reported that the test scores for those students were noticeably lower than the scores for the students who were previously enrolled in the schools. According to Texas officials, "64 percent of displaced students in grades 3-8 and 10th grade passed assessments in reading/English language arts, compared with 85 percent of other Texas students. Forty-eight percent passed mathematics exams, while 76 percent of all other Texas students did" (Davis, 2006, p. 22). Georgia reported similar results; 74 percent compared to 84 percent in reading and language arts, and 67 percent compared to 81.9 percent in math. After the storm, Texas had enrolled approximately 40,200 displaced students while Georgia enrolled 10,300 students and Alabama and Florida enrolled more than 5,000 each. Within Louisiana, approximately 105,000 students were enrolled in new schools due to the storm (Jacobson, 2006).

Sieur de Bienville Middle School opened its doors to students who had fled the aftermath of Katrina. According to the Louisiana school performance data from 2004-2005, Orleans Parish was ranked number 67 out of 68 schools according to the district performance score. In addition, Orleans Parish was labeled "academically unacceptable". During the same time period, the metropolitan area parish in which Sieur de Bienville

Middle School is located had no schools with the "academically unacceptable" label, was labeled with three stars, and was ranked number eight in the state (Louisiana Department of Education, 2004). This distinction suggests that students within Orleans parish were overall, performing at lower levels than the students at Sieur de Bienville Middle School. The test scores released for this study did not differentiate between those students who were evacuees and those who were not.

Researchers Valdez, McNabb, Foertsch, Anderson, Hawkes, and Raack (2000) and Rockman (2003), agree that the amount of research that connects computer access to student achievement in the form of test scores has been difficult to obtain. One suggested reason is the changing goals of research studies; another possible reason may be that states measure improved student achievement in different ways. In Louisiana, improved student achievement is measured by performance on the norm and criterion referenced tests. This study focused on the student performance results from the criterion referenced Louisiana Educational Assessment Program (LEAP). The goal for schools is to reduce the number of students who perform at the "Unsatisfactory" and "Approaching Basic" levels while increasing the number of students performing at the "Basic," "Mastery," and "Advanced" levels. In analyzing Question 1, "Is there a significant difference in English Language Arts, math, science, and social studies achievement scores when comparing students who participated in a laptop-learning initiative's 1:1 student-to-computer ratio and those who did not?" results indicated that there was no significant difference in the content area scaled scores based on the years of the laptop initiative. Therefore, there was no significant improvement in student achievement. When examining the scaled scores of the content areas, it was noted that the school was successful in producing students who performed at higher achievement levels in science. Each year of the initiative the lowest and highest science scaled score earned by students was higher than the previous year's. In science and social studies, the maximum scaled score earned by students increased each year, indicating that the school was successful in producing students who performed at the "Advanced" achievement level. In English Language Arts, the data suggested that the school was successful in producing students who produced higher scores in the "Mastery" achievement level each year of the initiative.

Another interesting finding is that in math and social studies the mean of the scaled scores improved during the implementation year, 2005, but then decreased again in 2006. The decrease in math and social studies may have been due to the effects of Hurricane Katrina and the resulting changes in the student population of Sieur de Bienville Middle School. Alternatively, the decrease in the mean value could have been due to the suspension of the high stakes testing requirement by the state department of education after Hurricane Katrina, which required that students score at least a combination of "Basic" and "Approaching Basic" in math and Language Arts in order to be promoted to the 9th grade. Even though the state suspended the requirements, it was left to individual districts to determine promotion of students (Louisiana Department of Education, 2006, Spring). This may have resulted in students not taking state assessments seriously. However, the opposite effect occurred in English Language Arts and science; that is, the mean of the scaled scores decreased during 2005 (the implementation year), but then improved in 2006. The improvement in these two content areas in 2006 may be due to these students having been exposed to the laptop initiative for two years, since they were able to use the laptops as seventh grade students in both content areas.

The laptop-learning initiative may have had an impact on student performance in relation to student performance regarding achievement levels on the LEAP test. In both English Language Arts and science, there was a significant relationship between the implementation year and the percentage of students moving to higher achievement levels. In 2006, after two years of the initiative, the percentage of students performing at the “Unsatisfactory” level was the lowest it had been for all three years, while the second year of the initiative revealed that a larger percentage of students were achieving at the “Mastery” level in all content areas. In social studies the relationship was significant, $p = .003$.

The findings concerning student achievement and test scores are not supported by Gulek and Demirtas (2005) who reported that the Harvest Park Middle School laptop initiative improved students’ standardized test scores. In addition, Silvernail, Harris, Lane, Fairman, Gravelle, Smith, Sargent, and McIntire (2003) found that the Maine Learning Technology Initiative (MLTI) was successful in producing significant increases in the scores for math and science. In the MLTI initiative, scores from students using laptops for 1:1 computing were compared against those who had not participated in the initiative during the same year. Lewis’ (2004) research contradicted the MLTI findings. In a school-based study, Lewis found that there was no significant impact on student test scores when comparing students who participated in a laptop initiative to students who had not participated in a laptop initiative. Canuel (2005) also reported finding no quantitative correlations to student achievement after evaluating the laptop project, *Enhanced Learning Strategy*.

The second research question asked, "Is there a significant difference in technology proficiency when comparing students who participated in a laptop-learning initiative's 1:1 student-to-computer ratio and those who did not?" The data came from the LCET Technology Proficiency Self Assessment Instrument for Students, and reflected the students' perceptions of their abilities in using technology. This survey was developed as one tool that documents that both students and schools meet the NCLB requirement that students leave the eighth grade proficient in the use of technology. The student self-assessment surveys indicated that student exposure to technology-integrated lessons resulted in a significant relationship between student technology proficiency and technology-integrated lessons in classrooms with a 1:1 student-to-computer ratio. These results confirm that the laptop-learning initiative made significant strides in meeting the goal of *The No Child Left Behind Act of 2001* (NCLB) that all students be technologically proficient by the end of the eighth grade with the work force skills necessary to be productive citizens in the Twenty-first Century (No Child Left Behind Act of 2001, § 2402, 2002). The findings in this study are supported by Means and Olson (1997) and Styron and Disher (2003) who found that student technology proficiency improved because of participation in technology-integrated lessons during a laptop initiative.

Research Question 3 was, "Is there a significant difference in student attitude towards technology when comparing students who participated in a laptop-learning initiative's 1:1 student-to-computer ratio and those who did not?" The results obtained in this study indicated that exposure to technology-integrated lessons in a 1:1 student-to-computer learning environment led to students indicating that they had more positive attitudes towards technology, school, and assignments. In 2004, 35.3% of the students indicated “Never” or “Seldom” in answering the attitude questions from the survey; however, in 2005/2006 the percentage of students indicating “Never” or “Seldom” was reduced to 6.2%. These results are supported by Lewis (2004), Muir, Knezek, and Christensen (2004a), and (Lowther et al., 2005). These researchers also reported that students, when surveyed about their participation in laptop initiatives, indicated they were more motivated to do their schoolwork, more interested in learning, more focused on schoolwork, and more positive towards school in general.

This study allowed for the formation of three conclusions. First, technology-integrated lessons conducted in classroom environments supported with 1:1 student-to-computer ratios do not have a significant relationship with student achievement based on standardized test scores. There was no significant improvement in the scaled scores from 2004 through 2006. Therefore, this study does not show that the laptop-learning initiative improved student performance. The second conclusion formed from the results of this study is that students who experienced technology-integrated lessons conducted in classrooms supported with 1:1 student-to-computer ratios became more knowledgeable in technology skills and proficiency than those students who did not. The third conclusion produced by this study is that student attitudes regarding school, assignments, and technology became more positive after participation in the technology-integrated lessons of the laptop-learning initiative.

Limitations

This study had some limitations that may have had an impact on the findings and may limit the generalizations or applicability of the results.

1. Measuring achievement based on the scaled scores of students after taking standardized tests may not be the best measurement of student achievement.
2. Comparing achievement scores of one group of students from one year to another group of students from another year may not be the best method for measuring student achievement.
3. Hurricane Katrina's long-lasting psychological effects on the test subjects could have negatively affected student performance on the LEAP test.

Recommendations for Policy or Practice

This study examined a laptop initiative that provided for one-to-one computing within the classroom when teachers plan and implement technology-integrated lessons. The conclusions formulated from this study can assist educational policy makers in determining the type of laptop deployment configuration that will best fit the school, students, discretionary funds, and the outcomes that are desired. Local and state policy makers should give considerable thought before spending hundreds of thousands of dollars in order to purchase laptops for every student in an effort to provide ubiquitous computing. Based on the questionable results of past research, changing research methods, changing goals of initiatives, and this study, it is difficult to conclude that student performance on standardized test scores is influenced by 1:1 computing.

Based on the results of this study, educational leaders may want to opt for a more affordable method of providing 1:1 student-to-computer ratios. Deploying mobile laptop labs within schools can offer teachers and students a cost effective alternative to one-to-one computing for the completion of technology-integrated lessons. This study has also shown that with effective teacher training and support in the delivery of technology-integrated lessons, the 1:1 classroom ratio provided by a mobile lab can significantly increase student technology proficiency. Improving technology proficiency of eighth grade students through effective technology-integrated lessons has become another school improvement goal of many elementary and middle schools, as they try to achieve the goals of NCLB legislation and produce students who become technologically proficient by the end of the eighth grade (No Child Left Behind Act of 2001, § 2402, 2002). In addition, this study and the previously documented research have shown that 1:1 computing can also help improve student attitudes in regards to school, their interest in schoolwork, and towards technology itself. For school leaders looking for ways to improve student attitudes towards school and generating interest in lessons and assignments, the purchase of mobile labs that offer classroom student-to-computer ratios of 1:1 could help to improve the general climate of the school.

Recommendations for Leaders of Educational Organizations

If educational leaders are searching for ways to improve student achievement, laptop-learning initiatives may not be the cost effective method for completing the task. In this study, one-to-one computing was effective in improving student technology proficiency as required by NCLB, and in improving student attitudes towards technology and its use. When looking to improve student achievement, educational leaders should define the laptop-learning initiative goals and focus on processes that can be completed using the technology, such as writing and research. Today's technology can allow students to complete the entire writing process on a computer. Coupled with the access to numerous educational databases, online encyclopedias, and online libraries, students can improve their research skills while writing. Utilizing technology for these processes can have the effect of improving student attitudes towards technology, which can translate into more student enthusiasm in learning, thus improving the overall climate of a school.

There are more cost effective methods for implementing one-to-one computing than purchasing a laptop to put into the hand of every child. For example, during the last year of this study, Sieur de Bienville Middle School implemented a 32 unit Palm© Tungsten E2 Handheld Computer mobile lab. This mobile lab was a smart and effective approach to improving proficiency and attitude and was a fraction of the cost of the laptop-learning initiative. A single laptop can cost around $1,000.00 without the necessary software, while a handheld equipped with the software to allow it to print and create Word, Excel, and PowerPoint documents can cost around $250.00. To improve ease of use for writing tasks, portable keyboards can be purchased for about $50.00. Additional software can be purchased that can turn the handheld computer into scientific probes used for gathering data. However, there is a lot of freeware online that can be downloaded and used for brainstorming, facilitating visual learning, reinforcing math concepts, and for supporting reading and language arts. The handhelds in a mobile lab modeled after the laptop mobile labs in this study could possess the Documents to Go software suite supported by the Microsoft Office® products: Word, Excel, and PowerPoint, and Internet capabilities; thus allowing one-to-one computing for all students within the classroom at a significantly lower cost than a mobile lab of laptops.

By implementing one or two mobile labs at the start of an initiative, a school can ease into the use of the handheld and its integration capabilities provide the necessary training of teachers, and eventually expand the mobile labs to ubiquitous handheld computing, placing a handheld into the hands of every child.

Recommendations for Future Research

The interest in educational technology's influence on student achievement has been a popular research topic since the appearance of the computer in classrooms throughout North America. However, many of the studies that have been conducted have had differing goals and objectives. Recent NCLB legislation has led to increased school accountability and the desire to know if educational technology is linked to student achievement, particularly test scores. Although this study was not successful in showing a relationship between a laptop-learning initiative and student achievement in regards to test scores, it was successful in showing a relationship between a laptop initiative and student technology proficiency with student attitude towards technology, two other areas that are considered essential components in school improvement and accountability.

Future researchers may want to focus on such areas of student achievement that are directly linked to processes that can be carried out utilizing technology. Petraglia (1998) maintained that the elements of educational technology help to promote authentic learning experiences and provide experiences that involve the student constructing his/her own knowledge. The writing process and the ability to locate, select, and synthesize information are examples of such authentic learning experiences that use technology. Peace River North School District's Wireless Writing Project (WWP) used laptops to improve student achievement in writing (Jeroski, 2003). Goldberg, Russell, and Cook, (2003) found that when students compose their writings on the computer they are more engaged in the steps of the writing process and more motivated when it comes time to write. Research conducted by Russell and Plati (2001) demonstrated that students who use computers to compose and edit their writings do much better on standardized assessments when they are allowed to use computers compared to the results achieved when having to compose with pencil and paper. Both “writing composition” and “locate, select, and synthesize information” are subsections of the LEAP criterion reference test and could be used as variables indicating student achievement in future studies. One should be cautious in using both variables. As students use the technology to complete those processes, they become more proficient and dependent on the tool. However, when it is time to take the standardized test to measure student achievement, in many cases, the tool that students are accustomed to using is removed and they are provided with the old tools – pencils and paper. That is the case with the Louisiana Educational Assessment Program (LEAP) test. For a true measure of student achievement in relationship to technology, the student should be allowed to use the technology tool that they are accustomed too. Unfortunately, to carry out such an assessment, each child would need to be in possession of a laptop, computer, or other word processing device.

If a laptop-learning initiative is to be used for school improvement, that goal should be linked to the improvement of students compared to themselves instead of compared to another group of students. This can be accomplished by utilizing pre-tests and post-tests for the processes being assessed, such as writing or research. Thus, the impact of the initiative will be measured by the achievement of the participating students rather than reflect a comparison of one group’s test scores to another group’s test scores.

When examining the improvement in student technology proficiency, one needs to keep in mind that this study made use of a survey that reported the results of a student self-assessment. Future researchers may want to measure proficiency based upon student work that documents student ability. This can be accomplished by examining student created portfolios that document technology skills and abilities.

One of the reasons that student proficiency improved in this study may be because the teachers were trained in not only how to use the hardware and software, but they were trained to effectively integrate both into their teaching. Technology proficient teachers can help produce technology proficient students because they are more likely to use the technology and more capable of modeling its use. The teachers in this study received many various forms of technology training as well as technical and curricular support. Additional studies may want to focus on measuring the effects of the technology training on the pedagogical practices of teachers in relation to the International Society of Technology Education's (ISTE) National Educational Technology Standards (NETS) for Teachers. Another reason that technology proficiency improved among students may have been the addition of a Palm® Handheld Computer lab. This additional mobile lab allowed for more technology integrated lessons in more of the school's classrooms. This configuration was a fraction of the cost of the mobile laptop labs and was used to perform the same functions.

Computer technology has become another accepted educational tool. However, like any tool, there must be an articulated purpose for its use and a recognized benefit. Although different studies have reached different conclusions about technology's influence on student achievement in regards to test scores, it is recognized that lower student-to-computer ratios are necessary for students to use computers to become problem solvers, practice real world skills, and be successful in becoming technology proficient. Budgeting millions of dollars in the effort to provide laptops for ubiquitous computing may not be possible for many school systems. However, purchasing mobile laptop labs may be the cost effective solution for providing one-to-one computing and producing students ready for the Twenty-first Century work place.

APPENDIX A

INSTITUTIONAL REVIEW BOARD FORM

The University of Southern Mississippi

Institutional Review Board

118 College Drive #5147
Hattiesburg, MS 39406-0001
Tel: 601.266.6820
Fax: 601.266.5509
www.usm.edu/irb

HUMAN SUBJECTS PROTECTION REVIEW COMMITTEE
NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee 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: **26062601**
PROJECT TITLE: **A Laptop-Learning Initiative: Relationships With Student Achievement, Technology Proficiency, and Attitude Towards Technology**
PROPOSED PROJECT DATES: **06/21/06 to 09/15/06**
PROJECT TYPE: **Dissertation or Thesis**
PRINCIPAL INVESTIGATORS: **Kevin S. Nicholas**
COLLEGE/DIVISION: **College of Education & Psychology**
DEPARTMENT: **Educational Leadership & Research**
FUNDING AGENCY: **N/A**
HSPRC COMMITTEE ACTION: **Expedited Review Approval**
PERIOD OF APPROVAL: **07/31/06 to 07/30/07**

Lawrence A. Hosman (signature) — 8-02-06

Lawrence A. Hosman, Ph.D.
HSPRC Chair

Date

APPENDIX B

LETTER OF CONSENT

St. Charles Parish Public Schools

13855 River Road • Luling, Louisiana 70070
(985) 785-6289 • www.stcharles.k12.la.us

SACSCASI

August 12, 2005

Kevin Nicholas
10950 Jefferson Hwy.
Apt. H-17
River Ridge, LA 70123

Dear Mr. Nicholas:

The St. Charles Parish Public School System grants permission for you to use the following information from Cammon Middle School in your dissertation:

- Technology survey results from 2004, 2005, and 2006
- Eighth grade LEAP scores from 2004, 2005, and 2006
- Eighth grade LEAP Student Questionnaire Reports for 2004, 2005, 2006

Names of students or other personally identifiable information from Cammon Middle School may not be used in the dissertation.

Please share your findings with school and district administrators who supervise technology and curriculum and instruction programs.

Sincerely,

Rodney R. Lafon
Superintendent

Xc: Rochelle Cancienne

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