Laptop Education: Impact on Learning and Achievement

Christopher E. Mills

Follow this and additional works at: https://commons.und.edu/theses

Recommended Citation
https://commons.und.edu/theses/1028
LAPTOP EDUCATION: IMPACT ON LEARNING AND ACHIEVEMENT

by

Christopher E. Mills
Bachelor of Arts, Bemidji State University, 1993
Master of Education, St. Cloud State University, 1997
Sixth Year Degree, St. Cloud State University, 1997

A Dissertation
Submitted to the Graduate Faculty
of the
University of North Dakota
in partial fulfillment of the requirements

for the degree of
Doctor of Education

Grand Forks, North Dakota
August
2010
This dissertation, submitted by Christopher E. Mills in partial fulfillment of the requirements for the Degree of Doctor of Education from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

This dissertation meets the standards for appearance, conforms to the style and format requirements of the Graduate School of the University of North Dakota, and is hereby approved.

[Signatures]

Joseph D. Benoit
Dean of the Graduate School
August 3, 2010
Date

ii
PERMISSION

Title                  Laptop Education: Impact on Learning and Achievement
Department            Educational Leadership
Degree                Doctor of Education

In presenting this dissertation in partial fulfillment of the requirements for a graduate degree from the University of North Dakota, I agree that the library of this University shall make it freely available for inspection. I further agree that permission for extensive copying for scholarly purposes may be granted by the professor who supervised my dissertation work or, in his absence, by the chairperson of the department or the dean of the Graduate School. It is understood that any copying or publication or other use of this dissertation or part thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of North Dakota in any scholarly use which may be made of any material in my dissertation.

Signature  
Date  

7-12-10
TABLE OF CONTENTS

LIST OF TABLES .............................................................................................................. vii

ACKNOWLEDGEMENTS ................................................................................................ ix

ABSTRACT ......................................................................................................................... x

CHAPTER

I. INTRODUCTION .............................................................................................................. 1
   Outcomes of Successful Programs for Students ...................................................... 8
   Purpose of the Study .......................................................................................... 9
   Research Questions .......................................................................................... 10
   Significance of the Study .................................................................................. 10
   Delimitations ...................................................................................................... 13
   Definition of Terms .......................................................................................... 14
   Acronyms & Abbreviations ............................................................................ 17
   Overview of the Study ...................................................................................... 18

II. LITERATURE REVIEW ................................................................................................. 20
   Historical Perspective – Technology Integration Into Education .................. 20
   The Fertile-Beltrami 1:1 Laptop Experience ...................................................... 27
   Technology Integration in 21st Century Education ........................................ 30
   Technology Integration and Student Achievement ......................................... 35
Research Question #2 ........................................................... 99

Research Question #3 ........................................................... 101

Conclusions ................................................................................... 104

Limitations ................................................................................... 105

Recommendations for Actions.......................................................... 105

Recommendations for Further Study ............................................... 107

APPENDICES .......................................................................................................... 111

A. Letter of Permission – Survey ............................................................... 112

B. Letter of Cooperation – Fertile-Beltrami Schools ................................. 113

C. Survey of Students ................................................................................. 114

D. Survey of Faculty ................................................................................... 118

REFERENCES.......................................................................................................... 123
LIST OF TABLES

Table                                           Page

1. Frequency and Percentage of Students who Participated in the Laptop Program per Grade Level (N = 81) ........................................................................................................................................ 67

2. Frequency and Percentage of Fertile-Beltrami School Students who Participated in the Minnesota Comprehensive Assessment Tests and Participated in 1:1 Laptop Program (N = 81) .................................................................................................................................... 69

3. Indicates the Fertile-Beltrami Schools Academic Achievement of the Minnesota Comprehensive Assessment Tests vs. the State of Minnesota in Reading and Math in 2008 & 2009 .................................................................................................................................. 69

4. Frequency and Percentage of Students who are Laptop and Non-laptop Participants in the Fertile-Beltrami Schools and the Average Academic Achievement as Measured by School District Grade Point Average .................................................................................................................................. 70

5. Frequency and Percentage of Student Home Computer Use and Internet Access .................................................................................................................................. 74

6. Amount of Laptop Use by Students at Home .................................................................................................................................. 75

7. Amount of Laptop Use by Students at School .................................................................................................................................. 75

8. Frequency and Percentage of Student Perceptions Regarding 1:1 Laptop Collaboration Between Student to Student and Student to Teacher (N = 43) .................................................................................................................................. 76

9. Frequency and Percentage of Students Perceptions Regarding Changes in Their Learning Environment as a Result of 1:1 Laptop Program (N = 40) .................................................................................................................................. 77

10. Frequency and Percentage of Subject Areas Taught by Participating Faculty (N=13) .................................................................................................................................. 78

11. Frequency and Number of Years Teaching of Participating 1:1 Laptop Faculty Members (N=13) .................................................................................................................................. 79
12. Frequency and Percentage of Faculty Perceptions to Their Technology Skill Levels (N = 13).................................................................................. 80

13. Frequency and Percentage of Students Perceptions Regarding Changes in Their Academic Achievement and Learning as a Result of the 1:1 Laptop Program (N=40).................................................................................. 81

14. Frequency and Percentage of Students Using Laptops to Complete the Identified Tasks (N = 42).................................................................................. 83

15. Frequency and Percentage of Faculty Perceptions on the Impact of the 1:1 Laptop Program on Traditional Student Academic Achievement and Learning (N=13).................................................................................. 84

16. Frequency and Percentage of Faculty Perceptions on the Impact of the 1:1 Laptop Program on At-risk or Low Achieving Student Achievement and Learning (N=12).................................................................................. 86

17. Frequency and Percentage of Faculty Perceptions on the Impact of the 1:1 Laptop Program on High Achieving Student Achievement and Learning (N = 10).................................................................................. 87

18. Frequency and Percentage of Students who are Laptop and Non-laptop Participants in the Fertile-Beltrami Schools and the Average Academic Achievement as Measured by School District Mean Grade Point Averages During the 2008-2009 School Year.................................................................................. 89

19. Indicates the Fertile-Beltrami Schools Academic Achievement on the Minnesota Comprehensive Assessments Test vs. the State of Minnesota in Reading and Math in 2008 & 2009 .................................................................................. 90

20. Indicates the Fertile-Beltrami Schools Laptop Students Academic Achievement on the Minnesota Comprehensive Assessment Test vs. Fertile-Beltrami Schools Non-Laptop Student Academic Achievement on the Minnesota Comprehensive Assessment Test of Reading and Math in 2008 & 2009.................................................................................. 91
ACKNOWLEDGEMENTS

The opportunity to participate in the doctoral cohort process has been an amazing professional experience. The completion of the program will provide the opportunity to accomplish a major personal and professional goal. I would like to thank the faculty of the Educational Leadership department for the guidance and support throughout the program.

I would like to thank the Fertile-Beltrami School District for their willingness to participate in the study. I would especially like to thank Superintendent Brian Clark and Technology Coordinator Yvonne Halvorson for their time and effort to collect data and history for the study. I would also like to thank the Fertile-Beltrami School Board for their willingness to support the study.

I would like to thank my committee members Dr. Gary Schnellert, Dr. Kent Hjelmstad, Dr. Sherry Houdek, Dr. Jared Keengwe, and Dr. Glenn Olsen. Their time and expertise assisted in the development of the study into a quality piece of work. I would also like to thank Sharon Fields and Melanie McGlynn for their editing and formatting support in the process.

Most importantly, I would like to thank my wife Angie and my children Davis, Peyton, and Isaac. Their support in this process has provided the motivation to reach the goal of completion. I believe the completion of this process will set goals into the future for my children and provide opportunities for my family.
ABSTRACT

The purpose of this study was to examine how 1:1 Laptop initiatives in the 10th, 11th, and 12th grade affected student achievement and student academic performance over the 2008-2009 school year at a selected small rural, Minnesota high school. The two variables in this study were: perceived student performance skills based on survey results from both student and teacher participants, and pre-existing Minnesota graduation testing results and grade point averages from Fertile-Beltrami School District students. The three questions that were researched in this study were:

1. What effects does a 1:1 Laptop initiative have on student academic performance based on perceptions of participating sophomores, juniors, and seniors?

2. What effects does a 1:1 Laptop initiative have on student academic performance based on perceptions of participating faculty?

3. What effect does the 1:1 Laptop initiative for students in grades 10th, 11th, and 12th in the Fertile-Beltrami School District have on student achievement based on Minnesota graduation testing and local assessments in math and reading?

The research was conducted in a small, rural setting with students in grades 10-12. The study population consisted of 105 students that attend the small, rural school during the 2008-2009 school year. A survey instrument created by the Mitchell Institute
was used by the school district to collect data on student perceptions of the impact of 1:1 computing on academic achievement and learning, as well as student engagement in school. A survey instrument created by the Mitchell Institute was also used to collect data on faculty perceptions on the impact of 1:1 computing on student achievement and learning, as well as faculty's integration of technology.

Evidence from this study indicates that the integration of 1:1 computing positively impacts student engagement in learning and student achievement. Evidence from this study further indicates that the amount of impact is directly related to the amount of integration by faculty. Students and faculty indicate that skills and engagement is improved through the use of 1:1 computing.
CHAPTER I

INTRODUCTION

Across the world, access to technology tools has changed the way students learn and access information. The first IBM personal computer was released in August of 1981 (Bellis, 2010); the following year, the personal computer was named, “Man of the Year” or “Machine of the Year” by Time Magazine (Computer History Museum, 1983; TIME Magazine, 1983). In 1999, the number of Internet users in the U.S. and Canada over the age of 16, was 92.2 million. The usage represented an increase of 59% over 1997 (Website Design Associates, 2010). In 2009, Internet World Stats, estimated there were 227,719,000 million Internet users in the U.S., which represented 74.1% of the population at that time (Miniwatts Marketing Group, 2009). According to Van Dusen (2009), “K-12 schools and districts are catching on to this idea and are boosting their spending in response, with technology expenditures expected to hit $21.9 billion by 2013 – a 30-percent jump from $16.8 billion in 2008”.

This study focused on the impact of laptop technology on student learning when each student was given his or her own laptop computer (1:1 ratio) to use in the Fertile-Beltrami School District. The Fertile-Beltrami School District is located in Polk County, Minnesota in the central part of the Red River Valley. The school district is located in the south central section of Polk County. Fertile is the most centrally located community and the largest community in the school district with a population of 893 according to the
2000 census (Polk County Minnesota-Schools, 2010). Beltrami and Mentor are two additional smaller communities located within the school district boundaries. Fertile is 28 miles from Crookston, 64 miles from Fargo/Moorhead, and 68 miles from East Grand Forks/Grand Forks (Polk County Minnesota-Schools, May 2010).

The primary economic industry in the Fertile-Beltrami School District has been agriculture and agricultural industries. There are a number of small lakes in the Fertile-Beltrami School District area that make the resort industry part of economic development. In addition, community members commute to Crookston, Fargo-Moorhead, and East Grand Forks-Grand Forks for employment (Polk County Minnesota-Schools, 2010).

Enrollment in the Fertile-Beltrami School District, during the 2008-2009 school year, was 453 students, in grades K-12. All students attended school in Fertile. Grades Pre-school-6th grade were located in a south building, and 7-12 were located in a two-level north building Polk (Polk County Minnesota-Schools, 2010). For this study, grades 10-12 were used.

In 1997, members of the Fertile-Beltrami School District staff, administration, and school board had a vision of providing laptops to students to facilitate technology integration in the classrooms and balance access to technology for all students. The vision included identifying funding sources, community support, implementation timelines and priorities, and long-term objectives (Personal Interview Yvonne Halvorson, 2008).

One of the many factors influencing how students use computers and access the Internet is the availability of technology. Access to computers and the Internet has not
always been uniform among students who come from different backgrounds, races, and geographic areas. There exists a “digital divide” that is influenced by socioeconomic status (DeBell & Chapman, 2006). An example of the digital divide is 86% of adults with annual incomes over $75,000 used the Internet in 2003, while only 31% of adults with annual family incomes below $20,000 did so (DeBell & Chapman, 2006). DeBell and Chapman reported additional gaps identified in race/ethnicity, with white students having pronounced advantages in access to technology over students of black and Hispanic origins. Some schools demonstrated a major ability to decrease this digital divide of access to technology for students (DeBell & Chapman, 2006).

During the past 10 years, K-12 public schools all over the United States have increased the number of computers available to students and also access to the Internet for both children and staff (Lewis & Wells, 2006). Access to the Internet has become an instrumental tool for educating our youth. Access to the Internet is a priority in schools because of the dramatic increase in access to the Internet within schools over the past several years. In 1994, 35% of public schools in the United States had access to the Internet. In 2005, nearly 100% of public schools had access to the Internet (Lewis & Wells, 2006). In addition, access has expanded to classrooms. In 1994, 3% of classrooms in public schools had access to the Internet. In 2005, this number skyrocketed to 94% of classrooms in public schools having access to the Internet (Lewis & Wells, 2006). This increase has demonstrated a continued commitment by public school educational stakeholders to the use of the Internet in the process of integrating technology into the classroom.
Access to the Internet and computers in schools and homes has increased as a result of the changes in availability and pricing over the past 30 or more years. Dessoff (2009), a contributing writer for District Administration, a magazine covering current trends and smart management solutions for K-12 administrators, put together a timeline on progressions in mobile technology occurring over recent decades:

1982  The first laptop, the GRID Compass 1100 starts to sell.
1983  The Gavillan SC is the first computer marked as a laptop, and the Apple II computer is widely accepted in education.
1984  Apple introduces Macintosh personal computer, the first to feature a mouse and images rather than just text.
1986  K-8 schools buy mostly Apple computers.
1992  Gopher servers provide students with on-line information.
1994  Most U. S. classrooms have at least one computer for instruction.
1995  Microsoft launches Windows 95.
1996-1999 Many schools rewire for Internet access. A few schools install Web servers and provide ways to create instructional Web pages.
2005  The One Laptop per Child (OLPC) organization is created.
2007  Foleo, the first protonet-netbook is launched by Palm Computing.
2009  Netbooks gain popularity. (Dessoff, 2009)

Local, state, and federal funding sources have demonstrated a commitment to the use of technology in the classroom by the investment of hardware and software in schools (Lewis & Wells, 2006). In addition to the investment in software and hardware, access to technology should be supported by staff development for faculty. In 1999, approximately
one-half of public school teachers reported using computers or the Internet for instruction during class time, and/or they assigned students work involving research using the Internet (Smerdon, Cronen, Lanahan, Anderson, Ianotti, & Angeles, 2000).

The creation of 21st Century classrooms has provided opportunities for students to use various forms of technology tools to connect to information, their peers, and other classrooms and students throughout the world. However, classroom integration has not kept pace with increases in available technology tools (Keengwe, 2007). Schools should to continue to make investments in staff development in order to integrate the tools of technology currently available for schools today (Greaves & Hayes, 2006a). In their report, America's Digital Schools 2006: A Five Year Forecast, Mobilizing the Curriculum, Greaves and Hayes (2006a) identified ten trends for the future of education as follows:

1. Ubiquitous Technology and the Digital School – 1 to 1 Computing Usage in U.S. Public Schools
2. Climate for Change – Adopting Technology-Based Initiatives
3. Digital Learning – Factors and Roles for Digital Computing
4. Professional Development – Expenditure Priorities
5. On-Line Learning – Value, Offerings, and Delivery
6. Academic Performance – Achievement linked to 1 to 1
7. Home-School Connection – Connectivity and Parental Access
8. Devices and Hosting Models
9. The Changing Landscape of Expenditures – Spending, Budget, and Investment

5
10. A Technologist Looks in The Future – Usage, Needs, and Global Outlook

(Greaves and Hayes, 2006)

These trends provide a blueprint for technology leaders to generate a vision for the future. According to Greaves and Hayes, in 2006, 19% of all student devices were mobile and 50% would be mobile by 2011. It is important to note schools do not have the same capacity for change. The transition from a desktop world to a mobile world is a reality of today and tomorrow that schools will have to learn to facilitate with in the future.

Connected to the issue of mobilizing the curriculum is the move toward ubiquitous, or 1:1 computing. The idea is that every teacher and student will have his or her own computing device not shared with others in the classroom. According to Quality Education Data reported 4% of U. S. school districts had started 1:1 implementation (Greaves & Hayes, 2006b). Greaves and Hayes (2006b), reported more than 24% of school districts were in the process of transitioning to 1:1 implementation at the time of their report. Many schools globally are making the move to placing mobile computing devices in students hands as a result of the declining cost, equity for students, and interest in educational reform (Zucker & Light, Jan. 2009).

The integration of mobile technology and 1:1 technology programs has demonstrated many barriers for education leaders. The following is a list of barriers identified by Schoepp (2005):

1. Poor administrative support
2. Problems with time, access, space, supervision, and operation
3. Poor software
4. Curriculum integration difficulties

5. Teacher attitudes and knowledge towards computers

6. Computer limitations and inadequate numbers of computers

7. Lack of technical support (Schoepp, 2005).

Many school districts are implementing 1:1 Laptop initiatives programs to deal with access, mobility, and student engagement issues. There are several statewide programs such as Maine’s “Learning Technology Initiative,” Michigan’s “Freedom to Learn Program,” Florida’s “Laptop for Learning,” and New Hampshire’s “Technology Promoting Student Excellence”, all programs committed to providing staff and students with opportunities that 1:1 Laptop access provide. Many individual school districts across the country, i.e. Irving and Austin, TX, Richmond and Alexandria, VA, and San Francisco and Fullerton, CA, are examples of large urban school districts making commitments to 1:1 Laptop technology (Poole, 2009).

In a current 1:1 Laptop setting in Kentucky, there are 6 steps identified for a successful 1:1 Laptop program.

1. Set goals and objectives to create accountability.

2. Gather support from educational stakeholders.

3. Evaluate the needs of staff to ensure successful integration.

4. Find funding resources

5. Train teachers to integrate the technology tools.

6. Engage students with the technology tools (Roscoria, 2010).

The evolution of technology integration in schools has made it easier for problems to be solved in facility and strategic planning, rather then in staff development and
curriculum integration. Classroom design in new buildings, wireless access to classrooms and throughout school buildings, specialized training for technology support positions, and cross training of teachers are key components to dealing with technology barriers (Poole, 2009).

The collaboration with technology integration plans, specific outcomes must be established for students and staff participating in the implementation of successful 1:1 Laptop programs. The following paragraphs describe identified outcomes of successful programs for students.

Outcomes of Successful Programs for Students

Some key outcomes of successful 1:1 Laptop programs show laptop students spend more time engaged in collaborative work than non-laptop students, participate more in project-based instruction, write more and access more information, and show better research analysis skills. Students spend more time with technology in a 1:1 Laptop program, as a result they commit more time and effort into the learning that occurs through their projects and collaborations (Apple, Inc., 2007). In addition, students become collaborators, direct their own learning, report a greater reliance on active learning strategies, and readily engage in problem solving and critical thinking. Finally, laptop students consistently show deeper and more flexible uses of technology and spend more time doing homework on computers than other students (Barrios, Ambler, Anderson, Barton, Burnette, & Feyton, 2004).

Some positive teacher related outcomes to successful laptop programs include: teachers who use laptops use a more constructivist approach to teaching, feel more empowered in their classrooms, and spend less time lecturing (Barrios et al., 2004).
The implementation of 1:1 Laptop programs for students and staff demonstrate a number of benefits to students and teachers in the new digital world (Winking, 2009). Benefits may include: improved academic achievement, higher rates of attendance, better student engagement in the 21st Century learning process, parental satisfaction with educational systems, improved teacher ability to prepare students for the 21st Century, and a greater ability to meet the changing needs of students, teachers, and parents.

Results of a Microsoft study on benefits of ubiquitous computing indicates that students can collaborate with other students and teachers, get homework assignments, and even take tests when they're out sick; or students can use the Internet to do research, to study, or to simply explore during after school hours and on weekends. Additionally, parents who use computers can monitor homework assignments and attendance, track student progress, and communicate with teachers and administrators. Generally, the advantages of mobile computing allow learning to go far beyond the walls of schools.

Purpose of the Study

The purpose of this study was to examine how 1:1 Laptop initiatives in the Fertile-Beltrami School District 10th, 11th, and 12th grade affected student achievement and student academic performance over the 2008-2009 school year, a selected small, rural Minnesota high school. The two variables in this study were perceived student performance skills based on survey results from student and teacher participants and pre-existing Minnesota graduation testing results and grade point averages from Fertile-Beltrami School District.
Research Questions

1. What effects does a 1:1 Laptop initiative have on student academic performance based on perceptions of participating sophomores, juniors, and seniors?

2. What effects does a 1:1 Laptop initiative have on student academic performance based on perceptions of participating faculty?

3. What effect does the 1:1 Laptop initiative for students in grades 10, 11, and 12 in the Fertile-Beltrami School District have on student achievement based on Minnesota graduation testing and local assessments in math and reading?

Significance of the Study

At the time of this study, the challenge in 1:1 Laptop research was that researchers couldn’t specifically identify the direct impact of 1:1 Laptop implementation on student achievement in reading and math. Researchers in the Freedom to Learn Program 2005 in Michigan were working on quasi-experimental research in a more intensive and controlled study to collect data on the effects of one-to-one laptop implementation on student achievement (Ross & Strahl, 2005). The Great Maine Schools Project (2004) had collected enough data at this point of implementation that indicated that there was no significant difference between standardized test scores of laptop and non-laptop students (Mitchell Institute, 2004). However, the data also indicated that laptop students demonstrated stronger skills in writing and problem solving than non-laptop participating students. The Laptop for Learning Task Force in Florida indicated that students that participate in 1:1 Laptop programs produced multimedia projects at a higher level of understanding than their counterparts not involved in 1:1 Laptop programs.
Barrios et al., (2004). Students were learning the same content, but within four different perspectives:

1. As researchers, students were locating and selecting the information and resources necessary to understand concepts.

2. As authors, students had to consider the intended audience and decide what type and amount of information was necessary to teach the concepts to their intended audience.

3. As designers, students were selecting the most appropriate media to share content of their projects, and were deciding how to structure their material to communicate it effectively.

4. As producers, students had to think carefully about how they could use the media’s capabilities and features to represent their content, and then they had to interact extensively with the materials as they built a final product (Barrios et al., 2004).

Gulek and Demirtas (2005) study demonstrated students participating in a 1:1 Laptop initiative at Harvest Park Middle School in Pleasanton, California. Pleasanton, California, demonstrated a high level of academic excellence historically. Students participating in the 1:1 Laptop program earned significantly higher test scores and grades in writing, language arts, math, and overall grade point averages than students not involved in the study. This study contradicted the idea that socioeconomic status influences achievement (i.e. higher socioeconomic status tends to mean higher achievement).
A national Gallup poll reported that 71% of United States parents were satisfied with their child's education. In Henrico County, Virginia, the parent satisfaction was 94%; this represented a direct correlation between parent satisfaction with education and schools allowing students to take laptops home. Florida schools participating in 1:1 Laptop programs increased student attendance by 40% (Gulek & Demirtas, 2005).

Literature and research studies indicated conclusive benefits to the implementation of 1:1 Laptop initiatives with middle and high school students. Students are demonstrating increased performance in areas of attendance, writing, reading, math, behavior, homework, critical and higher order thinking, and student engagement. Research continues on improvements in student achievement on standardized assessments identified in core academic areas (Gulek & Demirtas, 2005).

Technology integration into our educational systems is a critical element for future learning if schools wish to engage students in the digital age. Increased access to computers and information is a foundation of learning in the 21st Century. The support for 1:1 Laptop programs is visible by policy makers to reduce the "digital divide" for all children. Fiscal investments and changes in policy are important to fostering innovations in teaching and learning that result from technology integration and access. 1:1 Laptop initiatives are increasing in schools across the country, and data collection is continuing to support the overall learning process for students (Zucker & King, 2009).

This research study reviewed student performance levels and academic benefits of a voluntary 1:1 Laptop initiative in a small, rural Minnesota school and provided additional literature and research concerning 1:1 Laptop programs to educators throughout America (Gulek & Demirtas, 2005).
Delimitations

The study was conducted at the Fertile-Beltrami School District in Minnesota, with 10th, 11, and 12th grade students, faculty, and administration participating in, and utilizing test data and surveys. The school district was in its 10th year of a voluntary 1:1 Laptop program; the data collected in surveys and students assessments was from the 2008-2009 school year. Students had access 24 hours a day, seven days a week to 1:1 Laptops by leasing the computers through the school year. In addition, all middle and high school staff had laptops for instructional purposes. Fertile-Beltrami is a small, rural school district in Northwest Minnesota.

The researcher was familiar with the Fertile-Beltrami School District. The researcher spent the past 13 years working in collaboration with the Fertile-Beltrami School District, as well as, working directly with past and current superintendents. The Fertile-Beltrami School District is similar to the researcher’s school district.

The Fertile-Beltrami School District attempted to measure the impact of student academic performance by analyzing results of an interest survey; the survey was based on perceptions of faculty and students. The data collected by Fertile-Beltrami School District was limited by the number of students and faculty participating in the surveys and also by the number of students participating in the voluntary 1:1 Laptop program.

The number of student participants volunteering to complete the surveys varied according to grade levels and timing of the survey. Completing the survey, not all participants answered all of the survey questions. Fertile-Beltrami School District opened the voluntary 1:1 Laptop program to all students in grades ten through twelve.
Definition of Terms

The following terms are defined to support the reader.

1:1 Laptop: One-to-one computing, in education, refers to when a laptop computer becomes a constant companion and primary resource for information and communication, students become vested in caring for it and learning how to use it more effectively (Livingston, 2006).

Digital Divide: The term digital divide refers to a gap between people with effective access to digital and information technology and those with very limited or no access at all. (Livingston, 2006)

E-Learning: is a term for all types of technology-enhanced learning (TEL), where technology is used to support the learning process. Most often, the medium of instruction is some sort of computer technology, particularly involving digital technologies. E-learning has been defined as "pedagogy empowered by digital technology" (American Society for Training and Learning, 2009).

E-Rate: is the commonly used name for a Schools and Libraries Program of the Universal Service Fund, which is administered by the Universal Service Administrative Company (USAC) under the direction of the Federal Communications Commission (FCC) (Lewis & Wells, 2006).

Internet: The origins of the Internet reach back to the 1960s when the United States funded research projects for its military agencies to build robust, fault-tolerant, and distributed computer networks. This research, and additional research during a period of civilian funding for a new U.S. backbone computer system by the National Science Foundation, spawned worldwide participation in the development of new networking
technologies. This led to the commercialization of an international network in the mid 1990s, and resulted in the following popularization of countless applications in virtually every aspect of modern human life. By 2009, an estimated quarter of the Earth's population was using the services of the Internet (Cherian, 2009).

*Microsoft's Anytime Anywhere Learning Program:* a 1997 program that provided every student with their own full featured laptop computer to use 24 hours a day, 365 days a year. Every machine included a copy of Windows 95, Microsoft Office Professional, and a modem that could be used to connect to the Internet. Microsoft and Toshiba were funding a two-year evaluation of the program. While the results of this study wouldn't be available for another year, the reactions of the various participants were clear; the program was having a positive impact (Rockman, 2003).

*Milken Family Foundation:* the Milken Family Foundation is a charity trust established by Lowell Milken and Michael Milken in 1982.

*Millenials:* refers to those born after 1980 – The first generation to come of age in the new millennium.

*Minnesota Graduation Test:* also known as the Profile of Learning and the Minnesota Academic Standards, created in 1998, were intended to raise standards of education for Minnesota high school students. The Minnesota Graduation Standards were developed to ensure minimum competence in survival skills for all Minnesota graduates from high school. The standards included two parts: the Minnesota Statewide Assessments and the Minnesota Academic Standards.
Networked Society or Net Generation: is a society in which a combination of social and media networks shapes its prime mode of organization and most important structures at all levels (individual, organizational, and societal).

OLPC: One Laptop Per Child

Quantitative Methods: refers to the collection of research to identify key patterns, make comparisons and commonalities or differences in the data (Warschauer, 2006).

Quasi-Experimental: studies that do not use random assignment to create the comparison groups; designs include cohort analytic, interrupted time series, and correlational designs (Ross & Strahl, 2005).

Student Achievement: standardized measurements of varying levels of comprehension within a subject area (Kay & Honey, 2005).

Student Engagement: occurs when students make a psychological investment in learning. They try hard to learn what school offers. They take pride not simply in earning the formal indicators of success (grades), but in understanding the material and incorporating or internalizing it in their lives (Kay & Honey, 2005).

Ubiquitous Computing: is the method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user (International Society of Technology Education, Partnership for 21st Century Skills, State Educational Technology Directors Association 2007).

21st Century Skills: The skills necessary for students to succeed in the 21st Century. The following six elements are at the core of 21st Century skills:

1. Emphasize core subjects
2. Emphasize learning skills

3. Use 21st Century tools to develop learning skills

4. Teach and learn in a 21st Century context

5. Teach and learn in 21st Century context


Acronyms & Abbreviations

The following acronyms & abbreviations are listed to support the reader.

ACOT: Apple Classrooms of Tomorrow is a collaborative effort with the education community to identify the essential design principles for the 21st century high school by focusing on the relationships that matter most: those between students, teachers, and curriculum (Apple, 2007).

CCC: Computer Curriculum Corporation

e-MINTS: Enhancing Missouri’s Instructional Networked Teaching Strategies

ESEA: Elementary and Secondary Education Act

FTL: Freedom to Learn – Michigan 1:1 laptop program

IEA: International Association for the Evaluation of Education Achievement

ISTE: International Society for Technology in Education

ITC: Information and Communication Technology

MAP: Missouri Assessment Program

MEAP: Michigan Education Assessment Program

NCLB: No Child Left Behind is the latest federal legislation that enacts the theories of standards-based education reform, which is based on the belief that setting
high standards and establishing measurable goals can improve individual outcomes in education. The Act requires states to develop assessments in basic skills to be given to all students in certain grades, if those states are to receive federal funding for schools. The Act does not assert a national achievement standard; standards are set by each individual state (Honey, McMillian-Culp, & Spielvogel, 2005).


*SEIR*TEC*: Southeast Initiatives Regional Technology in Education Consortium

*SES*: Socioeconomic Status is an economic and sociological combined total measure of a person's work experience and of an individual's or family's economic and social position relative to others, based on income, education, and occupation. When analyzing a family's SES, the household income earners' education and occupations are examined, as well as combined income, versus with an individual, when their own attributes are assessed (National Center for Educational Statistics. March 2010).

*TEL*: Technology-Enhanced Learning

Overview of the Study

Chapter I provides an introduction to this study, outcomes of successful programs for students, purpose of the study, research questions, significance of the study, delimitations, definitions of terms, and acronyms and abbreviations. Chapter II provides a review of the literature including a historical perspective on technology integration into public education, a description of the Fertile-Beltrami Schools 1:1 Laptop Experience, how technology integration in the 21st Century, technology integration and student achievement, 21st Century learning expectations in a Global Economy, barriers to successful technology integration in K-12 education, and 1:1 Laptop initiatives in the
21st Century educational systems. Chapter III focuses on methodology of the study including purpose of the study, research questions, selection of study population, data collection, and data analysis. Chapter IV includes the data results and analysis. Chapter V contains a summary of findings, conclusions, implications, and recommendations resulting from the study.
CHAPTER II
LITERATURE REVIEW

This chapter contains a review of literature that pertains to this study. The chapter is organized into seven major areas of review. The first section covers the historical perspective of technology integration into public education. Section two reviews the Fertile/Beltrami Schools implementation of laptops in a 1:1 program and status of the 1:1 Laptop current program. The third section highlights the importance of technology integration into 21st Century education. The fourth section focuses on technology integration and student achievement. Section five focuses on 21st Century learning expectations in a global economy. The sixth section reviews barriers to successful technology integration into K-12 education. Section seven reviews 1:1 Laptop initiatives in 21st Century educational systems.

Historical Perspective - Technology Integration Into Education

Public education was built to provide two core functions: to transmit culture, values, and lessons of the past to the current generation, and to prepare our children for the world they will live in (Molnar, 1997). The goal of schooling in the early 1800s was to learn the mechanics of writing; later during the mid 1800s, students were encouraged to write thoughts and ideas (Cherian, 2009). The educational system evolved in the 1900s with a focus on functional technology knowledge for students to move to a production or manufacturing job market. During the 1800s and early 1900s, the focus
was an agricultural based, labor-intensive job market that featured the ability to gain employment based on physical abilities rather than educational background. To rebound from The Depression and World War II, a technology based assembly-line economy emerged. As a result of a need for consumer goods and military hardware, a new focus on education, research, and technology advancement evolved. In the later 1900s, literacy became a priority for learners and the evolution of education continued to follow changing societal needs and expectations (Cherian, 2009). The 1940s became a decade of transition at all levels of American education. The primary and secondary American education system became standardized, better organized, and funded by state and federal government. The higher education system became modernized with a new level of social and academic freedom, restructured its pedagogy to emphasize science, professionalized it humanities curriculum, and integrated activities with government and industry. American education was on the way to becoming standardized, professional, scientific, and nationalized (Gale Group, 2001).

Major changes in education have evolved as a result of World War II, the National Defense Education Act of 1957, the Soviet launch of Sputnik, and No Child Left Behind legislation. Technology has been a key component to educational reform for the past sixty years (Cherian, 2009). Technological changes have enabled a new era of capitalism, termed post-industrialism or informationalism, and new forms of social interaction leading to the notion of a “networked society” (Castells, 1996).

Government has played a major role in educational reform; it has also supported the reform of technology with the following five identified initiatives:
1. Sesame Street, one of the first programs to promote television as a learning tool at home;

2. Programmed Logic for Automatic Teaching Operations, better known as PLATO, an early system of computer based instruction,

3. Computer-assisted instruction at Stanford and its offshoot, the Computer Curriculum Corporation (CCC);

4. Star Schools, a program to develop technology infrastructure for distance learning; and

5. E-Rate, which encourages the spread of telecommunications technology for learning. (Cherian, 2009)

These programs highlight the relevance of the federal government's involvement in educational technology development in schools.

Over the years, educational demands have been changing, and technology as an educational tool has been evolving. Several markers in history highlighted this evolution:

1937 – Model K(itchen) was created by George Steblitz and improved in 1940. Steblitz used a teletype machine at Dartmouth College in New Hampshire to transmit a problem to his Complex Number Calculator in New York and received results. This was a first example of a network.

1939 – ABC computer was designed at Iowa State University. Designed by John Vincent Atanasoff, it was used to solve linear equations common in physics. The school never filed a patent application.

1944 – The MARK I computer was the first operational computer at Harvard
1946 – The ENIAC (Electronic Numerical Integrator and Computer) computer at Penn State was developed by John Mauchly and J. Presper Eckert of Moore School.

1951 - UNIVAC was delivered to the Census Bureau. It had reusable software that used a higher level language, and was used to predict the outcome of the 1952 presidential election.

1953 – The IBM 701 was introduced. It was the first successful commercial computer.

1956 – FORTRAN was introduced. It uses ALGOL as a communication language.

1959 – The PLATO project at the University of Illinois introduced a first Large Scale Computers in Education project.

1963 – In Dartmouth, a timeshare system was developed with students to allow students to interact directly with a computer. The system was expanded to incorporate regional computing centers for colleges and schools. During this operation, the machine language was upgraded from FORTRAN to BASIC.

1963 – At Stanford, computer-assisted instruction was developed by Suppes and Atkinson for research in math and reading.


1969 – Bell Labs left MIT and developed its own operating system – UNIX. It also developed a precursor to today’s internet, ARPANet.

1970s – At MIT, Papert developed a new and different approach in computer language called LOGO. It encouraged rigorous thinking about math.
1960s-1974 – The National Science Foundation established 30 regional computer networks, that included 300 higher education institutes and some secondary schools. In 1963, only 1% of the nation’s schools used computers for instructional purposes. By 1975, 55% of the schools had access and 23% were using computers for primary instruction.

1975 – The first personal computer was marketed in kit form. The Altair featured 256 bytes of memory.

1977 – Stores began to sell personal computers (Molnar, 1997).

The 1980s and 1990s brought a need for programs to improve student learning. The need for improvement brought the implementation of computer technology into the curriculum. Pilot programs began throughout the country trying to improve student achievement by investing in new programs that would enhance education beyond the traditional classroom (Cherian, 2009). Computers were introduced to schools in the early 1980s. Since their inception, over 40 billion dollars have been spent on hardware, teacher training, and connections to the Internet to improve educational opportunities for students and provide an American work force that will compete globally (Dickard, 2003).

In 1983, the landmark report, *A Nation at Risk*, identified computer competence as part of “Five New Basics” – English, Math, Science, Social Studies, and Computer Science. Twenty years later, the No Child Left Behind Act of 2001 (NCLB) included a recommendation that by eighth grade all students should be technology literate and repeatedly referenced technology as an important source of support for teaching and learning across the curriculum (McMillian-Culp, Honey, & Mondumach, 2003).
The identification of a need for specific technical skills in *A Nation at Risk* was a very powerful initiative to enhance the integration of technology into higher education as well as the high school classroom (Molnar, 1997). This began in 1984 with the establishment of five "Supercomputer Centers" that provided a high-bandwidth backbone for computers to communicate through. It continued in 1985, as the National Science Foundation built a national network to make large systems available to all colleges and universities for research and education (Molnar, 1997). This system linked 1,500 networks, over 100,000 computers, and over 1,000,000 users all over the world (Jennings, 1986).

There were a number of projects that continued to bring ubiquitous computing to the forefront of educational reform. The Apple Classroom of Tomorrow, The Buddy Project, Newton, and Palm began additional transformation of how technology could be used in learning (Keefe & Zucker, 2003). Currently, 1:1 Laptop programs in Maine and Henrico County, Virginia, as well as One-to-One-Apple programs, Anytime-Anywhere-Microsoft, and Notebooks for Schools-Toshiba are providing opportunities for educational change through technology (Keefe & Zucker, 2003).

In 1987, a change of focus in classroom project-based or inquiry-based learning provided the opportunity for teachers to integrate the Internet into classrooms through programs such as National Geographics for KidsNet and Global Laboratory Network. These Robert Tinker developed programs provided global access to research based learning activities (Foehr & Roberts, 2000).

In 1992, an IEA (International Association for the Evaluation of Educational Achievement) study identified the definition of technology literacy as a combination of
information skills and literacy, communication skills and literacy, and the skills necessary to function in a technological environment (Fulton, 1992). As the identification of skills needed in a computer literate world continued to be refined during the 1990s, the federal government increased its funding and oversight of education. The influx of federal funding for education supported an increase in computer to student ratios. The overall student-computer ratio in the United States in elementary and secondary schools fell from an estimated 168.0 to 1 in 1983 (Anderson & Ronnkvist, 1999) to 3.8 to 1 in 2005 (Market Data Retrieval, 2005). This rapid influx of technology into our school systems created additional barriers to quality integration of technology into classrooms.

As the amount of hardware and software in public schools began to increase, technology enthusiasts saw an increase in use of technology for direct instruction and learning opportunities for students. Many schools installed computer labs in schools to meet integration of technology requirements. The system of computer labs worked for schools, but few saw any opportunity for student engagement in the use of laptop computers. As technology changes, so do the learning needs and opportunities of students. School access to the Internet had been addressed through the E-Rate program, and by the early 2000s equity to access had been achieved in most schools throughout the U.S. (Sivin-Kachala & Bialo, 2000).

Schools in the early 2000s began to evolve beyond the lab and desktop computer to 1:1 Laptop programs throughout the United States. The Great Maine Schools Project in Maine, Freedom to Learn Program in Michigan, and Stillwater Area Schools Program in Minnesota are examples of states and school districts that have made the move to bridge the digital divide for 21st Century learners by the use of 1:1 Laptop programs with
students and staff (Penuel, 2005). A review of the studies in these programs demonstrates the engagement of 21st Century learners through technology.

The history of technology integration is deep with history, ideals, and vision for the future of education. There have been many individuals that provided directions for a future of learning through the use of technology. A National Technology Standards project has been working since 1998 to produce a set of standards for K-12 education to promote 21st Century literacy for all students and staff. The first document published by this project in 2000, supplied a first guide for schools to provide a curriculum integrated with technology for all subject areas (Kelly, Thomas, Knezek, & Bitter, 2000). In 2007, the International Society for Technology in Education (ISTE) established an additional set of standards for K-12 education. These standards focused on student creativity and innovation, communication and collaboration, research and information fluency, critical thinking, problem solving and decision making, digital citizenship, and technology operations and concepts (International Society for Technology in Education, 2007).

The Fertile-Beltrami 1:1 Laptop Experience

In 1997, members of the Fertile-Beltrami staff, administration, and school board had a vision to provide laptops to students to facilitate technology integration into the curriculum and balance access to technology for all students. The technology instructor and superintendent collected survey data and analyzed costs, and then presented their findings to the school board. The collection of data and committee work yielded the following goals for implementation of a laptop program:

1. Level the playing field for students that had access to computers at home and those students that did not have access to computers.
2. Integrate technology into the curriculum – by staff and students.

3. Prepare students for higher education opportunities by identifying technology proficiency as a goal of graduates.

4. Support and enhance technology opportunities for students and community members to promote growth in their local economy.

The implementation of the Fertile-Beltrami 1:1 Laptop program was done in several phases. In the first phase, the staff wrote grants and researched programs for hardware resources. The Superintendent wrote an initial grant that funded 50 laptops for 9th grade students. This supported the goal of implementation of the program for grades 10-12 the following year by establishing resources and a pilot project for implementation of the 1:1 Laptop technology. As a result of the laptop integration in 9th grade, the school identified a need for an additional 100 laptops, the school district found funds to purchase the additional computers through “Computers for Schools.” The “Computers for Schools” program provides refurbished computers for schools at a low cost. The computers are donated to the program from businesses throughout the State of Minnesota.

Information was collected from staff through survey to identify current abilities in the use of technology and the need for professional development in the use of new hardware and software. The staff identified training needs in the use and classroom integration of word processing, Internet, and presentation software. In addition, the district technology committee identified the need for specific training for each staff member on how to integrate the laptop technology into the classroom.
During the first year staff, students, and parents were provided training in school district acceptable use policies, parent and student education of using the laptop and Internet Safety, new curriculum, professional development staff and students, and direct class integration methodology. A year of planning took place to develop areas identified in the staff survey as well as to make purchasing decisions, develop physical infrastructure for increased technology usage, and initiate staff development for integration of technology into the curriculum. The first year of integration of the 1:1 Laptop program produced a need for key partnerships with parents. Parents and students attended required meetings in order to receive a laptop to ensure proper usage and maintenance. The meeting outlined the laptop program, expectations, costs, and contracts. This process changed over time as parents and students came to understand the program and school expectations.

In the fall of 1998, 150 laptops were integrated into the curriculum for grades 9-12. The initial implementation of hardware took advantage of a PC format. This was selected due to cost, technical specifications, and program availability through the Minnesota Computers for Schools program. The best laptops were distributed to senior students first, laptops continued to be distributed through the seniority chain of students by grade levels. The distribution pattern changed after the first year to designate the best machines for classes that required computers the most. The highest specification computers were distributed to students participating in Web Design, Video Editing, a Microsoft Office Certification course, and Computer Aided Drafting courses.

A change in instructional methods in the classroom was initiated during the first year, the planning and staff development year, of the program at Fertile-Beltrami.
Schools. The staff and administration identified that classrooms should be identified as student-centered and project-based to curriculum areas. A focus on staff development opportunities in-house and outside of the system was instituted. Developing staff skills to use, present, and integrate technology into the curriculum was a major goal of the implementation process.

Technology Integration in 21st Century Education

Early last century, technological advance required workers with a higher level of cognitive skills – for instance the ability to read manuals, to interpret blueprints, or to understand formulas.

Our educational system responded: In the 1920s and 1930s, high school enrollment in this country expanded rapidly, pulling youth from rural areas, where opportunities were limited, into more productive occupations in business and broadening the skills of students to meet the needs of an advancing manufacturing sector. It became the job of these institutions to prepare students for work life.

But in the past two decades, our system has had obvious strains, apparently reflecting an inability of our workforce to fully meet the ever-increasing skill requirements of an economy whose GDP is becoming more conceptual.

We need to be forward looking in order to adapt our educational system to the evolving needs of the economy and the realities of our changing society. Those efforts will require the collaboration of policymakers, educational experts, and -- importantly -- our citizens. It is an effort that should not be postponed. (Greenspan, 1999)

The job of our educational system is to prepare kids for life and engage our students in a relevant learning system (Becker, 2000). In addition, schools have a responsibility to provide balance in educational opportunities for all students. Almost 100 million young people were born between 1976 and 2000, and will come to adulthood having grown up with the Internet and the use of digital technology. In 2000, there were over 10 million computers in schools (Becker, 2000). The “Millennials,” born between 1980 and 2000, are a generation nearly as numerous as the Baby Boomers, and they are
charged with potential. Also called the Internet generation, they use computers more than any other age group. The U.S. Department of Education (2001) identified that 90% of children between the ages of 5-17 use computers, and more than 90% of students in the 12 to 18 age group use the Internet (Barrios et al., 2004). The “Millennials” expect to receive instant feedback in their learning, and as educators, we must engage them in learning this way in order to prepare them for the global workforce of the 21st Century.

This generation of learners and those that follow have a tremendous burden to meet general expectations for technology access, skills, and knowledge as they enter the workforce. The following are some general expectations our country has of our children as identified by the International Society for Technology in Education (2007):

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.... use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.... apply digital tools to gather, evaluate, and use information.... students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.... understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.... demonstrate a sound understanding of technology concepts, systems, and operations.

If these are what we expect of our learners, we must work to improve many parts of our system including policy and staff development. Jukes (2004) identifies in the Laptop for Learning Report:

What is the definition of insanity? It’s doing the same thing you have always done, but expecting, wanting, or needing completely different results. If we continue to use new technologies to reinforce what we have always done, we’ll continue to get the same results we’ve always gotten. (Barrios, 2004, p. 6)
In their report, *A Retrospective on Twenty Years of Education Technology Policy*, McMillan-Culp, K., Honey, M., & Mondimach, E (2003) identified two themes that emerged from their analysis of 20 years of policy on technology investments. “First, the ebb and flow of practitioners’ needs and challenges is a guiding force in shaping where and how technology becomes part of the educational system.” “Second is the need for a better understanding among both researchers and policymakers of the systematic nature of educational change in general and of educational technology integration in particular” (p. 23).

The identification of student skills is very important, but the identification of staff skills and training is as important in the proactive alignment of 21st Century curriculum. A new paradigm needs to be created in order to assure that students are not merely being assessed by standardized tests, but that ability to apply concepts and complex applications to real world situations (Apple, 2007). As reported in Honey, McMillan-Culp, and Spielvogel (2005), there are “six arenas critical to students’ success in the workplace.” In order to gain digital and technical literacy for staff and students, the future curriculum focus for staff development must be focused on the same critical areas as the students. According to Honey, McMillan-Culp, and Spielvogel (2005) those areas are:

1. **Communicate Effectively**: Staff must generate curriculum that motivates students to develop a range of skills to express themselves not only on paper with pencil, but also audio, video, animation, design software as well as a host of new environments (e-mail, Web sites, message boards, blogs, streaming media, etc.).
2. Analyze and Interpret Data: Staff must develop opportunities for students to have the ability to crunch, compare, and choose among the glut of data now available, both web-based and in other electronic formats.

3. Understanding Computational Modeling: Staff must facilitate students to possess an understanding of the power, limitations, and underlying assumptions of various data representations systems, such as computational models and simulations, which are increasingly driving a wide range of disciplines.

4. Manage and Prioritize Tasks: Staff must prepare students to be able to manage multi-tasking, selecting, and prioritizing across technology applications that allow them to move fluidly among teams, assignments, and communities of practice.

5. Engage in Problem Solving: Staff must facilitate students to have an understanding of how to apply what they know and can do to new situations.

6. Ensure Security and Safety: Staff must know and use strategies to acknowledge, identify, and negotiate 21st Century risks. They must convey these skills and knowledge to students.

Staff development is a critical element in reforming the integration of technology into curricula. Yesterday's methodologies will not work with today's students. At the time of this study, there was an unprecedented opportunity to reform teaching using the multiple technological resources for communication and information access available for schools at the time (Johnson, 2000). Teachers had the ability to work as learners to create models of instruction in our classrooms that could facilitate learning and make a
difference. Teachers that demonstrated the ability to be life-long learners to their students sent a powerful message on the value of learning and gained credibility as co-learners (Johnson, 2000).

Staff development must include several factors for effective and pertinent personal and professional growth. The following list highlights some key factors needed for educational staff development at the time of this report:

1. Time – Teachers must be provided time to learn and practice new skills.

Currently, U. S. teachers spend more time teaching and less time preparing for classes than teachers in other countries who are allocated more time for lesson preparation, in-service training, and staff meetings during the school day (Johnson, 2000).

2. Professional development and training must be held on a continual basis.

3. Mentors and peer coaches must be provided to model appropriate integration strategies in actual classroom settings.

4. Teachers must be provided feedback on classroom integration.

5. Teachers must be held accountable for implementing instructional strategies ar: 4 student learning (Rockman, 2003).

As leaders in education, we can support our teachers in the classrooms by following the recommendations identified by Nortel Networks (2005) “to ensure that optimal use of resources is made while enhancing the education of students within safe, productive learning environments” (Nortel Networks, 2005, p. 6).
1. Leverage personalized multimedia communications to enhance student learning, improve district communications and enable rapid emergency response.

2. Incorporate technology into the curriculum to improve student engagement and improve learning outcomes.

3. Explore opportunities to leverage technology to enhance parent-teacher communications and improve teacher productivity.

4. Explore how to make your school a safer learning environment.

5. Leverage wireless technologies to improve access to computers, boost teacher productivity and enhance school safety.

6. Reduce costs by converging networks and consolidating data centers, and develop a business continuity plan (Nortel Networks, 2005, p. 6).

It is critical that school leaders and decision makers continue to invest in technologies to allow school staff and students to be immersed in 21st Century skills and global access to learning.

Technology Integration and Student Achievement

At the time of this report, there had been a tremendous investment by states and the federal government in accessing technology. However, there was still a tremendous disparity between the “haves” and “have-nots” when it came to access to computers (Barrios et al., 2004). The number of African-American and Hispanic students aged 10-14 that would use computers at home to do homework was less than half the number of their Anglo classmates (Barrios et al., 2004). Many districts had continued to invest in technology to level the playing field for all students.
Research has demonstrated the challenge of helping teachers and students achieve ICT (Information and Communications Technologies) literacy, and the challenge of establishing frameworks for assessing their skills has been most acute in schools serving low socioeconomic and minority students (Becker, 2000). While there is public debate about the digital divide that centers on basic technology access, the gap is even wider when measured by the pedagogical practices associated with technology use in different schools. More than half (53%) of teachers in public schools who have computers use them or the Internet for instruction during class (Lenhart, Rainie, & Lewis, 2001). But in schools whose students are from higher-income families, 61% of teachers with computers use them in class compared to 50% of those teaching in schools with lower-income students (Lenhart, Rainie, & Lewis, 2001). As wired as many young people are, the same study that found 87% of young people use the Internet also found that 3 million remain without Internet access. Many of those without access come from financially disadvantaged backgrounds, and a disproportionate number are African-American (eSchool News, 2005).

There are studies identifying that the 1:1 Laptop immersion does impact student achievement and learning. It appears that socioeconomic status is a clear indicator of the amount of increase of student achievement on standardized tests in many urban settings. At the Malcolm X Academy in inner city Detroit, Michigan, students scored an impressive 83% meeting or exceeding state writing standards compared to the 63% state average. 63% of students met or exceeded state reading standards compared to a 49% state average (eSchool News, 2005). In addition, programs in Maine cite that 1:1 Laptop
programs close the digital divide and provide students with the 21st Century skills to compete in the global marketplace (Lemke & Martin, 2004b).

Schools serving students living in poverty tend to use technology for more traditional memory-based and remedial activities, while schools serving wealthier communities are more likely to focus on communication and expression. A nationwide study examining the relationship between socioeconomic status and teaching practices around technology found that teaching in low socioeconomic status schools correlated most strongly with using technology for reinforcing and remediating skills, while teaching in higher socioeconomic status schools correlated most with analyzing information and presenting information to an audience (Becker, 2000).

In Baltimore County Public Schools, the 26th largest district in the nation with a minority population making up 51.3% of the student population, an investment of 11 million dollars was made in 2000 for technology hardware and software to close the achievement gap between white and minority students. Since that investment, many additional steps needed to be followed to make the investment affect students in a positive manner. The Baltimore School District established a blueprint for progress that identified a vision for the future and eight performance goals. This plan established a framework for the leadership and facilitation of the growth in the school district (Winking, 2009).

The first set of data identifies the technological integration plan impacted student achievement by closing the achievement gap in reading between Anglo and African-American students. In 2004, 71% of African-American students achieved the level of advanced or proficient in 4th grade reading, while 87% of Anglo students did—-a
16-point gap. By 2008, 84% of African-American students were advanced or proficient in reading, compared with 93% of Anglo students. The gap narrowed to 9 points (Winking, 2009).

In 8th grade reading, all students are gaining ground, with a slight narrowing of the gap. In 2004, 54% of African-American students and 74% of the Anglo students were advanced or proficient. By 2008, that number had grown to 60% and 79%, respectively (Winking, May, 2009).

Baltimore County Public Schools is also noted by the Schott Foundation as having achieved the highest graduation rate for African-American males among the nation’s 50 largest school district. The district graduates 72% of its more than 21,000 Black males and 79% of the Anglo males (Winking, 2009).

In a 2000 study commissioned by Software and Information Industry Association, Sivin-Kachala and Bialo reviewed 311 research studies on the effectiveness of technology on student achievement. Their findings revealed positive and consistent patterns when students were engaged in technology-rich environments, including significant gains and achievement in all subject areas, increased achievement in pre-school through high school for both regular and special needs students, and improved attitudes toward learning and increased self esteem (Sivin-Kachala & Bialo, 2000).

Michigan’s Freedom to Learn (FTL) Initiative, an effort to provide middle school students and teachers with access to wireless laptop computers, has been credited with improving grades, motivation, and discipline in classrooms across the state, with exemplary schools seeing reading proficiency scores on the Michigan Education Assessment Program (MEAP) test, administered in January 2005, report increasingly
from 29% to 41% for seventh graders and from 31% to 63% for eighth graders (eSchool News, 2005).

While research linking technology integration, inquiry based teaching, and emphasis on problem solving with student achievement is emergent, some research exists that suggests a connection. In a 2001 study of Enhancing Missouri’s Instructional Networked Teaching Strategies (eMINTS) program, a statewide technology integration initiative, eMINTS students scored consistently higher on the Missouri Assessment Program (MAP) than non-eMINTS students, including eMINTS students classified as having special needs. The higher MAP results were found to be associated with the instructional practices (Pitler, Flynn, Gaddy, 2004). The eMINTS program provides teachers with professional development to help integrate technology so that they can use inquiry-based teaching and emphasize critical-thinking and problem-solving skills (Bickford, 2005).

The program has since expanded to not only Missouri schools and districts, but also other states as well. Currently, 232 Missouri districts, 10 Utah districts, 56 Maine districts, 2 Nevada districts, and 1 Illinois district, representing 1,000 classrooms and 22,500 students, now take advantage of the eMINTS classrooms. It has been found that eMINT schools scored higher than students enrolled in non-EMINTS classrooms and that low-income and special education students in e-MINTS classes generally score higher than their non-eMINTS peers (Bickford, 2005).

The eMINTS program has demonstrated three findings:

First, eMINT enrollment does demonstrate higher MAP scores. The findings are particularly true for those students enrolled in the second year of the program.
Second, eMINT helps teachers support student’s performance regardless of the type of lessons they conduct. On both MAP tests, students enrolled in second-year EMINTS classrooms scored higher than students enrolled in non-eMINTS classrooms across all lessons (Bickford, 2005).

Third, the evidence exists that eMINTS enrollment helps narrow the achievement gap between special education students and other students. eMINTS enrollment also reduces the achievement gaps for African-American students and for students receiving Title I services (Bickford, 2005).

Educational technology has had positive effects on student achievement. The research concerning effective integration of technology in education on student outcomes has been monitored for over 20 years. When implemented appropriately, the integration of technology into instruction has positive effects on student achievement.

Several states have emerged as leaders in integrating technology. The implementation of instructionally sound strategies in integrating technology into instruction can be seen in many state’s 1:1 Laptop programs. Missouri’s eMINTS programs, Michigan’s Freedom to Learn program, and Texas’s Technology Immersion Pilot, just to name a few, have all shown statistically significant gains in elementary and middle grade reading, math, and science achievement when comparing participating students to their non-participating peers (International Society of Technology Education, 2008).

21st Century Learning Expectations in the Global Economy

Two-thirds of children use personal computers at home or school. Increasingly, the new media is connected by the Internet, the expanding web of network that is
attracting million new users monthly. It is critical that in education we meet the needs of
the Net Generation (Tapscott, 2000).

The access of students to technology and the web is a start to the engagement of
learners. The business world is also highlighting this interest by identifying that 85% of
today’s jobs require education beyond high school, compared to 61% in 1991. The Year
4 report from The CEO Forum – School Technology and Readiness Report makes the
recommendation to the nation’s leaders to invest in education to support student
achievement and benefits in a global economy (Year 4 STaR Report, 2001):

- Focused educational technology investments on specific educational
  objectives.
- Make the development of 21st Century skills a key educational goal.
- Align student assessment with educational objectives and include 21st
  Century skills.
- Adopt continuous improvement strategies to measure progress and adjust
  accordingly.
- Increase investment in research and development and dissemination.
- Ensure equitable access to technology for all students (Year 4 STaR

The report continued to highlight the five building blocks for Student
Achievement: Assessment, Alignment, Accountability, Access, & Analysis. These
building blocks are used to identify priority 21st Century skills:

- Digital Age Literacy
  - Basic, Scientific, and Technological Literacy
- Visual and Information Literacy
- Cultural Literacy and Global Awareness

• Inventive Thinking
  - Adaptability/Managing Complexity
  - Curiosity, Creativity, and Risk Taking
  - Higher Order Thinking and Sound Reasoning

• Effective Communication
  - Teaming, Collaboration, and Interpersonal Skills
  - Personal and Social Responsibility
  - Interactive Communication

• Higher Productivity
  - Prioritizing, Planning, and Managing Results
  - Effective Use of Real-World Tools
  - Relevant, High Quality Products

(CEO Forum on Education and Technology. 2001)

The building blocks and skills are highlighted throughout the literature as priorities for progressive education and learning. The focus of these skills must be made by educational leaders and teachers in order to reach identified objectives in technology integration. A continued focus will be on reading, writing, and math must be made in the classroom, while integrating the identified 21st Century skills by educational leaders to ensure readiness for the global workforce (Boston College, 2010).

There are many factors that influence successful integration of technology in teaching and learning. A study completed from 1995-2000 by SEIR*TEC (Southeast
Initiatives Regional Technology in Education Consortium) schools identified eight key lessons that will support successful integration:

Lesson #1 – Leadership is the key ingredient

• Start with a vision: School principals need to have a vision of what is possible through the use of technology and be able to work with others to achieve into action. Leaders who are committed to helping their teachers and students use technology effectively.

• Lead by example: Effective principals have a clear idea about how technology can support best practices in instruction and assessment; they use technology fluently and participate in professional development opportunities.

• Support the faculty: Highlight the efforts of faculty who attempt to use technology to improve teaching and learning. Effective leaders also participate in professional development activities with staff.

• Focus, focus, focus: Reform takes time and energy. Effective school leaders focus on reform initiatives that offer the most promise for improving teaching and learning, and they ensure faculty have resources, skills, and time necessary for turning the promise into reality.

• Share Leadership roles: School technology committees can play an important role in making decisions that reflect the needs of a total school community. Committee members should be those who are representatives of the total faculty. Shared input and decisions are critical for committee members to feel that they serve a real role and to increase the chances that decisions will be implemented.
• Use evaluation to further professional growth: Professional development is necessary as school teams strive to reach their vision for technology. Teams depend on evaluation instruments for selecting and planning the most appropriate professional development models and strategies. We have found that other tools can be more helpful, such as self-assessment of teacher technology skills and use of open-ended classroom observation protocols.

Lesson #2 – “If you don’t know where you’re going, you’re likely to wind up somewhere else” – Yogi Berra (Byron & Bingham, 2001).

• Each organization, whether it is a district or an individual school, needs to spend time developing and updating a comprehensive plan-starting with it’s vision, mission, and goals. The success of the technology plan depends on the quality and maturity of the plan. The plan must focus on the use of technology to support teaching and learning. Implementing the plan also requires working together in groups, devising new patterns for staffing, and many other organizational changes that are brought on by the use of technology.

Lesson #3 – Technology integration is a slow process.

• Truly integrating technology into teaching and learning is a slow, time-consuming process that requires substantial levels of support and encouragement for educators. Two examples, Apple Classrooms of Tomorrow (1991) and Milken Family Foundation (1998), identify what happens in technology rich environments and that change takes 3 to 5 years in
schools. Schools that received the most attention are making the most progress.

Lesson #4 – No matter how many computers are available or how much training teachers have had, there are still substantial numbers who are “talking the talk” but not “walking the walk.”

The following is a list of those identified features of effective learning expectations (Collins, 1997):

• Learners help plan the learning experiences to fit their needs.

• New information is received through more than one of the five senses.

• Learners process information in more than one context and in more than one way.

• Questions are thoughtfully and thoroughly discussed.

• Learners are encouraged to reflect, wonder, suppose, and predict.

• New concepts and information are related to current knowledge and experience. Learners may connect the new with the old by drawing on previous experience to illustrate new ideas; by comparing and contrasting new knowledge with previous knowledge; by applying new strategies or skills to familiar situations and by constructing metaphors for new concepts.

• The learning environment is collegial. Learners learn from one another. Ideas and perspectives reflect the ethnic and gender diversity of the learners. Learners value and welcome diverse viewpoints.

• Learners use new information over time by testing, comparing notes with other users and revising and refining understanding and practices.
• Learners have access, when needed, to support and are provided feedback from those with expertise.

• Learners experience success (Collins, 1997).

When these features are incorporated into professional development, and the following common-sense observation from SEIR-TEC’s work in the intensive site schools is considered, changes can occur that lead to teachers “walking the walk”.

Teachers begin with teaching and learning, not with hardware and software. Using the training-of-trainers model means more than providing a workshop to a few people and expecting them to train their colleagues on what they learned. Use teachers as mentors and coaches. Provide resources, opportunities, and support they need to apply their knowledge and skills. Finally, professional development is ongoing and comes in many shapes and sizes (Byron & Bingham, 2001).

Lesson #5 – Effective use of technology requires changes in teaching; in turn, the adoption of a new teaching strategy can be a catalyst for teaching integration.

• The amount and quality of technology used by the teacher and the student affects the integration and use.

• Teachers embrace strategies for student-focused learning, such as tailoring instruction to meet individual students’ learning needs, helping students develop problem solving and critical thinking skills, and providing opportunities for project based learning.

Lesson #6 – Each school needs easy access to professional with expertise in technology and pedagogy.
• Teachers need on-site and on-demand technical assistance with both the technology and the integration of technology into teaching and learning.

• Build support within and recognize staff take on the extra work and responsibility.

• Connect on-line technology support for technical issues and curriculum support.

• Document technical support needs.

Lesson #7 – Barriers to using technology to support learning are the same for all poor communities, but some populations have additional issues.

• Identify the educational problems that technology can help solve. Then focus on the problem.

• Locate others with similar problems and learn how they are addressing them.

• Learn what resources and funding are available for special circumstances or populations, and advocate the development of additional products and opportunities.

Lesson #8 – Evaluation is often the weakest element of technology programs.

Evaluation is a tiny aspect of most technology programs, for a variety of reasons:

• Lack of expertise is how to set up an effective evaluation program in technology and how to conduct an evaluation that will yield meaningful and useful results.

• Standardized tests seldom measure the kinds of things that technology is most likely to enhance, such as creativity, problem solving, critical thinking, design, school attendance rate, dropout rate, and discipline referrals.
• Evaluation is both an art and a science requiring substantial levels of specialized trainings (Byrom & Bingham, 2001).

The lessons identify a framework of experience and priorities for technology integration into education to create a globally competitive system for our students. The excerpt below magnifies the lessons message.

The emergence of a global information society is changing the way people live, learn, work and relate. An explosion in the free flow of information and ideas has brought knowledge and its myriad applications to many millions of people, creating new choices and opportunities in some of the most vital realms of human endeavors. Timely access to news and information can promote trade, education, employment, health and wealth. One of the hallmarks of the information society—openness—is a crucial ingredient of democracy and good governance. Information and knowledge are also at the heart of efforts to strengthen tolerance, mutual understanding for diversity. (Anan, K., June 18, 2003)

There is no doubt that the when technology is integrated effectively into curriculum, technology has a positive affect on student engagement and learning. However, integration must come from a trained and skilled teaching force with access to resources. Teachers must access network resources such as International Education and Resource Network (iERN), ePals, and Global SchoolNet to support the use of technology in schools beyond use as a substitute textbook (Peters, 2009).

Barriers to Successful Technology Integration in K-12 Education

The digital age of learning in a global society has required education to integrate technology into the daily learning environment for every student. The initial goal of technology integration is to make available technology resources for teachers to use as tools and students to have access to the learning tools that will be part of their future. As
technology initiatives have been integrated into schools, critics have called for hard data to demonstrate accountability for the fiscal investment in technology. The first challenge is to demonstrate the link between technology integration and students achievement. There are ten potential barriers to technology integration and 1:1 Laptop programs that must be addressed to create the link to student achievement and learning. The ten potential barriers are leadership, time, staff development, fiscal planning, logistical planning, community partnerships, parental training, technology support, integration timeline, and evaluation of programming of a successful integration of technology planning (Bonifaz & Zucker, 2004).

Approximately, one-half of public schools teachers in 1999 reported they used computers or the Internet for instruction during class time, and/or that they assigned their students work that involved research using the Internet (Smerdon et al., 2000). Teachers are seeking leadership to transform education. Leaders set the tone for action. Policymakers, superintendents, and school administrators can promote 21st Century education by committing to the incorporation of 21st Century skills in standards and assessments, investing in professional development and technology, and allocating adequate resources to ensure equitable access to 21st Century tools (Partnership for 21st Century Skills, 2002). In addition, the International Society for Technology Education (ISTE) has formulated and adopted technology standards for school administrators in six areas:

- Leadership and vision
- Learning and teaching
- Productivity and professional practice
• Support management and operations
• Assessment and evaluation
• Social, legal and ethical issues (International Society of Technology in Education, 2007).

Staff must be given time to implement change in classroom instruction and learning. Building time into the daily schedule allows teachers time to collaborate and to work with students. Preparation time needs to be provided to staff for curriculum and assessment development, development of instructional skills that develop a student-centered classroom, and ability to use and access additional technology tools as instructional resources. As schools continue to acquire more technology for students to use, and as teachers are able to find more ways to integrate technology into daily instruction, the problem will no longer be not enough computers, but not enough time (Becker, 2000; Byron & Bingham, 2001).

“Giving every child a computer will only improve student learning to the extent that teachers integrate the technology into the classroom practice, and change that practice to leverage the features of ubiquitous computing environments” (Center for Digital Education, 2008). Providing computers was the beginning for the need for staff development, to achieve the best uses of technology in support of learning at school, it is likely its teachers will need opportunities and support learning (Zhoa, Pugh, Sheldon, & Byers, 2002). Teachers need in-depth learning opportunities to learn appropriate use of technology in their subject area. A ten-year research study completed by The National Research Council’s Committee on Development of Science of Learning determined that
the there are four elements for effective learning environments which transitions to teacher learning environment:

- Learner-centered, taking individual learner needs in account.
- Knowledge-centered, directed toward developing deep understanding assessment-centered.
- Using assessment mechanisms to guide the learner.
- Community-centered, allowing for social processing (Bransford, Brown, & Cocking, 1999).

In addition, the following six key elements were identified by the “Learning for the 21st Century” for teachers to focus upon for instruction and learning in the classroom:

- Emphasize core subjects
- Emphasize Learning Skills
- Use 21st Century Tools to Develop Learning Skills
- Teach and Learn 21st in a Century Context
- Teach and Learn 21st Century Content

Fiscal planning for technology integration is the key element of sustainable change in education and learning. Many schools are cutting 1:1 Laptop programs and technology initiatives throughout the country as a result of economic issues. K-12 schools and districts are projected to spend $21.9 billion by 2013 – a 30% jump from the $16.8 billion in 2008 (Van Dusen, 2009). Schools must budget for equipment, software costs, charges for setup and upgrades, network access fees, insurance, operating costs,
security, professional development and consultation, training and technical support.

Schools must work to develop state and federal funding sources as well as develop community partnerships (Bonifaz & Zucker, 2004).

Alan Greenspan identified in a 1997 speech at Syracuse University the following remarks:

the advent of the twenty-first century will certainly bring new challenges and new possibilities for our business, our workers, and our educational system. We cannot know the precise direction in which technological change will take us. As in the past, our economic institutions and our workforce will strive to adjust, but we are able to recognize that adjustment is not automatic. All shifts in the structure of the economy naturally create friction and human stress, at least temporarily. However, if we are able to boost our investment in people, ideas, and processes as well as machines, the economy can readily adapt to change, and support ever-rising standards of living. (Chapman, 2000)

The challenge of preparing for prosperity in the 21st Century is a major issue for education as an institution. The development of community partnerships and inclusion of local communities into education are key elements to providing resources.

The logistical planning of technology integration involves resource security, accessibility, transportation of equipment, and development of a code of conduct for usage. These issues should be addressed in an updated and effective technology plan and in a process for integration. The amount of technological support provided in schools correlates to the success of technology integration. Schools that demonstrate a commitment to long-term planning and implementation of technology also demonstrate the most successful gains in technology literacy (Byron & Bingham, 2001).

The development of community partnerships to support technology integration is critical element to long-term technology implementation. A widening gap has formed between the knowledge and skills students are acquiring in schools and the knowledge
and skills needed to succeed in the increasingly global, technology infused 21st Century workplace (Partnership for 21st Century Skills, 2002). NCLB requires states to demonstrate that “every student is technologically literate by the time the student finishes the eighth grade, regardless of the student’s race, ethnicity, gender, family income, geographic location, or disability” (U.S. Department of Education, 2001). It is critical to prepare students for the global world that awaits them in their future. To continue to facilitate community partnerships with the business community the Information and Communication Technology (ITC) Literacy skills have been identified in a collection of business groups. These six skill areas are critical to students' success in the workplace (Kay and Honey, 2005):

- **Communicate effectively**: Students must have a range of skills to express themselves not only through paper and pencil, but also through audio, video, animation, design software as well as a host of new environments (e-mail, Web sites, message boards, blogs, streamline video, etc.)

- **Analyze and Interpret Data**: Students must have the ability to crunch, compare, and chose among the glut of data now available Web-based and through other electronic formats.

- **Understand Computational Modeling**: Students must possess an understanding of the power, limitations, and underlying assumptions of various data representation systems, such as computational models and simulations, which increasingly drive a wide range of disciplines.
• Manage and Prioritize Tasks: Students must be able to manage the multi-tasking, selection, and prioritizing across technology applications that allow them to move fluidly among teams, assignments, and communities of practice.

• Engage Security and Safety: Students must know and use strategies to acknowledge, identify, and negotiate 21st Century risks (Byron & Bingham, 2001).

In today’s global world it is not only business that demands a dramatically different set of skills. Changing technology has integrated into parent’s everyday lives. Changing job skills at work, effectively managing personal affairs in everyday life, shopping on-line, and selecting health care providers, requires people to use a different set of skills to process information. The integration of 1:1 Laptop technology in Maine has required parents to participate in a 90-minute training before laptops go home with students (Bonifaz & Zucker, 2004).

In addition, parents are asked to support financial investments through bond and levy requests to provide the funding for technology integration in schools. Leaders, policymakers, and program developers must involve parents in program development. The involvement will facilitate the community participating in the development of 21st Century learning at all stages of development and provide community fiscal support for program development and implementation (Partnership for 21st Century Skills, 2002).

A major challenge in any technology initiative is the development of a strong technical infrastructure and adequate technical support for staff. If teachers do not have the technology infrastructure to integrate the technology tools they are provided, they will become frustrated and regress in integration. Schools have the responsibility to not only provide hardware, software, and training, but also to assist these things with support and
an infrastructure that will make a real difference for classroom integration. Teachers must have access to personnel that are trained to troubleshoot and provide assistance after technology has been integrated in the classroom (Byron & Bingham, 2001).

In Henrico County, Virginia’s 1:1 program a student technology support “Help Desk” run by students was formed under the supervision of faculty. If teachers and parents new to technology can’t get the help they need when problems arise in the middle of a lesson or homework, they will sour to the future use of technology (Bonifaz & Zucker, 2004).

When planning for the integration of technology initiatives, such as 1:1 Laptop programs, schools must focus on reasonable timelines for integration. The fiscal impact of technology on schools requires school leaders and planning committees to consult with field experts and other schools when making purchasing decisions. Staff development planning and commitment to school’s learning goals need to be part of the decision making process. Schools must allow time in the implementation project for teachers learn how to use technology as well as learn through their use of technology (Bebell & O/Dwyer, 2010).

Computers are becoming common in schools, but training for faculty significant lags on how to effectively integrate technology into the daily student learning. Teachers’ first technology projects generate excitement, but often little content learning as a result of lack of staff development. Often it takes a few years until teachers can use technology effectively in the classroom as a result of lack of training for faculty (Goldman, Cole, & Syer, 1999 & Bianchi, 2004).
The final barrier identified in this section is the evaluation of the impact of technology on student achievement and learning. The evaluation technologies impact in achievement and learning is very difficult as a result of the following impediments identified by Glennan & Melmed (1996) and Kosakowski (1998):

- "Most available tests do not reliably measure the outcomes being sought. The measures that are being reported are usually from traditional multiple-choice tests. New measures need to be developed which would assess the higher-level skills and other effects often affected by technology (p. 46)."

- "Assessments of the impact of technology are really assessments of the instructional processes enabled by technology, and outcomes are highly dependent on the quality of the implementation of the entire instructional process. Crucial elements include instructional design, content, and teaching strategies associated with both the software and the classroom environment (p. 46)."

- "The very dynamic nature of technology makes meaningful evaluation difficult. By the time long-term studies are completed, the technology being evaluated is often outdated" (p. 47).

In this era of fiscal accountability aligning with student achievement results, it will become more important to design evaluation tools that can measure critical elements of students’ learning and engagement.

1:1 Laptop Initiatives in the 21st Century Educational Systems

There has been widespread interest in 1:1 computing for about the last 10 years throughout the United States. The program is not about school improvement; it is about systematic, whole-school reinvention that prioritizes individual student’s needs above all

56
else (McHale, 2007). The earliest initiatives in the U.S. began appearing in the mid-1990’s, and the most visible program at the time was Microsoft’s Anytime Anywhere Learning program (Rockman et al., 1998). In the past five years Apple Computer, Inc. has become actively involved in 1:1 computing.

A growing number of states and school districts are purchasing laptop computers for all students and teachers even as costs of implementation appear to be high. Currently, South Dakota, Wyoming, and Maine have the highest percentage of schools that have ubiquitous or 1:1 computing programs for their students, while California ranks last (Devaney, 2009). The largest and earliest state to commit to such a massive technology initiative is Maine with a commitment of 34,000 computers for the states 7th and 8th grade students. The largest school district to date is the Henrico County Schools in Virginia with over 23,000 computers. Additional state experimentation with 1:1 Laptop programs is happening in Indiana, Texas, New Hampshire, New Mexico, and Vermont. As the 1:1 initiatives increase throughout the country, there is on-going research about the effectiveness of 1:1 learning in increasing student achievement (Devaney, 2009).

The 2005 research brief conducted under contract with Apple, Inc conducted by Dr. William Penuel, aimed to analyze the following areas:

- The effects of 1:1 computing initiatives on students.
- How students use laptops and wireless connectivity?
- What teaching looks like in 1:1 classrooms?

The summary of the key findings were:
Effecting change in teaching practice depends on professional development and changing some teachers' beliefs about the role of technology and students' capabilities. Available research-based evidence is generally positive, especially with respect to laptop programs' effects on technology use, technology proficiency, and writing skills.

- Overall, however, there is limited research-based evidence from rigorously designed experimental or quasi-experimental studies of laptop programs' effectiveness.
- More quasi-experimental and experimental research is needed that examines both outcomes and implementation if further large scale investments in 1:1 initiatives are to be warranted by research base (Penuel, 2005).

The Maine Learning Technology Initiative (MLTI) was designed to "transform the state of Maine into the premier state for utilizing technology." The Maine Education Policy Research Institute conducted a Phase One evaluation of the MLTI. The research indicated that the MLTI impacted teaching and learning in the following ways:

- Teachers are using laptop computers in a variety of methods, such as developing instructional materials, conducting research for instructional purposes, and communicating with colleagues.
- Students have reported using laptops most frequently for finding information, organizing information, and taking class notes.
- The majority of teachers surveyed reported that the laptops assisted them most effectively to meet their curriculum goals and individualize their curriculum to meet particular student's needs.
- The majority of teachers reported that the utilization of the laptop computers has assisted them to better meet Maine's statewide learning standards.
• 4 out 5 teachers surveyed reported that students are more engaged in their learning, more actively involved in their own learning, and produce better quality work (Barrios, et al., 2004).

Additional support for laptop programs is supplied by Henrico County Schools in Virginia. The Henrico County Schools began their laptop initiative in 2001. At that time, 785 of the district’s schools were fully state accredited, meaning that at least 70% of the students had passed the Virginia Standards of Learning test. By spring 2003, every single school in the district was fully accredited (Pitler, Flynn, & Gaddy, 2004).

Virginia’s Standards of Learning tests indicated that scores in Standards of Learning tests showed improvement in 9 of 11 fields, increasing 14 points in World History and 20 points in U.S. History. High School accreditation increased from 63% to 75% in district schools, and the number of graduates continuing their education rose 2.5%. A dropout rate of 1.52% is the lowest in the history of the school district (Barrios et al., 2004).

In Missouri, an analysis of the eMINTS schools reflects the following findings of the program:

• eMINTS enrollment does support higher MAP scores. The finding is particularly true for those students enrolled in the second year of the eMINTS program, where students and teachers began the school year fully-functioning eMINTS environments.

• eMINTS helps teachers support student performance regardless of the types of lessons they conduct. On both MAP tests, students enrolled in the second-year eMINTS
classrooms score higher than students enrolled in non-eMINTS classrooms across all lesson types.

- Evidence indicates that eMINTS enrollment helps to narrow the achievement gap between special education students and other students persists. eMINTS enrollment also reduces the achievement gaps for blacks and for students receiving Title I services (Bickford, 2004).

In Michigan, the implementation of a 1:1 computing program is being viewed as a way to restore economic viability to an area of the country that is struggling economically. Policymakers are viewing the investment in ubiquitous technology as a strategy for diversifying that state's industries in a tight economy (Lemke & Martin, 2004a). Providing "digital equity" is another motivation for implementing state and district 1:1 computing programs. The programs have the opportunity to level the playing field for students by providing all students with the access to technological equipment that is needed to be successful in today and tomorrow's workplace (Pitler, Flynn, & Gaddy, 2004).

There is evidence through the 1:1 computing community that the implementation of these programs can improve student achievement, increase student engagement in learning, close the digital gap for students that are considered to have socioeconomic issues, and change the landscape of educational delivery to a student centered model. It is also important to note that ubiquitous computing creates an environment that today's youth expects in their learning environments. They do not see technology as a mere tool for learning, but a basic element of their day to day environments.
Summary

This chapter provided a review of literature focused on the history of integration of technology into public education, how the technology evolution has impacted classroom use of technology, and how the impact of technology in the classroom will prepare students for the 21st Century. The introduction provided an overview for the chapter and a view of the historical evolution of educational technology. The second section provided an overview of the history and evolution of the Fertile-Beltrami Schools laptop program. The third section showed a view of technology integration in the 21st century education. The fourth section focused on technology integration and student achievement. Section five reviewed 21st Century learning expectations in the global economy. The sixth section focused on barriers to successful technology integration in E-12 education. The last section reviewed 1:1 Laptop initiatives in the 21st Century educational systems.
CHAPTER III

METHODOLOGY

Purpose of the Study

The purpose of this study was to examine how 1:1 Laptop initiatives in the Fertile-Beltrami School District 10th, 11th, and 12th grades affected student achievement and student academic performance over the 2008-2009 school year, a selected small, rural Minnesota high school. The two variables in this study were perceived student performance skills based on survey results from student and teacher participants and pre-existing Minnesota graduation testing results and grade point averages from Fertile-Beltrami School District.

Research Questions

1. What effects does a 1:1 Laptop initiative have on student academic performance based on perceptions of participating sophomores, juniors, and seniors?

2. What effects does a 1:1 Laptop initiative have on student academic performance based on perceptions of participating faculty?

3. What effect does the 1:1 Laptop initiative for students in grades 10th, 11th, and 12th in the Fertile-Beltrami School District have on student achievement based on Minnesota graduation testing and local assessments in math and reading?
The origins of the 1:1 Laptop: Impact on Learning and Achievement began as the researcher collected literature and data on 1:1 Laptop programs across the country to identify if the information collected would provide support for a local 1:1 Laptop initiative in the researcher’s home school district of Stephen/Argyle Central. The professional interest in the topic of 1:1 Laptop programs began to evolve after engaging in dialogue with Fertile-Beltrami School District into a dissertation topic proposal as it became clear 1:1 Laptop programs were being used as a method of transforming education into the 21st Century. In addition to the literature and information that was available on the 1:1 Laptop programs nationally and globally, the opportunity to study the Fertile-Beltrami Schools 1:1 Laptop program in Northwest Minnesota supported my topic of study.

The researcher investigation of the Fertile-Beltrami Schools as a possible study site included interviewing several staff in June 2009. Yvonne Halvorson, District Technology coordinator, Don Blaeser, former Superintendent, and Brian Clarke, Superintendent all provide background information on the 1:1 Laptop program currently implemented in Fertile-Beltrami Schools. They also indicated they would like to find a way to collect information on the program to gain some additional insight on the success of the program as it relates to students achievement. The researcher began to review the State of Maine 1:1 Laptop program to look for assessment tools. The Mitchell Institute, 2005, had a survey being used in 1:1 Laptop programs for gathering assessment data from schools on the perceptions of 1:1 Laptop programs by students, staff, and parents. The researcher request information and permission Appendix A) to use the Mitchell
Institute surveys (Appendix C&D) for Fertile-Beltrami Schools to collect data on their current 1:1 Laptop program. The researcher provided the survey to the administration of Fertile-Beltrami Schools as a data collection instrument.

The interviews of the Fertile-Beltrami Schools administrative personal provide incredible insight and history of the 1:1 Laptop program. The researcher was able to document a timeline of the development and implementation of the 1:1 Laptop program. Yvonne Halvorson was part of the process of development, implementation, and continues today to be part of the program. Yvonne Halvorson provided the following background information on the program.

The Fertile-Beltrami Schools Implementation Model

In 1997, members of the Fertile-Beltrami Schools staff, administration, and school board had a vision of providing 1:1 Laptops to students to facilitate technology integration and balance access to technology for all students. The technology instructor and superintendent collected survey data and cost analysis to present to the school board. The collection of data and committee work yielded the following goals for implementation of a 1:1 Laptop program.

In 1998, the implementation of the Fertile-Beltrami Schools 1:1 Laptop program was done in several phases. The implementation process was facilitated by Superintendent Kristen Anderson. In the first phase, the staff wrote grants and researched programs for hardware and software resources. The Superintendent wrote an initial grant that funded 50 laptops for 9th grade students. This facilitated the goal of implementation of the 1:1 Laptop program for grades 10-12 the following year by establishing resources and a pilot project for implementation of the 1:1 Laptop
technology. As a result of the 1:1 Laptop integration in 9th grade, the school identified a need for an additional 100 laptops. The school district prioritized funds to purchase the additional computers through “Computers for Schools.” The “Computers for Schools” program provides refurbished computers for schools at a low cost. The computers are donated to the program from businesses throughout the State of Minnesota.

Information was collected from staff through survey to identify current abilities in the use and integration of technology and the need for professional development in the use of new hardware and software. The staff identified training needs in the use and classroom integration of word processing, Internet, and presentation software. In addition, the district technology committee identified the need for specific training for each staff member on how to integrate the laptop technology with the students in the classroom.

In 1997, the planning year was used to develop curriculum areas, make purchasing decisions, develop physical infrastructure for increased technology usage, and staff development for curriculum integration. In addition, financial resources were identified and grants were written for funding. During this year, staff, students, and parents were provided training in school district acceptable use policies, parent and student education of using the laptop and Internet Safety, new curriculum, professional development staff and students, and direct class integration methodology.

In 1998, the integration of the 1:1 Laptop program produced the need for key partnerships with parents. Mandatory parent/student meetings were required in order to receive a laptop. The meeting outlined the laptop program, expectations, costs, and
contracts. This process has changed with integration as parents and students understand the program and the expectations.

In the fall of 1998, 150 laptops were integrated into the curriculum grades 9-12. The initial implementation of hardware was PC platform. This was selected due to the cost, technical specifications, and program availability through the Minnesota Computers for Schools program. The highest quality laptops were distributed to senior students first and additional laptops were distributed down the seniority chain of students. The distribution pattern changed after the first year to designate the best laptops for the classes that required the higher level software and hardware requirements. The highest specification computers were distributed to students who were participating in Web design, video editing, Microsoft Office certification course, and computer aided drafting courses (Personal Interview Yvonne Halvorson, 2009).

A change in instructional methods for the classroom was initiated during the planning and staff development year at Fertile-Beltrami Schools. The staff and administration identified changing instructional methods to reflect student centered and project based curriculum. A focus on staff development opportunities internal and external of the system was instituted. Developing staff skills to use, present, and integrate 1:1 Laptop into the curriculum was a major goal of the implementation process.

The implementation of 1:1 Laptop technology in the school system placed pressure on the hardware backbone of technology system and support. A major investment into upgrading Information Technology software and hardware was made by the School Board. A full-time technology support staff was hired, with students beginning to serve as technical support as well.
The program has evolved over the years with the inclusion of electronic curriculum, on-line courses work, and project based curriculum. The program has also evolved into the community with students creating and supporting business web sites.

Selection of the Study Population

The population studied consisted of 23 sophomores, 24 juniors, and 34 senior students who participated in the 1:1 Laptop program at Fertile-Beltrami Schools in 2008-2009. There was a total of 105 students in grades 10-12. The students in the study population were involved in the 1:1 Laptop program on a voluntary basis.

Table 1 illustrates the frequency and percentage of Fertile-Beltrami School students who participated in the 1:1 Laptop program during the 2008-2009 school year per grade level. 81 of 105, or 77%, of Fertile-Beltrami sophomore, junior, and senior students participated in the program. Even though there were additional students that owned personal laptop computers, only students with school district laptop computers participated in the survey (N=81).

Table 1. Frequency and Percentage of Students who Participated in 1:1 Laptop Program per Grade Level (N=81).

<table>
<thead>
<tr>
<th>Student Grade</th>
<th>Total Students in Grade</th>
<th>Frequency of Participants</th>
<th>Percent of Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>33</td>
<td>23</td>
<td>69.6%</td>
</tr>
<tr>
<td>11</td>
<td>30</td>
<td>24</td>
<td>80.0%</td>
</tr>
<tr>
<td>12</td>
<td>42</td>
<td>34</td>
<td>80.9%</td>
</tr>
</tbody>
</table>
The following information shows the percentages of sophomore, junior, and senior students who voluntarily took part in the May 2009 survey administrated by the school. Five sophomores or 20%, eleven juniors or 45%, and thirty-two seniors or 94% participated in the survey administered by Fertile-Beltrami Schools to determine perceptions and effects of the 1:1 Laptop program on student performance based on student and faculty results.

The survey used to collect data was based on the Mitchell Institute survey instrument (Appendix C&D) for laptop initiatives. Permission was granted by the Mitchell Institut* (Appendix A) to use a form of the survey to collect data in the Fertile-Beltrami School District.

1:1 Laptop students participated in the Minnesota Graduation Testing in Reading and Math in April 2008 and April 2009. Students are measured at three levels Proficiency; Proficient, Partially Proficient, and Not Proficient. The testing occurred in reading and math.

Student grade point averages were also collected on all 1:1 Laptop students. This information will be used to measure academic progress for laptop students and non-laptop students. Table 2 represents the academic achievement information for 1:1 Laptop and non-laptop students.

Permission was granted by the Fertile-Beltrami School District to utilize existing student data and survey information for students and staff to conduct this study (Appendix A). Table 2 identifies the frequency and percentage of students who participated in the Minnesota GRAD testing conducted in April 2008 & April 2009 and participated in the laptop program.
Table 2. Frequency and Percentage of Fertile-Beltrami School Students who Participated in the Minnesota Comprehensive Assessment Tests and Participated in 1:1 Laptop Program (N=81).

<table>
<thead>
<tr>
<th>Students</th>
<th>MN MCA Test Laptop Students April 2008</th>
<th>MN MCA Test Laptop Students April 2009</th>
<th>MN MCA Test All Students April 2008</th>
<th>MN MCA Test All Students April 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N %</td>
<td>N %</td>
<td>N %</td>
<td>N %</td>
</tr>
<tr>
<td>Grade 10</td>
<td>23 100</td>
<td>33 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 11</td>
<td>24 100</td>
<td>30 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 12</td>
<td>34 100</td>
<td>42 100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Indicates the Fertile-Beltrami Schools Academic Achievement of the Minnesota Comprehensive Tests vs. the State of Minnesota in Reading and Math in 2008 & 2009.

<table>
<thead>
<tr>
<th>Students</th>
<th>Fertile-Beltrami N-Tested</th>
<th>State of Minnesota N-Tested</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Proficient</td>
<td>% Proficient</td>
</tr>
<tr>
<td>Grade 10 – Reading 2009</td>
<td>33 84.84</td>
<td>65,330 74.20</td>
</tr>
<tr>
<td>Grade 11 – Reading 2008</td>
<td>30 86.14</td>
<td>66,114 75.13</td>
</tr>
<tr>
<td>Grade 12 – Math 2008</td>
<td>42 35.71</td>
<td>64,253 41.10</td>
</tr>
</tbody>
</table>

Twelve laptop teachers and one administrator, or 100% of the faculty, completed the survey of the Fertile-Beltrami School District. The faculty survey was completed on-line and was a modified version of the Mitchell Institute survey, 2005.
Table 4. Frequency and Percentage of Students who are Laptop and Non-laptop Participants in the Fertile-Beltrami Schools and the Average Academic Achievement as Measured by School District Grade Point Averages.

<table>
<thead>
<tr>
<th>Students</th>
<th>Laptop</th>
<th></th>
<th>Laptop - Grade Point Average</th>
<th>Non-laptop</th>
<th></th>
<th>Non-laptop - Grade Point Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 10</td>
<td>28</td>
<td>84.8</td>
<td>Mean - 3.10</td>
<td>5</td>
<td>15.2</td>
<td>Mean - 1.89</td>
</tr>
<tr>
<td>Grade 11</td>
<td>28</td>
<td>93.3</td>
<td>Mean - 2.85</td>
<td>2</td>
<td>6.7</td>
<td>Mean - 1.56</td>
</tr>
<tr>
<td>Grade 12</td>
<td>39</td>
<td>92.8</td>
<td>Mean - 2.82</td>
<td>3</td>
<td>7.2</td>
<td>Mean - 1.78</td>
</tr>
</tbody>
</table>

Data Collection

As a result of the interviews information and literature search, the researcher developed a short proposal for Dr. Schnellert to review and provide feedback on the dissertation topic in November 2008. As a result of this proposal and feedback, the researcher began to proceed with the study development.

In December of 2008, the researcher began to work formally to collect data for the literature review. The researcher had been collecting article for about 12 months, at this time the researcher began researching the topic into formal sections of a literature review. The researcher received formal consent from the Fertile-Beltrami Schools to study and collect their data in relation to the 1:1 Laptop program in June 2009.

During the information gathering process, the researcher began to gather data from the Fertile-Beltrami Schools in the areas of survey data of student and parent perceptions of the 1:1 Laptop program through the Mitchell Institute survey and academic data as measured through the Minnesota Graduation Test data and local
assessment data. The information was preexisting data that was available through the Minnesota Department of Education and Fertile-Beltrami Schools.

Fertile-Beltrami School District provided the researcher with existing test scores in reading and math from the Minnesota GRAD tests for 2008 and 2009 and grade point average data for all sophomore, junior, and senior students. Fertile-Beltrami School District tests sophomore students in reading and junior students in math each per the State of Minnesota testing calendar. The test scores provided data for the study and were compared to Minnesota students who took the GRAD Tests during the 2008 and 2009 testing period. Permission to use the pre-existing data was granted by the Fertile-Beltrami School District (Appendix B).

The Fertile-Beltrami School District surveyed students and faculty in May of 2009, and measured perceived student academic performance and academic engagement in relations to the 1:1 Laptop program implemented during the 2008-2009 school year (Appendix C&D). The survey was part of an assessment tool measuring the overall perceived impact of the 1:1 Laptop program. The researcher and Fertile-Beltrami School district acquired permission to use the Mitchell Institute survey instrument assessment tool for laptop initiatives from the Mitchell Institute (Appendix A).

In April of 2010, the data was compiled and measured in percentages and frequencies to establish baselines of measurement for academic achievement of students participating in the 1:1 Laptop program and non-participating students. In addition, perceptions of students and faculty participating in the 1:1 Laptop program were measured to identify the positive and negative impacts of the program.
Data Analysis

The two variables in this study were perceived student performance skills based on survey results from student and teacher participants and pre-existing Minnesota graduation testing results and grade point averages from Fertile-Beltrami School District. A frequency and percentage analysis was conducted to determine whether the laptop program improved academic performance and how it impacted instructional practices of participating staff. A frequency and percentage analysis was interpreted to determine student and staff perceptions of student academic performance based on the 1:1 Laptop program that is in place at Fertile-Beltrami School District.

The data collected from the Minnesota GRAD tests, student grade point averages, and surveys was analyzed through frequency and percentage analysis.

Summary

The procedures described in this chapter were designed to determine the nature of the relationship between the implementation of 1:1 Laptop program in schools and the impact of the technology on students' achievement and learning. In addition, a review was provided of student and faculty perceptions of the effect of 1:1 Laptops on improving student achievement and learning. The study included forty-eight students in grades 10-12 and thirteen faculty members in a small rural school district in Northwestern Minnesota. Appropriate frequencies and percentages were performed to answer the research questions identified in Chapters I and III.
CHAPTER IV

RESULTS AND ANALYSIS

The purpose of the study was to examine the effect of a 1:1 Laptop Program on student achievement and learning in the Fertile-Beltrami School District. The students in grades 10-12 were examined during the 2008-2009 school year. There were two variables in the study. The first variable measured perceived student performance skills based on a modified survey from the Mitchell Institute (Appendix C&D). The survey was completed by 48 students, 12 faculty members, and 1 administrator. The second variable was pre-existing results of participating students from Fertile-Beltrami Schools District from the Minnesota Comprehensive Assessments. Frequency and percentages were used to determine student and staff perceptions of the students' academic performances and learning-based on the implementation of 1:1 Laptop Program in the Fertile-Beltrami School District. Frequency and averages were used to determine student performance in comparison to other students in Minnesota 10th, 11th, and 12th grade on the Minnesota Comprehensive Assessments in reading and math. This chapter focuses on analysis of data as identified in the research questions.

Analysis of Data

A frequency and percentage analysis of the survey data provided by the Fertile-Beltrami School District was completed to determine the perceptions of student and staff on whether the 1:1 Laptop initiative positively affected academic achievement and
students learning. In addition, the data reviewed how the implementation of 1:1 Laptops affects instructional practices of Fertile-Beltrami School faculty. A frequency and percentage analysis was also performed to determine if there was a relevant relationship between students and staff perceptions of how the 1:1 Laptop program impacted student's achievement and learning. A second frequency and percentage analysis was performed to determine whether the 1:1 Laptop program impacted student achievement on the Minnesota Comprehensive Assessments in the content areas of reading and math.

An important measure for the study was to identify how providing students with 1:1 Laptop program impacted usage of technology and the Internet at home. Table 5 illustrates the frequencies and percentages of student home computers use and Internet access prior to receiving their school laptop.

Table 5. Frequency and Percentage of Student Home Computer Use and Internet Access.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students who had a computer at home prior to Laptop program</td>
<td>41</td>
<td>85.4</td>
</tr>
<tr>
<td>Students who have Internet access as home</td>
<td>47</td>
<td>97.9</td>
</tr>
</tbody>
</table>

Of the 48 students participating in the survey, 41 students, or 85.4%, indicated they had a home computer before the implementation of the Laptop program. 47 of the students, or 97.9%, indicated that they had Internet access at home prior to participating in the laptop program. Table 6 displays the Laptop usage time of participating students at home.
Table 6. Amount of Laptop Use by Students at Home.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not use Laptop</td>
<td>6</td>
<td>12.5</td>
</tr>
<tr>
<td>1-4 hours per week</td>
<td>10</td>
<td>20.8</td>
</tr>
<tr>
<td>5-10 hours per week</td>
<td>12</td>
<td>25.0</td>
</tr>
<tr>
<td>More than 10 hours per week</td>
<td>20</td>
<td>41.7</td>
</tr>
</tbody>
</table>

Student computer and technology usage are important goals of the Laptop program. Twenty of the 48, or 41.7% of the students, indicated that they use their laptop 10 or more hours per week at home. An additional 12 students, or 25%, indicated that they use their laptop 5-10 hours per week at home.

Table 7 displays the amount of laptop use by students at school.

Table 7. Amount of Laptop use by Students at School.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not use Laptop</td>
<td>9</td>
<td>18.8</td>
</tr>
<tr>
<td>1-4 hours per week</td>
<td>21</td>
<td>43.8</td>
</tr>
<tr>
<td>5-10 hours per week</td>
<td>9</td>
<td>18.8</td>
</tr>
<tr>
<td>More than 10 hours per week</td>
<td>9</td>
<td>18.8</td>
</tr>
</tbody>
</table>

Student laptop usage at school was measured through survey. Nine of the 48 students, or 18.8%, indicated that they use their laptop 10 or more hours per week at
school. An additional 9 of the 48, or 18.8%, students indicated that they use their laptop 5-10 per week at school.

The goal of collaboration was established in the development of 21st Century skills by the Fertile-Beltrami School District. To measure collaboration in the laptop program, frequencies and percentage of student to teacher assistance were measured. Table 8 indicates the frequencies and percentages of the collaborative assistance that resulted in the laptop program.

Table 8. Frequency and Percentage of Student Perceptions Regarding 1:1 Laptop Collaboration Between Student to Student and Student to Teacher (N=43).

<table>
<thead>
<tr>
<th>Question</th>
<th>Never</th>
<th>Never</th>
<th>Monthly</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you typically help another student use a computer?</td>
<td>4</td>
<td>9.3</td>
<td>12</td>
<td>27.9</td>
<td>10</td>
<td>23.3</td>
</tr>
<tr>
<td>How often does another student help you use your laptop?</td>
<td>9</td>
<td>21.4</td>
<td>13</td>
<td>31.0</td>
<td>10</td>
<td>23.8</td>
</tr>
<tr>
<td>How often do you typically help a teacher use a computer?</td>
<td>14</td>
<td>32.6</td>
<td>14</td>
<td>32.6</td>
<td>5</td>
<td>11.6</td>
</tr>
<tr>
<td>How often does a teacher help you use your laptop?</td>
<td>15</td>
<td>7.5</td>
<td>10</td>
<td>25.0</td>
<td>4</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Table 9 indicates student perceptions to the changes in their learning as a result of the implementation of the Laptop program into their classrooms. Students were asked to rate the following areas compared to before they were provided a laptop as part of their learning experience. Table 9 identifies research, exploration, multiple activities, and increased writing responses as major areas of improvement in the learning environment.
Table 9. Frequencies and Percentage of Students’ Perceptions Regarding Changes in Their Learning Environment as a Result of the 1:1 Laptop Program (N=40).

<table>
<thead>
<tr>
<th>Classroom Learning Practices</th>
<th>Less Often</th>
<th>About as Often</th>
<th>More Often</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Students teach other students</td>
<td>2</td>
<td>5.0</td>
<td>23</td>
</tr>
<tr>
<td>Students teach the teacher</td>
<td>12</td>
<td>30.0</td>
<td>15</td>
</tr>
<tr>
<td>Student Select their own research areas</td>
<td>2</td>
<td>5.0</td>
<td>16</td>
</tr>
<tr>
<td>Students explore a topic on their own</td>
<td>6</td>
<td>15.0</td>
<td>9</td>
</tr>
<tr>
<td>Students work in groups</td>
<td>3</td>
<td>7.5</td>
<td>24</td>
</tr>
<tr>
<td>Students present their work in class</td>
<td>1</td>
<td>2.5</td>
<td>22</td>
</tr>
<tr>
<td>Student engage in multiple activities during class</td>
<td>2</td>
<td>5.0</td>
<td>17</td>
</tr>
<tr>
<td>Students write more than one page</td>
<td>2</td>
<td>5.0</td>
<td>12</td>
</tr>
<tr>
<td>A textbook is the primary guide</td>
<td>16</td>
<td>40.0</td>
<td>17</td>
</tr>
<tr>
<td>Students interest influences lessons</td>
<td>5</td>
<td>12.5</td>
<td>24</td>
</tr>
<tr>
<td>Students answer textbook questions</td>
<td>5</td>
<td>12.5</td>
<td>30</td>
</tr>
<tr>
<td>Direct instruction by teachers</td>
<td>7</td>
<td>17.5</td>
<td>29</td>
</tr>
<tr>
<td>Quizzes and tests</td>
<td>3</td>
<td>7.5</td>
<td>31</td>
</tr>
<tr>
<td>Teachers make connections across classes</td>
<td>3</td>
<td>7.5</td>
<td>29</td>
</tr>
</tbody>
</table>
Of the student responses thirty-one of forty students, or 79.5%, indicated that they agree or strongly agree that the inclusion of 1:1 Laptop program has helped them prepare for the future.

Thirteen faculty members participated in the 1:1 Laptop program at Fertile-Beltrami Schools during the 2008-2009 school year. 100% of the faculty completed the survey. Of the teachers that completed the survey, two faculty members teach multiple subjects, one faculty member is the K-12 principal, and all teachers have multiple grade levels. Table 10 shows the frequencies and percentages of the subject areas taught by participating faculty.

Table 10. Frequency and Percentage of Subject Areas Taught by Participating Faculty (N=13).

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art, Music</td>
<td>2</td>
<td>28.6</td>
</tr>
<tr>
<td>Language Arts</td>
<td>3</td>
<td>42.9</td>
</tr>
<tr>
<td>Science</td>
<td>1</td>
<td>14.3</td>
</tr>
<tr>
<td>Foreign Language</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Math</td>
<td>4</td>
<td>30.7</td>
</tr>
<tr>
<td>Social Studies, History</td>
<td>3</td>
<td>42.9</td>
</tr>
</tbody>
</table>

Of the faculty responses, a majority of the faculty taught in the areas of social studies, 42.9% and math, 30.7%. Faculty members were asked to indicate the areas of curriculum that a majority of the instructional time was spent. All foreign language classes in Fertile-Beltrami School District are taken on-line.
The faculty members survey measured the amount of years that the faculty has taught. Four faculty members have twenty or more years of experience. Three faculty members had thirteen to nineteen years of experience. Three faculty members indicated that they had ten to twelve years of years of experience. Three faculty members indicated in the survey that they had nine or fewer years. There were no faculty members with less then three years teaching experience.

Table 11. Frequency and Number of Years Teaching of Participating 1:1 Laptop Faculty Members (N=13).

<table>
<thead>
<tr>
<th>Years Teaching</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 or Fewer</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>4-6</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>7-9</td>
<td>2</td>
<td>15.4</td>
</tr>
<tr>
<td>10-12</td>
<td>3</td>
<td>23.1</td>
</tr>
<tr>
<td>13-19</td>
<td>3</td>
<td>23.1</td>
</tr>
<tr>
<td>20 or more</td>
<td>4</td>
<td>30.8</td>
</tr>
</tbody>
</table>

The survey measured the overall skill level that faculty had in using the laptop technology for instruction. Of the faculty responses, eight faculty, or 68.5%, reported their technology skill level as intermediate (e.g. assign projects, organize information, create your own class materials). There were two teachers, or 15.4%, that reported their skill level as advanced (e.g. regularly integrate technology into curriculum, provide staff development opportunities for others). Only one teacher, or 7.7%, rated their technology
skill level as novice (e.g. still learning to use machine). Table 12 illustrates the faculty perceptions regarding their technology skill levels.

Table 12. Frequency and Percentage of Faculty Perceptions to Their Technology Skill Levels (N=13).

<table>
<thead>
<tr>
<th>Skills Levels in the use of Laptop for instruction</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novice – (Still learning to use the machine)</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>Beginner – (e.g., e-mail, word processing, SIS)</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>Intermediate – (e.g., assign projects, organize information, create your own class materials)</td>
<td>8</td>
<td>61.5</td>
</tr>
<tr>
<td>Advanced – (e.g., regularly integrate technology into the curriculum, provide staff development opportunities for others)</td>
<td>2</td>
<td>15.4</td>
</tr>
<tr>
<td>Expert – (e.g., Use technology for student assessment, develop learner center strategies)</td>
<td>1</td>
<td>7.7</td>
</tr>
</tbody>
</table>

Research Question #1

What effects does a 1:1 Laptop initiative have on student academic performance based on perceptions of participating sophomores, juniors, and seniors?

A Likert-type scale was used in the modified Mitchell Institute survey instrument to measure student perceptions of the academic achievement and learning in regards to the laptop program during their participation. The research question was generated to determine what effects the use of laptops has on student academic achievement and learning based on student’s perceptions. The researcher used eight questions in the survey to measure the effect that the laptop program has on students’ academic achievement and learning. Participants were asked to select their response on a
Likert-type scale that ranged from 5=strongly agree to 1 = strongly disagree. Table 13 represents the student perceptions in regards to the effect that the laptop program had on their academic achievement and learning.

Table 13. Frequency and Percentage of Students Perceptions Regarding Changes in Their Academic Achievement and Learning as a Result of 1:1 Laptop Program (N=40).

<table>
<thead>
<tr>
<th>Statements</th>
<th>Strongly Agree N</th>
<th>Strongly Agree %</th>
<th>Agree N</th>
<th>Agree %</th>
<th>Neutral N</th>
<th>Neutral %</th>
<th>Disagree N</th>
<th>Disagree %</th>
<th>Strongly Disagree N</th>
<th>Strongly Disagree %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laptops make school work more interesting.</td>
<td>13</td>
<td>32.4</td>
<td>18</td>
<td>45.0</td>
<td>8</td>
<td>20.0</td>
<td>1</td>
<td>2.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Laptops make schoolwork easier to do.</td>
<td>19</td>
<td>47.5</td>
<td>18</td>
<td>45.0</td>
<td>3</td>
<td>7.5</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Laptops have improved the quality of my work.</td>
<td>16</td>
<td>40.0</td>
<td>18</td>
<td>45.0</td>
<td>6</td>
<td>15.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Having a laptop has improved my grades.</td>
<td>9</td>
<td>22.5</td>
<td>17</td>
<td>42.5</td>
<td>13</td>
<td>32.5</td>
<td>1</td>
<td>2.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I do more homework outside of school if I am able to use my laptop.</td>
<td>13</td>
<td>32.5</td>
<td>15</td>
<td>37.5</td>
<td>11</td>
<td>27.5</td>
<td>1</td>
<td>2.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I am more motivated to do schoolwork when I use my laptop.</td>
<td>10</td>
<td>25.0</td>
<td>15</td>
<td>37.5</td>
<td>13</td>
<td>32.5</td>
<td>2</td>
<td>5.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>What I learn in school is relevant to my life now.</td>
<td>7</td>
<td>17.0</td>
<td>15</td>
<td>37.5</td>
<td>16</td>
<td>40.0</td>
<td>2</td>
<td>5.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>What I learn in school is helping me to prepare for the future.</td>
<td>16</td>
<td>41.0</td>
<td>15</td>
<td>38.5</td>
<td>8</td>
<td>20.5</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Of the forty student responses, thirty-seven, or 92.5%, agreed or strongly agreed with the statement that laptops make schoolwork easier to do. In addition, thirty-four, or 85.0%, agreed or strongly agreed that Laptops have improved the quality of their work. Another thirty-one or 79.5%, of the students that responded agreed or strongly agreed that what they learn in school is helping me to prepare for the future.

A lower number of students, twenty-eight, or 70.0%, indicated that they do more homework outside of school if they are able to use laptop. Also, twenty-five, or 62.5%, expressed that they are more motivated to do school work when they use a laptop.

The survey was administered by the faculty of the Fertile-Beltrami School District. The survey measured frequencies and percentages of the usage of Laptop to support academic achievement and learning. Table 14 displays student frequencies and percentages on amount of time students use their laptop for the identified tasks.

Table 14 displays that thirteen-nine, or 90.7 of the participants indicate that they search for information on a daily and weekly basis. Another thirty-four, or 80.9 of the participants stated that they use their laptops to complete homework on a daily or weekly basis. Of the forty-two respondents, thirty, or 69.8%, identified that they use their laptop on a daily or weekly basis to organize information. There were also twenty-nine, or 67.4%, of the participants that identified that they use their laptop on a daily and weekly basis to communicate using e-mail or instant massaging.

**Research Question #2**

What effects does a 1:1 Laptop initiative have on student academic performance based on perceptions of participating faculty?
Table 14. Frequency and Percentage of Students Using Laptops to Complete the Identified Tasks (N=42).

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Never N %</th>
<th>Less than Monthly N %</th>
<th>Monthly N %</th>
<th>Weekly N %</th>
<th>Daily N %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search for Information</td>
<td>1 2.3</td>
<td>0 0.0</td>
<td>3 7.0</td>
<td>20 46.5</td>
<td>19 44.2</td>
</tr>
<tr>
<td>Creates presentations and projects on your own</td>
<td>2 4.8</td>
<td>3 7.0</td>
<td>11 26.2</td>
<td>17 40.5</td>
<td>9 21.4</td>
</tr>
<tr>
<td>Work on assignments in small groups</td>
<td>3 7.0</td>
<td>4 9.3</td>
<td>14 32.6</td>
<td>19 44.2</td>
<td>3 7.0</td>
</tr>
<tr>
<td>Organize information</td>
<td>3 7.0</td>
<td>1 2.3</td>
<td>9 20.9</td>
<td>16 37.2</td>
<td>14 32.6</td>
</tr>
<tr>
<td>Take notes in class</td>
<td>17 47.5</td>
<td>5 11.9</td>
<td>3 7.1</td>
<td>8 19.0</td>
<td>9 21.4</td>
</tr>
<tr>
<td>Communicate using e-mail or instant messaging</td>
<td>6 14.0</td>
<td>3 7.0</td>
<td>5 11.6</td>
<td>12 27.9</td>
<td>17 9.5</td>
</tr>
<tr>
<td>Take a quiz, test, or assignment</td>
<td>12 28.6</td>
<td>7 16.7</td>
<td>9 21.4</td>
<td>10 23.8</td>
<td>4 9.5</td>
</tr>
<tr>
<td>Complete homework</td>
<td>3 7.1</td>
<td>2 4.8</td>
<td>3 7.1</td>
<td>14 33.3</td>
<td>20 47.6</td>
</tr>
<tr>
<td>Do drills to increase skills in math, English, etc</td>
<td>20 47.6</td>
<td>9 21.4</td>
<td>4 9.5</td>
<td>5 11.9</td>
<td>4 9.5</td>
</tr>
<tr>
<td>Work on website, digital, film/media, etc</td>
<td>16 37.2</td>
<td>2 4.7</td>
<td>2 4.7</td>
<td>4 9.3</td>
<td>19 44.2</td>
</tr>
</tbody>
</table>

A Likert-type scale was used in the modified Mitchell survey instrument to measure faculty perceptions of the academic achievement and learning in regards to the laptop program during their participation. The research question was generated to determine what effects the use of laptops has on student academic achievement and learning based on faculty perceptions. The researcher used twelve survey questions to
measure the effect that the laptop program has on students’ academic achievement and learning. Faculty participants were asked to select their response on a Likert-type scale that ranged from 5=strongly agree to 1 = strongly disagree. Fertile-Beltrami Schools faculty were asked to identify the impact on academic achievement and learning for traditional, at-risk, and high-achieving students.

Table 15 represents the faculty perceptions in regards to the effect that the laptop program had on a traditional student’s academic achievement and learning.

Table 15. Frequency and Percentage of Faculty Perceptions on the Impact of the 1:1 Laptop Program on Traditional Student Achievement and Learning (N=13).

<table>
<thead>
<tr>
<th></th>
<th>Declined N</th>
<th>No Effect N</th>
<th>Improved N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation in Class</td>
<td>0 0.0</td>
<td>7 58.3</td>
<td>5 47.5</td>
</tr>
<tr>
<td>Preparation for Class</td>
<td>0 0.0</td>
<td>7 58.3</td>
<td>5 47.5</td>
</tr>
<tr>
<td>Attendance</td>
<td>0 0.0</td>
<td>13 100.0</td>
<td>0 0.0</td>
</tr>
<tr>
<td>Behavior</td>
<td>0 0.0</td>
<td>10 76.9</td>
<td>3 23.1</td>
</tr>
<tr>
<td>Motivation</td>
<td>0 0.0</td>
<td>4 30.8</td>
<td>9 69.2</td>
</tr>
<tr>
<td>Engagement and Interest Level</td>
<td>0 0.0</td>
<td>3 23.1</td>
<td>10 76.9</td>
</tr>
<tr>
<td>Ability to Work Independently</td>
<td>0 0.0</td>
<td>3 23.1</td>
<td>10 76.9</td>
</tr>
<tr>
<td>Ability to Work in Groups</td>
<td>0 0.0</td>
<td>10 83.3</td>
<td>2 16.7</td>
</tr>
<tr>
<td>Ability to Retain Content Material</td>
<td>0 0.0</td>
<td>7 58.3</td>
<td>5 41.7</td>
</tr>
<tr>
<td>Quality of Work</td>
<td>0 0.0</td>
<td>6 50.0</td>
<td>6 50.0</td>
</tr>
<tr>
<td>Interaction with Teachers</td>
<td>1 8.3</td>
<td>7 58.3</td>
<td>4 33.3</td>
</tr>
<tr>
<td>Interaction with Other Students</td>
<td>0 0.0</td>
<td>7 53.8</td>
<td>6 46.2</td>
</tr>
</tbody>
</table>
Of the thirteen faculty responses, ten or 76.9% of the faculty, stated that engagement and interest level improved as a result of the integration of laptops into the earning environment. In addition, ten or 76.9% of the faculty members, indicated that student’s ability to work independently improved during the laptop program. Another nine, or 69.2%, cited that the student motivation was improved as a result of the use of laptops.

100% or thirteen faculty members indicated that they observed no effect on attendance as a result of the laptop program. In addition, ten or 76.9% of the faculty members indicated no effect on behavior or the ability to work in groups.

Table 16 represents the faculty response to the impact of laptop program on student achievement and learning for at-risk or low-achieving level students.

Ten or 83.3% of faculty members felt that the use of laptops improved engagement and interest level in learning for at-risk or low achieving students. An additional nine or 75% of faculty members, perceived that student motivation improved as a result of student laptops. Another eight or 66.7%, indicated that student motivation had improved through the integration of laptops.

Ten or 90.9% of faculty members identified that there was no improvement in student attendance as a result of the integration of laptops. Also, nine or 81.9% of faculty members, perceived no effect on student preparation for class. Finally, eight or 66.7% of the faculty members identified no effect on participation in class, discipline, or interaction with teachers as a result of the integration of laptops into the classroom for low achieving or at-risk students.
Table 16. Frequency and Percentage of Faculty Perceptions on the Impact of the 1:1 Laptop Program on At-risk or Low Achieving Student Achievement and Learning (N=12).

<table>
<thead>
<tr>
<th></th>
<th>Declined N</th>
<th>%</th>
<th>No Effect N</th>
<th>%</th>
<th>Improved N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation in Class</td>
<td>0</td>
<td>0.0</td>
<td>8</td>
<td>66.7</td>
<td>4</td>
<td>33.3</td>
</tr>
<tr>
<td>Preparation for Class</td>
<td>0</td>
<td>0.0</td>
<td>9</td>
<td>81.9</td>
<td>3</td>
<td>25.0</td>
</tr>
<tr>
<td>Attendance</td>
<td>0</td>
<td>0.0</td>
<td>10</td>
<td>90.9</td>
<td>2</td>
<td>9.1</td>
</tr>
<tr>
<td>Behavior</td>
<td>0</td>
<td>0.0</td>
<td>8</td>
<td>66.7</td>
<td>4</td>
<td>33.3</td>
</tr>
<tr>
<td>Motivation</td>
<td>0</td>
<td>0.0</td>
<td>4</td>
<td>33.3</td>
<td>8</td>
<td>66.7</td>
</tr>
<tr>
<td>Engagement and Interest Level</td>
<td>0</td>
<td>0.0</td>
<td>2</td>
<td>16.7</td>
<td>10</td>
<td>83.3</td>
</tr>
<tr>
<td>Ability to Work Independently</td>
<td>0</td>
<td>0.0</td>
<td>3</td>
<td>25.0</td>
<td>9</td>
<td>75.0</td>
</tr>
<tr>
<td>Ability to Work in Groups</td>
<td>0</td>
<td>0.0</td>
<td>8</td>
<td>66.7</td>
<td>4</td>
<td>33.3</td>
</tr>
<tr>
<td>Ability to Retain Content Material</td>
<td>0</td>
<td>0.0</td>
<td>6</td>
<td>50.0</td>
<td>6</td>
<td>50.0</td>
</tr>
<tr>
<td>Quality of Work</td>
<td>0</td>
<td>0.0</td>
<td>6</td>
<td>50.0</td>
<td>6</td>
<td>50.0</td>
</tr>
<tr>
<td>Interaction with Teachers</td>
<td>0</td>
<td>0.0</td>
<td>8</td>
<td>66.7</td>
<td>4</td>
<td>33.3</td>
</tr>
<tr>
<td>Interaction with Other Students</td>
<td>0</td>
<td>0.0</td>
<td>6</td>
<td>50.0</td>
<td>6</td>
<td>50.0</td>
</tr>
</tbody>
</table>

Table 17 represents the faculty response to the impact of the 1:1 Laptop program on student achievement and learning for high achieving level.

Nine or 90% of faculty members indicated that there was an improved level of engagement/interest level by high achieving students. Also, eight or 80% of faculty members identified that there was an improvement in student motivation for achievement.
Table 17. Frequency and Percentage of Faculty Perceptions on the Impact of the 1:1 Laptop Program on High Achieving Student Achievement and Learning (N=10).

<table>
<thead>
<tr>
<th></th>
<th>Declined N</th>
<th>No Effect N</th>
<th>Improved N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Participation in Class</td>
<td>0 0.0</td>
<td>7 70.0</td>
<td>3 30.0</td>
</tr>
<tr>
<td>Preparation for Class</td>
<td>0 0.0</td>
<td>4 40.0</td>
<td>6 60.0</td>
</tr>
<tr>
<td>Attendance</td>
<td>0 0.0</td>
<td>10 100.0</td>
<td>0 0.0</td>
</tr>
<tr>
<td>Behavior</td>
<td>0 0.0</td>
<td>9 90.0</td>
<td>1 10.0</td>
</tr>
<tr>
<td>Motivation</td>
<td>0 0.0</td>
<td>2 20.0</td>
<td>8 80.0</td>
</tr>
<tr>
<td>Engagement and Interest Level</td>
<td>0 0.0</td>
<td>1 10.0</td>
<td>9 90.0</td>
</tr>
<tr>
<td>Ability to Work Independently</td>
<td>0 0.0</td>
<td>3 30.0</td>
<td>7 70.0</td>
</tr>
<tr>
<td>Ability to Work in Groups</td>
<td>0 0.0</td>
<td>6 60.0</td>
<td>4 40.0</td>
</tr>
<tr>
<td>Ability to Retain Content Material</td>
<td>0 0.0</td>
<td>6 60.0</td>
<td>4 40.0</td>
</tr>
<tr>
<td>Quality of Work</td>
<td>0 0.0</td>
<td>4 40.0</td>
<td>6 60.0</td>
</tr>
<tr>
<td>Interaction with Teachers</td>
<td>0 0.0</td>
<td>5 50.0</td>
<td>5 50.0</td>
</tr>
<tr>
<td>Interaction with Other Students</td>
<td>0 0.0</td>
<td>6 60.0</td>
<td>4 40.0</td>
</tr>
</tbody>
</table>

and learning. Finally, seven or 70% of faculty members, perceived an improved ability to work independently by high achieving students.

Ten or 100% of faculty members indicated that they observed no effect on attendance as a result of the integration of laptops with students. In addition, nine or 90% of faculty members that participated in the survey, indicated that they observed no effect on student behavior as a result of laptop integration. Seven or 70% of faculty members,
participants indicated they observed no effect on student participation as a result of the laptop program.

**Research Question #3**

What effect does the 1:1 Laptop initiative for students in grades 10, 11, and 12 in the Fertile-Beltrami School District have on student achievement based on Minnesota graduation testing and local assessments in math and reading?

Research question three was generated to assess if the Fertile-Beltrami Schools laptop students performed at a greater rate of academic achievement and learning in comparison to non-laptop student in Fertile-Beltrami Schools. In addition, a comparison of Fertile-Beltrami students vs. State of Minnesota students on the Minnesota Comprehensive Assessments was conducted to assess levels of academic achievement and learning.

Table 18 represents student achievement of laptop and non-laptop students in the Fertile-Beltrami School District. The data provides a view of academic achievement through student mean grade point averages during the 2008-2009 school year.

The review of the mean differences in student achievement at each participant’s grade level indicates a measurable difference. Twenty-eight, or 84.8% of laptop students, in grade 10 displayed a mean grade point average of 3.10. Five, or 15.2% non-laptop students, displayed a mean grade point average of 1.89. This comparison illustrates a 1.21 difference in mean grade point averages.

In grade 11, Twenty-eight, or 93.3% laptop students, demonstrated a mean grade point average of 2.85, and two, or 6.7% of non-laptop students, had a mean grade point
Table 18. Frequency and Percentage of Students who are Laptop and Non-laptop Participants in the Fertile-Beltrami Schools and the Average Academic Achievement as Measured by School District Mean Grade Point Averages During the 2008-2009 School Year.

<table>
<thead>
<tr>
<th>Students</th>
<th>Laptop</th>
<th>%</th>
<th>Laptop - Grade Point Average</th>
<th>Non-laptop</th>
<th>%</th>
<th>Non-laptop - Grade Point Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 10</td>
<td>28</td>
<td>84.8</td>
<td>Mean - 3.10</td>
<td>5</td>
<td>15.2</td>
<td>Mean - 1.89</td>
</tr>
<tr>
<td>Grade 11</td>
<td>28</td>
<td>93.3</td>
<td>Mean - 2.85</td>
<td>2</td>
<td>6.7</td>
<td>Mean - 1.56</td>
</tr>
<tr>
<td>Grade 12</td>
<td>39</td>
<td>92.8</td>
<td>Mean - 2.82</td>
<td>3</td>
<td>7.2</td>
<td>Mean - 1.78</td>
</tr>
</tbody>
</table>

average of 1.56. This comparison shows a difference of 1.04 in mean grade point average.

In grade 12, thirty-nine, or 92.8% of laptop students demonstrated a mean grade point average of 2.82, while three, or 6.2% of non-laptop students, displayed a mean grade point average of 1.78. The difference was 1.04 in mean grade point average.

Table 19 represents a review of the Minnesota Comprehensive Assessment data for student in Fertile-Beltrami Schools and students in the State of Minnesota.

The grade 10 students in Fertile-Beltrami Schools achieved 84.84% proficiency on the Minnesota Comprehensive Assessment in reading in 2009 vs. State of Minnesota students average proficiency of 74.20%. The difference represents 10.64% increase of achievement for the Fertile-Beltrami students. In addition, grade 11 students in Fertile-Beltrami Schools achieved 86.14% proficiency on the Minnesota Comprehensive Assessment of reading in 2008 vs. State of Minnesota student’s average proficiency of
Table 19. Indicates the Fertile-Beltrami Schools Academic Achievement on the Minnesota Comprehensive Assessment Test vs. State of Minnesota in Reading and Math in 2008 & 2009.

<table>
<thead>
<tr>
<th>Students</th>
<th>Fertile-Beltrami N-Tested</th>
<th>%-Proficient</th>
<th>State of Minnesota N-Tested</th>
<th>% Proficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 10 – Reading 2009</td>
<td>33</td>
<td>84.84</td>
<td>65,330</td>
<td>74.20</td>
</tr>
<tr>
<td>Grade 11 – Reading 2008</td>
<td>30</td>
<td>86.14</td>
<td>66,114</td>
<td>75.13</td>
</tr>
<tr>
<td>Grade 12 – Math 2008</td>
<td>42</td>
<td>35.71</td>
<td>64,253</td>
<td>41.10</td>
</tr>
</tbody>
</table>

75.13%. The difference represents 11.01% increase of achievement for Fertile-Beltrami students.

The grade 12 students in Fertile-Beltrami Schools achieved 35.71% proficiency on the Minnesota Comprehensive Assessment in Math in 2008 vs. State of Minnesota student’s average proficiency of 41.10%. The difference represents 5.39% deficit in achievement for students of Fertile-Beltrami Schools.

Table 20 indicated the number of Fertile-Beltrami Schools Laptop Students that were Proficient in the Minnesota Comprehensive Assessments vs. Fertile-Beltrami Non-Laptop that were Proficient in the 2008-2009 Reading and Math tests.

The grade 10 Fertile-Beltrami Laptop students achieved 89.2% proficiency on the 2009 Minnesota Comprehensive Assessment in reading. The grade 10 Fertile-Beltrami Non-Laptop students achieved 60.0% proficiency on the 2009 Minnesota Comprehensive Assessment in reading. The difference represents 29.2% increase in achievement for Fertile-Beltrami Laptop students.
Table 20. Indicates the Fertile-Beltrami Schools Laptop Students Academic Achievement on the Minnesota Comprehensive Assessment Test vs. Fertile-Beltrami Schools Non-laptop Student Academic Achievement on the Minnesota Comprehensive Assessment Test of Reading and Math in 2008 & 2009.

<table>
<thead>
<tr>
<th>Students</th>
<th>Fertile-Beltrami laptop</th>
<th>Fertile-Beltrami Non-laptop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N-Tested</td>
<td>% Proficient</td>
</tr>
<tr>
<td>Grade 10 - Reading 2009</td>
<td>28</td>
<td>89.2</td>
</tr>
<tr>
<td>Grade 11 - Reading 2008</td>
<td>28</td>
<td>82.1</td>
</tr>
<tr>
<td>Grade 12 - Math 2008</td>
<td>39</td>
<td>35.8</td>
</tr>
</tbody>
</table>

The grade 11 Fertile-Beltrami Laptop students achieved 82.1% proficiency on the 2008 Minnesota Comprehensive Assessment in reading. The grade 11 Fertile-Beltrami Non-Laptop students achieved 100.0% proficiency on the 2008 Minnesota Comprehensive Assessment in reading. The difference represents 17.9% increase in achievement for Fertile-Beltrami Non-Laptop students.

The grade 12 Fertile-Beltrami Laptop students achieved 35.8% proficiency on the 2008 Minnesota Comprehensive Assessment in math. The grade 12 Fertile-Beltrami Non-Laptop students achieved 33.3% proficiency on the 2008 Minnesota Comprehensive Assessment in math. The difference represents 2.5% increase in achievement for Fertile-Beltrami Laptop students.

The summary, conclusions, and recommendations for further study are presented in Chapter V.
CHAPTER V
SUMMARY

Chapter I is a review of the rationale for the study on Fertile-Beltrami Schools 1:1 Laptop program. Chapter II is a review of the literature and background for the framework of the study. Chapter III is the methods and design of the research. Chapter IV is a view of the results and data in the study. Chapter V contains the summary of the study, summary of the participants and data collection procedures, summary of findings and conclusions for research questions, recommendations for action, and recommendations for further study.

Summary of the Study

The purpose of the study was to assess the implementation of laptop learning programs and more specifically 1:1 Laptop program in the Fertile-Beltrami Schools. 1:1 Laptop programs are a fast growing change educational philosophy and delivery that many educators and policy makers believe provide an opportunity for educational innovation into the 21st Century. Schools are implementing 1:1 technology programs to offer choice, support life-long learning, offer flexible learning opportunities, and support digital and global learning opportunities. In addition, schools are creating personalized learning environments that engage collaboration and creativity (Martinez, 2010). The review of literature indicated that students participating in 1:1 Laptop programs demonstrate higher achievement in writing, language arts, math, attendance, student
behavior, project based learning, and higher order thinking skills (Rockman 2003; Mitchell Institute, 2004).

As the researcher observed that there was an increased need to focus on the following areas as a result of integrating 1:1 Laptop program:

- Staff development – There were two primary curriculum areas that laptop technology were being used daily, social studies and English. An increase of staff development in other curriculum areas may facilitate additional integration of 1:1 laptop technology into the daily curriculum.

- Curriculum Leadership – There are many faculty members that do amazing things with technology integration, i.e. digital story telling, Smart Board integration and lesson design, and use of gaming to engage students. There is an increased need for mentors in this area by faculty members.

- Teacher Preparation – As school leaders hire new teachers to replace staff a requirement of hiring must be the ability to integrate technology and 21st Century skills into the daily curriculum. These new staff will become mentors to existing staff to increase the preparation of students.

- Fiscal Commitment – School District must identify consistent budgets for technology and training. The integration of technology is as important as heat, textbooks, and toilet paper. It has become an essential part of preparing students for the global future.

Summary of Participants and Data Collection

The study population consisted of twenty-three sophomores, twenty-four juniors, and thirty-four senior of a total of eighty-one students that participated in the 1:1 Laptop
program at Fertile-Beltrami Schools in 2008-2009. The students in the study group are involved in the 1:1 Laptop program on a voluntary basis. There are additional students at Fertile-Beltrami Schools that participated in the 1:1 Laptop program, but these students have purchased personal laptops.

In Fertile-Beltrami Schools, eighty-one of one hundred and five, or 77%, sophomore, junior, and senior students that participated in the program. In addition, there were ten students that owned personal laptop computers, this allowed the students to participate in 1:1 Laptop instruction and learning.

There were fourteen students that did not participate in the 1:1 Laptop program. There were a variety of reasons for non-participation, but the main reasons identified during Personal Interview with Yvonne Halvorson, District Technology Coordinator, was that these students were involved in career and technical programs that did not use the laptop technology as part of the teaching and learning experience.

Student participating in the Fertile-Beltrami Schools survey included five sophomores, or 20%, eleven juniors, or 45%, and thirty-two seniors, or 94%, to determine attitudes and effects of the 1:1 Laptop program on student performance based on student and staff results.

The survey used to collect data was based on the Mitchell Institute survey instrument tool for laptop initiatives from Lisa Plimpton, Director of Research, at the Mitchell Institute (Appendix A). Permission was granted by the Mitchell Institute to use a form of the survey to collect data by the Fertile-Beltrami School District.

Laptop students participated in the Minnesota Graduation Testing in Reading and Math in April 2008 and April 2009. Students are measured at three levels Proficiency:
Summary of Findings and Conclusions

The section attempts to provide a summarization of the descriptive and statistical analysis of the data in Chapter IV. Findings and conclusions will be reported in order as presented by the three research questions in the study.

Research Question #1

Research Questions #1. What effects does a 1:1 Laptop initiative have on student academic performance based on perceptions of participating sophomores, juniors, and seniors?

Survey data collected consisted of eight statements relating to student perceptions on the academic impact and effect of laptop usage in and out of the classroom. This data was the basis for the descriptive data used to determine the effectiveness of the laptop program for student academic achievement and learning. The statements measured students' quality of work, interest in homework, motivation to complete homework, grades, motivation to complete work at home, motivation to complete work at school, relevant school work, and preparation for the future as affected by the integration of laptop technology.

The student's survey respondents indicated by strong agree or agree that 1:1 Laptop computers positively impacted the following areas: making school work more
interesting 77.4%, what students are learning at school is preparing them for the future
79.5%, improved quality of work 85%, and the ability to make schoolwork easier to do
92.5%. The data does support the research that the integration of 1:1 Laptops increases
student engagement in learning, as well as supports increases in student achievement.

There is evidence in the current studies on 1:1 computing that demonstrates
increases in student achievement and learning in situations of low achievement or
socioeconomic factors. In addition, there significant data suggesting that there are
increases in student use and engagement in learning as a result of 1:1 Laptop technology.
Suhr et al. (2010) indicates in a report that the most common uses for laptops at school
were, in order: writing papers, browsing the Internet, creating presentations, maintaining
a personal calendar, managing photos, working with movies, and taking quizzes. A
similar study performed by Shapely et al. (2010) indicates that most often students use
laptops in the classroom to conduct Internet research, create presentations, word process,
and to complete a test or quiz. The information indicates technology is being used in
classrooms, and the applications appear to increase engagement. The increase in
technology access and resources would support an increase in use by students and
faculty. As data becomes more available, the impact on teaching and achievement will
become more apparent.

Students were provided with a 1:1 Laptop and faculty were challenged to review
how the technology is being used in their classrooms. Student participants indicated the
major use of the laptop technology on a daily or weekly basis was to organize
information, complete homework, and communicate using e-mail or instant messaging.
Thirty-nine of forty-two, or 90.7% of students, reported using the laptops on a daily or
weekly basis to search for information daily. An encouraging piece of information from
students was the laptops were used to create presentations and work on assignments in a
small group on a monthly basis. This type of collaborative learning is an encouraging
aspect of 1:1 Laptop programs and changes in faculty methodology in the classroom.
This idea is supported by Judy Salpeter in: 21st Century Skills: Will Our Students be
Prepared. She identifies that rich, multidisciplinary approaches are proven to be success
by educators, but are difficult to show in test scores. She notes that collaborative learning
is showing achievement gains in several projects (Salpeter, 2003).

Students have grown up with technology in every aspect of their lives. Today’s
world is a digital society that has become a global world. Students have been engaged by
computers, video games, and large television screens that have been accessible to them
since birth. Student learning with technology has been in place for forty years, but the
impact of personal technology and access to the Internet has facilitated the idea that
technology must be more than an addition to learn, it has become an instrumental tool in
the process. 1:1 technology, cell phones, I-pods, and I-pads impact their daily lives and
can be used to impact our student’s daily learning.

Students were asked to identify the academic areas that integrated the 1:1 Laptops
in the daily classroom activities. The majority of students indicated that faculty engaged
them the most with laptops in Language Arts, 80.0% of the classroom time, and Social
Studies & History, 73.3% of the classroom time. These two curriculum areas were the
subject areas that used the 1:1 Laptop program for class work and projects the most. In
addition, students indicated that social studies, history, 72.7%, and language arts, 68.2%,
were the two classes that using the laptop were the most beneficial to their learning.
math and foreign Language were identified as the two curriculum areas that laptops were used the least on class projects and that students identified as being used the least as a beneficial part of their learning in the classroom, with only 2.2% of student participants indicating laptop use in the classroom. Language Arts and social studies/history are areas that benefit from research and word processing in writing. The survey also indicated that science was a developing curriculum area in the use of technology. In science, 35.6% of the student participants indicated that the laptops were used for class projects, and 27.3% of the student participants indicated that the laptop was beneficial to their learning.

Bebell and Kay (2009) support the survey data and results; they found in their study that technology was used somewhat less frequently in mathematics and science than for English, language arts, and social studies (Bebell & Kay, 2009).

The implementation of 1:1 Laptop programs established a high level of responsibility for students to care and maintain a laptop computer on a 24/7 basis. A primary student responsibility included care for the laptop. Students were asked in the survey if their laptop had been broken or damaged during the year. Thirty-eight of forty-eight, or 79.1% of the participants, indicated their machine had no issues during the year. In addition to maintaining machines, students and faculty must implement detailed user policies to control the many distractions involved in the use of 1:1 technology.

The user policy is a critical element of a 1:1 Laptop program for use of the technology in and out of the classroom. As part of the development and implementation phase of a 1:1 Laptop program schools create focus groups to develop user that fit the individual school setting. The policy involves all of the user responsibility and consequences, as well as parent and school responsibilities. A focus on learner outcomes
and the possible learning experiences created by 1:1 technology use, rather than the possible negatives created by inappropriate use of the Internet is very important to the success of the 1:1 Laptop program.

Research Question #2

Research Question #2. What effects does a 1:1 Laptop initiatives have on student academic performance based on perceptions of participating faculty?

The majority of faculty, ten or 79.9%, identified student engagement and interest level and student ability to work independently as improved areas as a result of the implementation of 1:1 Laptop technology for traditional students. In addition, nine or 69.2% of faculty members, identified an improvement in student motivation as a result of the implementation of 1:1 Laptop programs for traditional students.

In addition, ten or 83.3% of faculty members, identified at-risk or low-achieving students improved their engagement and interest levels as a result of the 1:1 Laptop program. Faculty also identified student’s ability to work independently, nine or 75.0%, and student motivation, eight or 66.7%, as areas of improvement for at-risk or low achieving students.

Finally, nine or 90% of faculty identified an improvement in the engagement of high achieving students as a result of the implementation of a 1:1 Laptop program. In addition, eight or 80% of faculty, felt the use of laptops improved student motivation, and seven or 70% of faculty, identified student’s ability to work independently as an area of improvement for high achieving students. The faculty based their judgments on experience in the program and observation.
Students and faculty believe that the implementation of 1:1 Laptops support improved learning opportunities for students by motivating and engaging students. The faculty and student perceptions of the 1:1 Laptop programs seem to correlate. Students who are motivated and engaged in learning will be more successful.

The study identified areas faculty members believed there was little or no effect on students. 100% of faculty members identified there was no effect on student attendance for traditional and high-achieving students. 90.9% of faculty believed that there was no effect on low achieving or at-risk students. The difference in this area would lead the researcher to believe the increase in motivation and engagement in some at-risk and low-achieving students may lead to improved attendance.

In summary, research question two measured faculty perceptions regarding 1:1 Laptop programs and the effects on student achievement and learning. Faculty identified research and writing as areas. Faculty also identified student engagement and interest, ability to work independently, and motivation as areas of improvement as a result of the 1:1 Laptop program. There was a very limited effect on student attendance or behavior. Faculty expressed no areas of decline as a result of the implementation of the 1:1 Laptop program.

The researcher’s conclusion was that faculty and students recognize improvements in student academic achievement and learning through the increases in engagement and interest, as well as student motivation through the implementation of the 1:1 Laptop program. The improvements identified by faculty are supported in the literature review materials.
In addition, the study measured the effect of the 1:1 Laptop program on at-risk or low achieving students, traditional students, and high-achieving students as identified by faculty. Engagement and interest, motivation, and the ability to work independently were areas identified in all three groups as areas of improvement as a result of the 1:1 Laptop program.

There are many factors schools must take into account during the process of implementing a 1:1 Laptop program in order to focus on student achievement and learning. Schools must develop strong policies and practices to deter irrelevant computer use by students during instruction (gaming, e-mail or instant messaging, or other districting applications). Faculty must consistently develop and implement the classroom practices that focus laptop use on instruction and learning. Faculty must also work with students to understand different technology applications to use the technology at higher levels beyond Internet browsing and word processing. Proper student usage, student-teacher interaction, and staff development on technology can support proactive implementation that will support increases in student achievement and learning.

Research Question #3

Research Question #3. What effect does the 1:1 initiative for students in grades 10th, 11th, and 12th in F/B have on student achievement based on Minnesota Graduation testing in math and reading and local assessment?

There were three tables used to display the differences in Minnesota Comprehensive Assessment data between Fertile-Beltrami students and the State of Minnesota students and Fertile-Beltrami Laptop students and Fertile-Beltrami Non-Laptop students in the curricular areas of reading and math. Also, Fertile-Beltrami
Laptop students were compared to Fertile-Beltrami Non-Laptop students in academic achievement by using student grade point averages.

In Table 20, there was a significant difference in grade point averages in Fertile-Beltrami Laptop students vs. Fertile-Beltrami Non-Laptop students. Fertile-Beltrami 10th grade Laptop students achieved a mean grade point average of 3.10, in comparison Fertile-Beltrami Non-Laptop students achieved an mean grade point average of 1.89, a difference of 1.21. Also, Fertile-Beltrami 11th grade Laptop students achieved a mean grade point average of 2.85, while Fertile-Beltrami Non-Laptop students achieved a grade point average 1.56. This represents a difference of 1.29 in mean grade point average. Finally, Fertile-Beltrami 12th grade Laptop students achieved a mean grade point average of 2.82, while Fertile-Beltrami Non-Laptop students achieved a grade point average of 1.78. This represents a difference of 1.04 in mean grade point average. Although there is a difference in student achievement of students who participated in the 1:1 Laptop program vs. those 1:1 Non-Laptop students. The actual impact of the 1:1 Laptop program on grade point average is difficult to measure.

Table 19 focused on a comparison of Fertile-Beltrami Students vs. State of Minnesota students on the Minnesota Comprehensive Assessments in Reading and Math. Fertile-Beltrami 10th grade students scored at 84.84% proficiency on the 2009 reading assessment. State of Minnesota 10th grade students scored at 74.20% on the 2009 reading assessment, a difference of 10.64% proficiency. Fertile-Beltrami 11th grade students scored at 86.14% proficiency on the 2008 reading assessment. State of Minnesota 11th grade students scored at 75.13% on the 2008 reading assessment, a difference of 11.01% proficiency. Fertile-Beltrami 12th grade students scored at 35.71%
proficiency on the 2008 math assessment. State of Minnesota 12th grade students scored at 41.10% on the 2008 math assessment, a difference of 5.39% proficiency. It is important to note that in the area of math, Fertile-Beltrami students achieved below the State of Minnesota average.

Table 20 identified the differences in proficiency on the Minnesota Comprehensive Assessments in reading and math for Fertile-Beltrami Laptop students vs. Fertile-Beltrami Non-Laptop students. Fertile-Beltrami 10th grade Laptop students scored 89.2% proficiency on the 2009 reading assessment vs. 60% proficiency by Fertile-Beltrami Non-Laptop students. A difference in proficiency is 29.2%. Fertile-Beltrami 11th grade Laptop students scored 82.1% proficiency on the 2008 reading assessment vs. 100% proficiency by Fertile-Beltrami Non-Laptop students. A difference in proficiency is 17.9%. The 100% represents 2 students in the Non-Laptop group. Fertile-Beltrami 12th grade Laptop students scored 35.8% proficiency on the 2008 math assessment vs. 33.3% proficiency by Fertile-Beltrami Non-Laptop students. A difference in proficiency is 2.5%. It is important to note that 100% of the Fertile-Beltrami 11th grade Non-Laptop students in 2008 reading assessment were proficient, but this represents 3 students.

The impact of 1:1 Laptop programs on student achievement and learning needs to be measured by additional research to provide a clear picture. Research should focus on types of 1:1 Laptop implementation, curriculum, staff development, instructional methodology, and impact engagement of learners. In addition, teacher experience, socioeconomic status of communities, and current levels of student achievement impact how the success of a 1:1 Laptop program may be measured. The era of accountability would support the use of standardized testing and growth based testing to measure the
impact of 1:1 Laptops on student achievement and learning. 1:1 Laptop programs should be recognized as important tools in the transition of our educational system to a 21st Century world.

Conclusions

Based on the findings related to the three research questions raised in the study, the following conclusions were reached:

1. The data provided evidence that the integration of 1:1 computing increased student engagement and learning, motivation, and ability to work individually. This was done through increased technology use in research, word processing, and use of the Internet. The increase in 1:1 computing produced stronger integration of technology in the classroom, access to information by students, and increased focus on 21st Century Skills.

2. The data provided evidence to suggest that the implementation of 1:1 computing increased the use of technology in the classroom and in the home by students. Student perceptions of their level of technology use seem to correlate to their academic achievement and learning.

3. The data provided evidence faculty believed that the integration of 1:1 computing improved traditional, at-risk, and high-achieving students learning experiences.

4. The data demonstrated an increase of student achievement by students participating in 1:1 Laptop programs. The study group provided limitations to the data because of the population size and dynamics.
Limitations

There are several limitations in the study of the Fertile-Beltrami Schools 1:1 Laptop program. There are as follows:

1. The small population of students and staff make the results of the survey and academic information limited for use in comparison to a larger study.
2. The data collected during 2008-2009 school year is limited by student population and the voluntary nature of the survey. The data would be more reliable if the study covered 5 years of data and the school district had mandatory participation in the survey.
3. The voluntary nature of the survey with students resulted in several questions on the survey not being answered. This provided an inconsistent population number for survey questions.

Recommendations for Actions

The 21st Century society requires public education institutions to prepare students for the challenges of a global society. Students must be immersed in technology to prepare them for a global world that expects skills in critical thinking, analyzing information, communication, collaboration, problem solving, and decision making. Weston and Bain (2010) identify some recommendations of how using ubiquitous computing as a tool in schools can change learning and achievement for the future.

1. Create a set of rules as a community that defines what a community believes about teaching and learning. The rules drive the overall design of school and the schooling that occurs.
2. The school community uses the rules to embed big ideas, values, aspirations, and commitment in the day-to-day actions and processes of the school. It establishes the best practices and excellence that will characterize innovation and reform.

3. Engage all members of the community in the creating, adapting, and sustaining the embedded design of the school. Each student must understand what constitutes effective cooperative and peer-assisted learning.

4. Embedded design generates feedback for all members of the school community. Feedback drives bottom-up change and makes the community capable of charting its own course absent of top-down intervention.

5. A shared conceptual framework for the program creates a schema – This is in place at the school level and provides constant feedback that makes the school dynamic, ever changing, and self-organized.

6. Guided by the schema – Community members demand systematic and ubiquitous technology. This type of technology use will facilitate a design and deliver curriculum, manage portfolios, enable research, inform classroom practices, gather and share feedback about practices and processes, and engage parents. (Weston & Bain, 2010)

In addition, if the commitment is made as Westin and Bain (2010) laid out in a long-term technology plan framework, these objectives can be achieved. Larry Cuban (2009) identifies some short term issues that can be addressed to assure ubiquitous computing supports student growth and achievement, as well faculty growth and change in instructional methods.
1. Provide technical support for teachers – The general technology industry recommends one technician for every fifty work stations. Also, provide technology specialists for teachers to learn how to integrate technology into their classrooms.

2. Alter traditional classrooms – reduce classroom size to 20 students in a class. 15 students in poverty areas. Reduce class loads of secondary teachers to support training and research in technology integration.

3. Funding for the recommendations – State and Federal officials support the development of partnerships in the private sector to support public school innovation. Federal and state categorical funding toward technology integration in software and hardware. State funds are directed to class-size reduction (Cuban, 2009).

Many of these recommendations identified by Cuban (2009) have been sporadically implemented in states. The fiscal impact of the recommendations are a priority for policy makers, rather than the impact on student achievement and learning that the recommendations indicate. Local leaders and school boards must make the integration of 1:1 technology and 21st Century skills into schools a priority. It is critical there be an accountability system in place to ensure recommendations are being consistently implemented by school systems to have an impact learning and teaching.

Recommendations for Further Study

The use of 1:1 Laptop programs in schools is a current trend to facilitate 21st Century learning into today’s classrooms. There are research studies that point to increased student achievement in 1:1 Laptop schools, as well as studies that identify little
effect on student achievement and learning as a result of 1:1 computing. The concept of 1:1 computing is a vision for learning that expands to create the computer as a cognitive tool for faculty that changes the way they teach and students learn. The expectation of increased student achievement as a result of the billions of dollars that has been invested into technology in schools is realistic. In order to meet that expectation a change in educational philosophy, curriculum, methodology, staff development, and leadership for the future must occur in schools. Based on this study, the recommendations that follow are suggested for further study regarding the implementations of 1:1 Laptop programs for the purpose of improving student achievement and learning.

1. Students and faculty indicate that the laptop program has improved student engagement and motivation. There has also been increased use of technology in research and writing. The student participants also indicated an increased use of technology, integration in the English and social studies curriculum. Additional research would be necessary to identify why motivation and engagement in learning have improved. Also, why staff integrate technology daily and weekly in social studies and English, but not in other subject areas? Finally, research compiling academic achievement results from students in laptop schools vs. non-laptop schools throughout the nation would compile a broader picture to academic achievement gains. A study should be replicated in two to three years to review the same data.

2. Staff development is a driving force behind the evolution of teacher centric classrooms to student-centric classrooms. 1:1 Laptop programs emphasize the need for leadership and professional development by faculty. Further research
to examine levels of technology integration by faculty, type and amount of staff development focused on curriculum integration and collaborative integration of technology would be useful for further classroom development toward the goal of preparing students for 21st Century expectations. In addition, studying increased staff development and the impact on student achievement would be beneficial to the 1:1 computing movement. Further studies would focus on larger sample group and a more valid instrument to measure faculty training and integration.

3. The study measured the effects on academic achievement and learning as measure by student and faculty perceptions. The study also analyzed pre-existing data from the Fertile-Beltrami School District in the areas of reading and math as measured by the Minnesota Comprehensive Assessments. There are many variables that impact student achievement such as curriculum offerings, instructional practices, and technology integration. Further research focused on the variable of technology integration and the laptop program would provide additional data to measure the impact on student achievement. The information generated through this study would provide data for funding, staff development, and curriculum decisions.

4. The vision of 1:1 Laptop programs is to prepare students for competition in global society and to prepare students for post-secondary opportunities that require 21st Century skills. It is recommended by the research to extend a longitudinal study over a five to eight year period to review the effect of 1:1 Laptop programs on students after their K-12 educational experience.
As the expectations of the 21st Century increase for our children, we must do everything possible to prepare them for their future. The integration of 1:1 Laptop programs into the daily lives of students provides vital tools for learning. The 1:1 Laptop programs engage students in learning at a higher level and provide opportunities for faculty preparing students for a future that may not be created at this time. Educational leadership can’t allow a lack of funding and teacher preparedness to be barriers to changing education practice for all students. The future of education will require full access to the Internet to seek information and ubiquitous computing for all students to analyze and present the knowledge. Engaged learning through technology is the future of students learning and preparation for a world of digital citizenship. "If we teach today as we taught yesterday, we rob our children of tomorrow" (John Dewey, 1921).
November 4, 2008

Dr. Gary Schnellert

Dear Dr. Schnellert:

I am writing to give Chris Mills and the Fertile-Beltrami School District permission to use the Mitchell Institute’s survey instruments, available in our 2004 report entitled One to One Laptops in a High School Environment, for the laptop initiative study.

Sincerely,

Lisa Plimpton
Director of Research
June 1st, 2009

University of North Dakota
Grand Forks, ND

ATTN: Dr. Gary Schnellert and the Institutional Review Board

Dear Dr. Schnellert:

Fertile-Beltrami School District grants permission to Christopher Mills, Superintendent of Stephen Central to utilize testing data and student and faculty surveys for the purpose of conducting a study dissertation. Both the testing data and survey data are pre-existing data that is used for our school educational decisions.

Thank You.

If you have additional questions you may contact me at:

Brian Clarke
Fertile-Beltrami Schools
Superintendent of Schools
210 South Mill Street
Fertile, MN 56540
218-945-6933
Appendix C
Survey of Students
Source: http://www.maine.gov/mlti/articles/research/PCHSLaptopsFinal.odf

1. Grade Level: □ 7 □ 8 □ 9 □ 10 □ 11 □ 12

2. Gender: □ Female □ Male

3. What is the highest level of education completed by either of your parents? (Check one.)
   □ Less than high school diploma
   □ High school diploma/GED
   □ Some college
   □ Associate degree (two-year college)
   □ Bachelor's degree (four-year college)
   □ Advanced degree (Master's, PhD...)
   □ I don’t know

4. For how many years have you had your own laptop computer provided by the school?
   □ One □ Two □ Three □ Four □ Five

5. Did you have a computer at home before you got your laptop at school? □ Yes □ No

6. Do you have access to the Internet at home? □ Yes □ No

7. What grades do you usually receive in school?
   □ Mostly As □ Mostly As and Bs □ Mostly Bs □ Mostly Bs and Cs
   □ Mostly Cs □ Mostly Cs and Ds □ Mostly Ds □ Other:

8. How much do you use a laptop at school during a typical week?
   □ Do not use a laptop
   □ 1 – 4 hours per week
   □ 5 – 10 hours per week
   □ More than 10 hours per week
9. How much do you use a laptop at home during a typical week?
- □ Do not use a laptop
- □ 1 – 4 hours per week
- □ 5 – 10 hours per week
- □ More than 10 hours per week

10. In which subjects do you use your laptop for class work or projects? (Check all that apply.)
- □ None
- □ Art, Music
- □ Foreign Language
- □ Language Arts/English
- □ Math
- □ Science
- □ Social Studies, History
- □ Other:

11. In which classes is using the computer most beneficial to your learning? (Check all that apply.)
- □ None
- □ Art, Music
- □ Foreign Language
- □ Language Arts/English
- □ Math
- □ Science
- □ Social Studies, History
- □ Other:

12. Has your computer been damaged or broken down this year? □ Yes □ No

   If YES, for how long were you without a computer?

13. How often do you use your computer to do the following:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Never</th>
<th>Less than monthly</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search for information</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Create presentations and projects on your own</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Work on assignments in small groups</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Organize information</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Take notes in class</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Communicate using e-mail or instant messaging</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Take a quiz, test, or assessment</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Complete homework</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Do drills to increase skills in math, English, etc.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Work on websites, digital films/media, etc.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

14. What software do you use on a weekly basis? (Check all that apply.)
- □ Word processing
- □ Internet/Web browser
- □ Email
- □ PowerPoint/Presentation
- □ Graphics/Image/Multimedia
- □ Database
- □ Simulation
- □ Website design/editing
- □ Spreadsheet
- □ Others: __________________
15. How would you rate your computer skills overall? (Check one.)
   □ Beginner (I am just learning)
   □ Intermediate (I am comfortable using a computer)
   □ Advanced (I can help teach others)

16. How often do you typically help another student use a computer?
   □ Never  □ Less than monthly  □ Monthly  □ Weekly  □ Daily

17. How often does another student help you use your laptop?
   □ Never  □ Less than monthly  □ Monthly  □ Weekly  □ Daily

18. How often do you typically help a teacher use a computer?
   □ Never  □ Less than monthly  □ Monthly  □ Weekly  □ Daily

19. How often does a teacher help you use your laptop?
   □ Never  □ Less than monthly  □ Monthly  □ Weekly  □ Daily

20. How many adults are there at school that you feel you can really talk to?
   □ None  □ One  □ Two  □ Three or more

21. Would you say that the following practices occur in your classes less often, about as often, or more often now than they did before the laptop program began?

<table>
<thead>
<tr>
<th>Practice</th>
<th>Less often</th>
<th>About as often</th>
<th>More often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students teach other students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students teach the teacher</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students select their own research areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students explore a topic on their own</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students work in groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students present their work in class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students engage in multiple activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>during class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students write more than one page</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A textbook is the primary guide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student interests influence lessons</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students answer textbook questions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct instruction by teachers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quizzes and tests</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teachers make connections across classes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
22. In terms of your ability to complete class assignments and projects, how would you rate your access to each of the following:

<table>
<thead>
<tr>
<th></th>
<th>Inadequate</th>
<th>Somewhat adequate</th>
<th>Adequate</th>
<th>Excellent</th>
<th>Don’t use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Printers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projection devices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital cameras, scanners</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other technology needs:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

23. Please indicate whether you agree with each of the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laptops make schoolwork more interesting.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laptops make schoolwork easier to do.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laptops have improved the quality of my schoolwork.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Having a laptop has improved my grades.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I do more homework outside of school if I am able to use my laptop.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am more motivated to do schoolwork when I use my laptop.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What I learn in school is relevant to my life now.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What I learn in school is helping me to prepare for the future.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

24. Have you ever used your laptop to communicate or work with students or teachers at another school? □ Yes □ No

If **YES**, have you worked with others at a school: (Check all that apply.)
□ in Maine □ in another state □ in another country

25. Please briefly describe the most interesting class project you have done with your laptop:

26. Do you have any suggestions for new ways laptops could be used to improve your learning experience at school? □ Yes □ No

If **YES**, please briefly describe:
Appendix D
Survey of Faculty
Source: http://www.maine.gov/mlti/articles/research/PCHSLaptopsFinal.pdf

1. What grade level(s) do you teach: □ 4 □ 5 □ 6 □ 7 □ 8
□ 9 □ 10 □ 11 □ 12

2. Which subject(s) do you teach? (Check all that apply.)
□ Art, Music □ Foreign Language
□ Language Arts/English □ Math
□ Science □ Social Studies, History
□ Other: _________________________________

3. For how many years have you been teaching?
□ 3 or fewer □ 4 - 6 □ 7 - 9 □ 10 - 12 □ 13 - 19 □ 20 or more

4. Do you have access to the Internet at home? □ Yes □ No

5. How would you rate your overall skill level in the use of the laptop for instruction?
□ Novice (still learning to use the machine)
□ Beginner (e.g., e-mail, word processing, PowerGrade)
□ Intermediate (e.g., assign projects, organize information, create your own class materials)
□ Advanced (e.g., regularly integrate technology into curriculum, provide staff development opportunities for others)
□ Expert (e.g., use technology for student assessment, develop learner-centered strategies)

6. How often do you use a computer to do the following:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Never</th>
<th>Less than monthly</th>
<th>Monthly</th>
<th>Weekly</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduct research for lesson plans or curriculum design</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Develop instructional materials or presentations</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Produce homework assignments</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Assess student work</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Manage student information</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Communicate with students and parents</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Communicate with colleagues</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>
7. Since the laptop program began, would you say that you: (Check one.)
   □ Spend more time planning lessons now than before
   □ Spend about the same amount of time planning lessons
   □ Spend less time planning lessons now

8. Overall, would you say that the laptop program has made you: (Check one.)
   □ Less efficient  □ Neither less nor more efficient  □ More efficient

9. Would you say that the following practices occur in your classroom less often, about as often, or more often now than they did before the laptop program began?

<table>
<thead>
<tr>
<th>Practice</th>
<th>Less often</th>
<th>About as often</th>
<th>More often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students teach other students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students teach the teacher</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students select their own research areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students explore a topic on their own</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students work in groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students review their own work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students engage in multiple activities during class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students do different assignments in one class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students write more than one page</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A textbook is the primary guide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student interests influence lessons</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students answer textbook questions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct instruction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quizzes and tests</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher evaluates student work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curriculum regularly connects to other disciplines</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10. Please indicate below the effect you think laptops have had on different groups of students in the following areas:

<table>
<thead>
<tr>
<th>Participation in class</th>
<th>Traditional Students</th>
<th>At-Risk or Low-Achieving Students</th>
<th>High Achieving Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Declined</td>
<td>No Effect</td>
<td>Improved</td>
</tr>
<tr>
<td>Preparation for class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attendance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engagement / Interest level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to work independently</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to work in groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to retain content material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality of work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction with teachers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction with other students</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. Please indicate whether you agree with each of the following statements:

<table>
<thead>
<tr>
<th>Since the laptop program began:</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My goals for students have changed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My role in the classroom has changed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The school climate has changed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student achievement in my classes has improved.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My computer skills have improved.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My understanding of how people learn has changed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My beliefs about teaching and learning have changed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The curriculum in my classes has changed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have had adequate professional development opportunities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The school has developed effective policies and procedures for the laptop program.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
12. In which of the following areas do you think the laptop program has had a positive impact? (Check any that apply.)

- Students' computer literacy
- Quantity and quality of what students learn in school
- Roles of students and teachers in the classroom
- Personalized learning opportunities for each student
- Rigor of the curriculum
- Reliable assessment of student progress, work, and effort
- Your access to educational resources

Please describe any others:

13. Do you think the laptop program has had any negative impacts? □ Yes □ No

If YES, Please describe:

14. In terms of meeting your instructional goals, how would you rate your access to:

<table>
<thead>
<tr>
<th></th>
<th>Inadequate</th>
<th>Somewhat adequate</th>
<th>Adequate</th>
<th>Excellent</th>
<th>Don't use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Printers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projection devices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital cameras, scanners</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support personnel at school</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology-related professional development activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (Please describe)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15. Please indicate whether you agree that:

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My beliefs about teaching and learning align with the principals and practices of Promising Futures.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>At school, my thoughts and opinions about teaching and learning are heard and considered.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

16. Have you participated in any professional development or training activities that have helped you integrate technology into the curriculum? □ Yes □ No

If YES, Roughly how many hours have you spent on this type of professional development since the laptop program began?
17. Please briefly describe how you see yourself using technology in the classroom in three to five years:

18. What training or assistance do you need to further integrate technology into the curriculum?

19. Which of the following formats for professional development activities do you prefer? (Check all that apply.)
   - Two-day training at the beginning of summer
   - Two-day training at the end of summer
   - A series of shorter after-school training sessions during the school year
   - Training during early-release time throughout the school year
   - Just-in-time training in class
   - Teaming with another teacher or student to learn more
   - Other (please describe):
REFERENCES


123


127


128


