Model Technology Integration School Program

Futurekids, Inc.

Final Report

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Submitted by:

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About Boise State University

Boise State University (BSU) is an urban university with over 15,000 students located in the heart of Idaho's capitol city. Committed to education and a leader in Educational Technology, Boise State serves its students with both on-campus and distance classes. BSU also provides the most widely used test of technology competency for teachers in the United States.

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ABSTRACT

The purpose of this research project was to determine the effects of a new technology integration program on 5th grade students and teachers. Futurekids, a private educational training company, developed and implemented a Model Technology Integration (MTI) program consisting of professional development, student curriculum, and the integration of technology. This study focused on both the students and teachers who participated in the program. Both the students' and the teachers' achievement was explored. Students were examined for growth in computer literacy and changes in student attitudes toward technology. Grades, attendance, and time-on-task were tracked for patterns of change. Teachers were investigated for their increased computer knowledge and their use of technology in the classroom.

A technology enriched learning environment had an overall positive effect on reducing a student's anxiety towards computers and raising their level of enjoyment. The Student Technology Assessment and the Educational Technology Assessment for teachers were both good predictors of an individual's technological ability, and provided statistically significant growth. Student grades and time-on-task measurements both showed patterns of growth over the duration of the study. Finally, the quantity and quality of teacher computer use in the classroom displayed statistically significant positive growth and was affected by the technology training the teachers received during this research study.

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SECTION I
Introduction

Computer technology has grown at a pace comparable to nothing else in history. Until recently, access to computers at the classroom level was scarce. However today, through multiple grants and significant technology funding from the state and federal governments, the availability of equipment is less of a problem than what to do with it once it arrives.

Everyday many new and innovative hardware components and software products are introduced to the public either to make our lives easier, or to assist us in being more productive. Many of these are designed for use in the educational arena. It would be nearly impossible to train teachers to use all technologies in the classroom to assist in a student's overall educational experience. Therefore, several organizations have come together to outline what a student should be taught by the time he/she graduates from high school, and also at specific intervals along the way (ISTE, 2001). The International Society for Technology in Education (ISTE) has also outlined the competencies desired for in-service teachers to be deemed technologically competent.

General computing skills such as knowledge of the components of a computer and how they operate is just a small portion of what students learn in today's classrooms. In addition, many children study and use what is referred to as tool software. Tool software can be defined as a piece of software that does not have content of its own, which is used to assist an individual or group in completing a task or project. Some of the most often taught tools that are considered both useful and affordable in the K-12 classrooms include the word processor, spreadsheet, database, and presentation software (Thorsen, 1998). In addition to tool software, the Internet, which has made many transitions since its inception, would also be considered a tool that is very useful in the classrooms. The Internet has many uses, from simple searches for information to virtual field trips.

Teaching children how to use computers effectively is a challenge. The first obstacle to overcome is training the teachers how to properly use the technology, and more importantly, how to integrate what they have learned into their classrooms. Training for these teachers can come from numerous different sources. There are private seminars, lectures, and training sessions. Additionally, there are companies that specialize in training teachers and students in the effective use of technology in the classrooms.

One such company is Futurekids of Long Beach, California. Educators at the University of California, Los Angeles (UCLA) founded Futurekids in 1983. They have formed partnerships with thousands of public and private schools both here in the United States and internationally. The primary focus of Futurekids is to provide a school or district with professional development, student technology curriculum, and integration procedures for the classroom in the area of technology.

The professional development offered by Futurekids is designed to make the computer a powerful tool not only for teachers, but technology coordinators, administrators, support staff, and parents as well. Continually updated and modified to meet a specific school's needs, the professional development program is designed to meet the International Society for Technology in Education (ISTE) standards. The student technology curriculum is not only grade specific, but also aligns with the National Educational Technology Standards for Students (NETS).

Integration into the teaching and learning process may be the most important step in the program. Futurekids provides training to help teachers infuse technology in *all* subject areas. The primary areas of computer technology skills typically include: word processing, spreadsheets, databases, Internet, multimedia, computing environments, and desktop publishing.

In January 2000, Futurekids selected schools in Chicago, Illinois; Kent, Washington (a suburb of Seattle); and Raleigh, North Carolina to begin an 18-month longitudinal pilot study on teacher and student achievement in technology-supported classrooms. According to the U.S. Department of Education (1998), pilot studies in technology are necessary to prevent costly mistakes before full implementation occurs. The program being evaluated in this study was not made available to additional markets until the results and recommendations of this research study were provided.

All schools were offered professional development, student curriculum, and integration training (a typical professional development schedule can be found in Appendix A) in exchange for the researcher evaluating the effect of this training program in their schools. Assessments occurred quarterly beginning in January 2000, and concluded in June 2001. A detailed and thorough research study on such a technology program provides valuable data and information for further curriculum development.

Teachers

Data was collected on teachers' knowledge and skills in two different areas, technology skills and increased integration of technology into the teaching/learning process in their classrooms. First, would they gain more computer savvy and knowledge in the target areas? These areas included:

- Databases
- General Computing
- Internet
- Presentation Software/Multimedia
- Spreadsheets
- Technology Integration
- Word processing

These skills were measured using the Educational Technology Assessment (ETA). The ETA is a computer generated competency examination used in the State of Idaho to certify its teachers in technology competency. This assessment has been used to test over 20,000 teachers and administrators worldwide.

Secondly, the researcher sought to determine if teachers' quantity and quality of technology use in the teaching/learning process increased over time. This was measured by evaluating their lesson plans for technology use. While some teachers may have already used technology on a daily basis, this research study examined lesson plans to determine whether they became more complex, and more refined. Baseline measurements were taken during the first data collection session, and lesson plans were evaluated throughout the duration of the study.

Students

Throughout this study students were not merely exposed to technology through teacher demonstration, but were actively taught by the teachers to use it effectively. The effect technology has on the classroom may go beyond simply increasing their computer literacy scores. Therefore, student growth and behavior was measured in multiple key areas. They were:

- Attitudes towards technology;
- Computer literacy;
- Grades;
- Attendance;
- Engaged learning (time-on-task); and
- Computer usage.

Student attitudes were tracked for the duration of the study. How does their attitude about technology change as they are exposed to increasing amounts of technology in their school? Attitudes about technology questions range from technology use to attitudes about gender accomplishments. In today's technology enriched society, we need to teach individuals at a young age not to fear technology. Many individuals still have a certain resistance to the use and integration of technology. Two separate attitude surveys were administered. Both attitude surveys included questions on specific attitudes towards the ease of the use of technology, gender abilities, and the future uses of technologies. Development of these instruments is covered in section two.

While teacher attitudes were not investigated in the present study, there is evidence that positive teacher attitudes are very important to the learning process and the successful integration of technology into the classroom (Woodrow, 1992). In a study conducted on 20 trainees over six weeks through the use of multiple self report instruments, researchers found that there was strong evidence that a reduction in anxiety regarding computer use occurred in all participants following the course (Knezek, 1997).

Like the teachers involved in the pilot, it was believed that the students would show significant growth in their technology aptitude (computer literacy) in the target areas previously mentioned. This was measured by administering the Student Technology Assessment (STA) developed by Boise State University. This assessment is aligned with

NETS standards and has been administered over 1500 times to measure student knowledge and growth in the area of computer literacy. Students were given this assessment quarterly and tracked over the duration of the study.

Quarterly grade reports were collected and analyzed for growth in language arts, science, social studies, and mathematics. Quarterly grades were put out at nearly the same date during the year (fluctuating only by individual school schedules and days off). Grades were tracked and examined for patterns of growth. Grades were chosen over standardized test scores due to the logistics in collecting the data.

Attendance was tracked by the number of days missed and was also collected quarterly, or once per visit. By increasing the amount of time a student spends on a computer, students may be more excited to come to school and complete their schoolwork. Grade reports should be reflective of their effort to do schoolwork, while attendance records help to establish the students' motivation to attend school.

Engaged learning is another essential component in the education process. How does the infusion of a technology-supported curriculum affect students' engaged learning? This was measured by recording time-on-task (TOT) observations. Students were observed individually for this measurement. These observations were random, and at times determined by the researcher. Again, it was believed that a higher percentage of time-on-task was likely as the students proceed through the implementation process. Student observations occurred at random times in which they may or may not have been working on a computer. Several observations were taken of each student at all schools during each data collection session.

Students were asked to self-report their computer usage over the duration of the study. This was checked against achievement levels on the Student Technology Assessment for correlation. As students' self-reports of number of hours spent on a computer rises, would their score on the STA also rise? Students were expected to self-report the number of hours they spend on the computer both at school and outside of school (home, public library, etc.).

Assumptions

Several assumptions guided this research project and are as follows:

- All teachers that participated received the same technology training through professional development sessions and individual learning opportunities.
- All students received the same technology integration lessons and on a similar timeline.
- The subject population was geographically dispersed, and ethnically and socio-economically diverse enough to make generalizations from the results of this study.
- Students answered all attitude surveys and demographic questions honestly.
- Teachers and students gave their best effort on the technology assessments and answered all questions to the best of their ability.

Significance of the Study

There are several reasons to conduct a research study of this nature. First, school administrators look to a study like this when they are giving consideration to implementing a new technology rich curriculum. This can answer several questions they may have on the effects a similar program may have on their students and teachers. Accountability is another reason to perform a sound research study on a new program. Why would a school want to continue to invest both time and money into a technology program that has been proven to have no positive effect on either students or teachers? Administrators may use data similar to that produced here to judge the effectiveness of their school in technology skills and integration against an established norm provided by this research.

Research Questions

The following are the research questions under investigation in this study. They are outlined with the instruments chosen to measure them.

1. Do students in computer supported-classrooms with teachers trained to use the computers effectively demonstrate:
    a) Engaged Learning

        -Behavior, time-on-task observations

        -Attitudes towards technology, student attitude surveys

b) Improved Grades

-Individual student grades in language arts, math, social studies, and science, in addition to a composite average

c) Improved Attendance

-Student attendance records

2. Do students in computer-supported classrooms with teachers trained to use the computer effectively demonstrate computer skills that transfer to their academic environment?

   -Student Technology Assessment

3. Are teachers that have undergone training more effective users of technology in their labs and classrooms? Is there an increased use of the technology and what is the nature of that increased use?

   -Educational Technology Assessment

   -Teacher computer use observations

Definition of Terms

ANOVA- Analysis of variance. A statistical measurement used to determine statistical significance between a number of data collection points.

CAQ- Computer Attitude Questionnaire. Survey instrument used to identify change in student attitudes over a specified period of time.

ETA- Educational Technology Assessment. Instrument designed to measure a teacher's computer aptitude.

Flesch-Kincaid reading grade level- A computerized reading analysis included in Microsoft Word designed to predict the reading grade level of a text passage.

ISTE- International Society for Technology in Education. An organization responsible for detailing the competencies for in-service teachers to be deemed technologically competent.

NETS- National Educational Technology Standards for Students. Organization responsible for detailing a student's ideal technological abilities by grade level.

PATT- Pupils' Attitudes Toward Technology. Survey instrument used to identify change in student attitude over a specified period of time.

Probeware- Scientific hardware designed to be used in conjunction with a computer and other computer hardware and software.

STA- Student Technology Assessment. Instrument designed to assess a student's computer knowledge.

Tool Software- Software that does not have content of its own, but assists an individual in completing a task.

TOT- Time-on-task. Used to determine if students are remaining on task at a given observation point.

SECTION II

Review of Literature

Introduction

Research in education should be thought of as a process of stages, much like maturation through the stages of life (Crocker & Algina, 1986). Often times it is very difficult to find concrete answers to our research questions, since the structure of education does not lend itself well to the evaluation process. Researchers may investigate a single research question for many years and only gain minimal knowledge for their efforts. But, from this we may have formed a building block for future research and future researchers. The present study has been conducted to provide all researchers some insight into the effects of a technology integration program on 5th grade students and teachers.

If research in education is often considered difficult to execute with concrete results, why would we spend the time and money to evaluate the effects of technology in the first place? Most hold the opinion that while they do not know how well technology works, it most likely does not have an adverse effect on the learning environment. According to Eva Baker (1999) at the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) we should evaluate technology to document its strengths and identify its shortfalls. She concludes that the data helps us not only to design and improve future lessons, but also helps us make decisions as to whether or not the gains are sufficient and promising enough to continue the investments of both time and money.

It should be noted that this research study did not look at technology as a stand-alone product, but rather as a component to an integrated lesson plan. Past research has shown that technology by itself has had little measurable or sustained impact on learning in schools (Culp, Hawkins, & Honey, 1999). The initiation and infusion of technology must take place as a single step in the instruction process, much like introducing a math concept for the first time. This is what makes an educational technology program like the one documented here so valuable. Futurekids spent over a decade designing and refining a method they believe will properly introduce and teach the use of technology, and the lessons that go along with it, both to the students and the individuals ultimately responsible for their education.

This literature review concentrates on an examination of the development of the instruments and the research associated with each. Student attitudes will be examined first, followed by grades, attendance, time-on-task, and technology assessments.

Attitudes

As early as 1982 researchers were trying to develop an instrument to identify the effects technology was having on students' attitudes (Reece & Gable, 1982). Hundreds of surveys have been developed since then. Two widely used computer attitude surveys are the Pupils' Attitudes Toward Technology (PATT-USA) and the Computer Attitude Questionnaire (CAQ). Both instruments have been used in a number of studies and have had significant validity and reliability testing done on them.

In 1984, investigators in the Netherlands began to investigate the attitudes of middle school students toward technology to assist them in developing a curriculum for physics that integrates technology (Raat & de Vries, 1985). The study sought to determine students' attitudes towards technology in addition to their understanding of technology related concepts.

Work began on the PATT-USA three years later. In 1987, E. Allen Bame and William Dugger (1989) worked to develop this instrument for use in the United States. With the help of de Vries, the translation and word clarification was completed a year later. The original PATT-USA contains four parts. The first section asks students for a short description of what they think technology is. The second part collects demographic information. The third part contains 57 statements to assess students' attitudes towards technology on a five-part Likert scale. The statements are organized into six subscales.

1. Interest in technology (*interest*);
2. Technology as an activity for both boys and girls (*gender*);
3. Consequences of technology (*consequences*);
4. Perception of the difficulty of technology (*difficulty*);
5. Technology in the school curriculum (*curriculum*);
6. Ideas about technological professions (*careers*).

The final section is designed to have students demonstrate their knowledge of technological concepts (Bame & Dugger, 1989). This is divided into four subscales:

1. Relationship between technology, human beings, and society (*technology and society*);
2. Relationship between technology and science (*technology and science*);
3. Skills in technology (*technology and skills*);
4. The raw materials or “pillars” of technology (*technology and pillars*).

After their initial development and validation of the PATT-USA, the researchers re-tested and validated the instrument in seven states in the United States (Bame, Dugger, de Vries, & McBee, 1993).

While the previously mentioned studies sought to create and validate the PATT, they did not use it in a way that this study used it (to determine growth). First, the average age of the students was much older than that of the average fifth grader. Also, this study used the PATT to look for change and growth in attitude, not simply to identify placement.

In 1989, during the time when the PATT was being translated for use in Western societies, Falco de Klerk Wolters (1989) began to investigate the attitudes of younger students, aged ten to twelve, in the Netherlands. The study focused on two questions. First, how well do ten to twelve-year-old students know what technology is, and how well do the like to use technology? Secondly, which variables affect attitudes towards technology? The sample used for this study consisted of 2,050 students in 60 different schools. He recommended that technology education should begin at an earlier age. He felt that these attitudes are developed at a much earlier age than ten, and are resistant to change. But, how does a well-designed and implemented student technology curriculum impact these students’ attitudes over time?

In 1998, nine years after de Klerk Wolters’ study, researchers sought to identify change in attitude after implementation of certain technology related instruction using the PATT instrument. The researchers investigated the effect of four instructional approaches using the PATT in a pre-test, post-test method to identify change in attitude among students (Boser, Palmer, & Daugherty, 1998). Prior to this study, the PATT was primarily used to assess attitudes prior to curriculum development. It has not been used to assess changes in attitude as the direct result of a treatment such as participation in a technology education program.

In lieu of assessing students' cognitive abilities, researchers used the PATT to gain insight into the effectiveness of their teaching approaches. The following research questions were used to guide their study.

1. Do the students' attitudes change as a result of participation in technology education programs?
2. How does the previous research involving the PATT, with regards to the discrepancy between boys and girls, compare to the current study as a result of involvement in a technology education program?
3. Does the instructional approach utilized have an effect on students' attitudes?

There were four instructional approaches used in this study (Boser, Palmer, & Daugherty, 1998). The *industrial arts* approach was a course organized for understanding all aspects of both industry and technology. The second approach incorporated other disciplines, such as English and math, to show how technology can be an integral part of other disciplines. The third approach, *modular*, was an individualized self-paced course designed to help students learn the latest technologies. *Problem solving* was the final approach and emphasized critical thinking to solve problems that are technology related.

Over 150 Chicago-area seventh graders participated in this study. The data was collected from intact classes. The pre-tests were administered during the first week of the students' program. The post-tests were administered during the last week of instruction. Program duration averaged nine weeks. All PATT instruments were color coded for the different instructional approaches.

By breaking the instrument into the five different attitude subscales and the concept subscale, researchers were able to identify change in student attitudes within the different approaches. Differences were found on only 5 of the 24 separate subscales. While each approach showed positive gains in the *technology is difficult* subscale, the problem solving approach found significant differences ($p<.01$) (Boser, Palmer, & Daugherty, 1998).

While no single approach proved to be better in all subscales, there were some interesting results. In all instructional approaches, students' belief that *technology is difficult* was reduced. In the *concept of technology* subscale, only one approach provided any change in the positive direction. The authors concluded that this might be a subscale where these instructional approaches may not have a measurable effect (Boser, Palmer, & Daugherty, 1998). The only subscale which did not change significantly with any of the instructional approaches was *general interest in technology.* A student's interest in technology may not be as easy to change as the attitudinal aspects of studying about technology.

While a search of the literature revealed that the PATT-USA is a well-documented computer attitude instrument, others have been used frequently. The Computer Attitude Questionnaire (CAQ) was used in this study as well. The CAQ is an instrument that was developed to be used with children in grades four through eight. The majority of the development and work done with this instrument has been conducted at the University of North Texas in the Texas Center for Educational Technology. Keiko Miyashita and Gerald Knezek (1992) began early development of the instrument in conjunction with the development of an instrument intended for children in grades one through three.

The CAQ was pilot tested with 240 students in grades one through eight at a public school system in Northern Texas during March 1993 (Knezek & Miyashita, 1994). Factor analysis for the 162 students in grades four through eight was used to confirm the anticipated subscale structure of the form for the intended target population. It contains 65 statements, which are rated on a four point Likert-type scale. The original instrument measures six psychological dispositions: *computer importance, computer enjoyment, motivation, study habits, empathy, and creativity.*

After validation procedures were complete, the CAQ was used as a means of comparing two computer curriculums at a Texas junior high school (Knezek & Christensen, 1995). Students were divided into three groups. Group one (N=245) contained students who were receiving the traditional computer literacy class. The second group (N=321) were those who received the pilot computer integration program. Finally, the third group (N=22) received both the computer literacy and the pilot integration program simultaneously. Overall reliability of the six-factor CAQ found in this study is listed in Table 1.

Table 1

Internal Consistency Reliability for CAQ

Subscale	# of Items	Reliability Alpha
Computer Importance	7	.82
Computer Enjoyment	9	.82
Motivation	9	.80
Study Habits	10	.83
Empathy	10	.87
Creative Tendencies	13	.86

Interestingly, group two was found to be higher than group one on all six subscales. They were significantly higher on *computer importance* ($p<.001$), *computer enjoyment* ($p<.001$), and *creative tendencies* ($p<.05$) (Knezek & Christensen, 1995). Due to the limited number of participants in group 3, no conclusions were drawn with regard to the other two groups.

The findings indicated that students participating in an integrated computer curriculum enjoyed computers more than students taking a standard computer literacy course. The integrated computer group also perceived the computer as more important and rated themselves as being more creative than their computer literacy counterparts. While additional research is needed to confirm these results, these findings could have serious implications for the way computer technology is presented to students in the classroom.

The current version of the CAQ (5.14), which was used in this study, has two additional subscales: school and anxiety. The school subscale has four items and measures students' attitudes toward school in general. Due to the limited number of items used to measure this construct, this subscale was removed from analysis. The anxiety subscale has eight items and measures a students anxiety levels (see Appendix B).

Michael Hobson (1998) used the current version of the CAQ in his investigation on the effects of a technology enriched learning environment on student development. The study was conducted on fifth and sixth grade students. The following research question guided this study: Do attitudes toward computers differ between students in a technology-enriched classroom and students in a traditional classroom?

No differences were found in the analysis of data for the sixth grade group. However, there were significant results obtained from the fifth grade group. As in the study by Knezek and Christensen (1995), students in the technology rich classroom rated computers significantly more important than those individuals in the traditional classroom ($p<.05$). Likewise, they self reported being significantly more creative then the traditional group ($p<.05$) (Hobson, 1998).

There are additional student attitude instruments available. Loyd and Gressard's (1984) Computer Attitude Scale (CAS) has been widely used to measure changes in students attitudes towards computers. In addition to attitudes, there are entire instruments available to measure computer anxiety in students. The most widely used is the Computer Anxiety Index (CAIN) developed by Maurer and Simonson (1984). While it is recognized that there are additional quality attitude measurement instruments available, we chose the Pupils' Attitudes Toward Technology (PATT-USA) and the Computer Attitude Questionnaire (CAQ) for this study.

Grades

How do we go about determining whether or not technology has an effect on student achievement? Grades are of special interest to both the school administration and the parents of the students. Unfortunately, not many individuals have attempted to correlate the use of a technology rich curriculum with student achievement through grades. How then do we make the correlation between grades and technology use in the classroom?

Harold Wenglinsky (1998) conducted a national study to determine the effects of different uses of technology. The study was conducted on 6,227 fourth graders and 7,146 eighth graders. His primary focus was to determine the relationship between the use of educational technology and mathematics achievement. This was done with several surveys and achievement measures, including grades. He concluded that not only did computers improve proficiency in mathematics, but when used properly, computers may also serve to improve the overall learning environment in the school (Wenglinsky, 1998).

In a study presented at the National Reading Research Center Conference *Literacy and Technology for the 21st Century* in 1996, a group of researchers investigated whether or not students who use Accelerated Reader as part of their curriculum had better overall academic achievement than a similar group of students who did not use the program. The researchers used a sample of 2,500 elementary, middle, and high school students who did not use the software as a control group, and nearly 3,500 students of similar demographic data that did use Accelerated Reader as the experimental group. They concluded that the Accelerated Reader group had significantly better test scores in reading, writing, math, science, and social studies (Paul, VanderZee, Rue, & Swanson, 1996). Also, they found the schools that owned Accelerated Reader for two or more years were 59% more likely to show growth on test scores as compared to the control group.

Attendance

School attendance is another factor sometimes discussed with the increased use of technology in a school (Paul et al, 1996). Attendance can be a strong indicator of a student's motivational interest. If a student is more motivated to attend school for any reason, it may have a positive ripple effect on the entire learning process of the individual student, as well as other students. From an administrator's view, attendance could be an indicator of the performance of the school, reflecting on the quality of teachers as well.

The Accelerated Reader study also sought to determine whether schools with Accelerated Reader had better attendance than a similar set of schools that did not own the software package. The study revealed a statistically significant difference in the attendance between the two groups (Paul et al, 1996). Schools that owned Accelerated Reader reported much lower absenteeism than schools that did not have the software.

Time-on-Task

If we put more computers in the classrooms, and we teach students to use them properly, will they be more likely to stay on task? Also, does this use of technology extend beyond the classroom into other activities in the school? Additionally, does technology affect their discipline and personal relationship issues with other students? Unfortunately, there is very little published data connecting technology integration to time-on-task. Observations for this research study were random, and students may or may not have been using computers at that time.

Technology Assessments

For this study the Educational Technology Assessment (ETA) and Student Technology Assessments (STA) developed by Boise State University were used to measure growth in computer aptitude. While there are other computer assessments available, the Boise State University assessments were chosen based on the published validity and reliability statistics. Outside of these assessments, no other assessment products have made validity or reliability statistics readily available. There is a strong need for such a test, one that could be used as a standardized assessment of teacher and student technology comprehension. The ETA for teachers and STA for students developed by Boise State University filled, and continues to fill this void.

It is imperative that a technology assessment not only test students' knowledge of computers and ability to navigate software, but also has students demonstrate problem solving abilities through the use of technology. According to DeLuca (1992), technology has historically been the solution to many of the problems people face. The ability to problem solve with technology has become an integral part of technology education. This is where the Student Technology Assessments become a solid choice for an instrument to measure growth in technology aptitude. While other assessments identify students' knowledge of the operation of the computer, the STA incorporates problem solving with technology as an important part of the evaluation process.

While testing with the STA has been limited (approximately 1500 administered), the ETA for teachers has been widely used. It has been administered in Idaho since 1995 and internationally since 1999. The current version of this assessment contains 105 multiple choice/true-false questions. Test versions change every three months and new questions range from skill to problem analysis for integration.

A committee of approximately 20 educators from across the State of Idaho develops questions for the ETA at least twice yearly. These questions are then examined by the Educational Technology Assessment office for both appropriateness and technical aspects of the multiple choice question construction such as proper stem and distracters. After questions are checked for punctuation, grammar, and construction they are sent back to the original question writers for review. At this time revisions may be made, and the process may continue. Each question may go through this process up to five times before it is ultimately approved.

After all questions have gone through the writing and editing stages, they are rated by a group of writers and educators on a four-point scale for relevance to the ISTE standards. Questions receiving a cumulative score of less than 80% on this scale are removed from consideration. The remaining questions are then available for inclusion. They are first included in the current version as non-graded pilot questions to test for validity and reliability.

While validity is always a concern, much of this is addressed during the question writing sessions. Overall reliability refers to the consistency in scores over repeated administrations of the test (Pagano, 1994). Reliability can also be measured within each of the individual subscales. This tells researchers how an individual answers questions that are similar. For instance, if a test taker misses a question on integration, will they also miss a similarly worded question? Conversely, will someone taking the assessment that knows the concepts very well be able to demonstrate this knowledge regardless of how the question is worded?

The current overall and individual subscale reliability statistics are listed in Table 2. This table includes pilot questions in the final calculation. Table 3 is the reliability alpha with the pilot questions omitted. Cronbach's Alpha is considered acceptable at values of .70 or greater (Reynaldo & Santos, 1999). While this is a well-documented acceptability threshold, ideally overall test reliability will remain above .80.

Table 2

ETA Reliability Analysis (with Pilot Questions)

Subscale	# of Items	Reliability Alpha
Overall	105	.91
Computing	16	.52
Database	14	.63
Integration	16	.57
Internet	16	.67
Presentation	16	.63
Spreadsheet	12	.44
Word Processing	15	.62

Table 3

ETA Reliability Analysis (Pilot Questions Removed)

Subscale	# of Items	Reliability Alpha
Overall	91	.90
Computing	14	.51
Database	12	.60
Integration	14	.54
Internet	14	.65
Presentation	14	.69
Spreadsheet	10	.38
Word Processing	13	.59

As is demonstrated in Tables 2 and 3, the number of items used in the analysis influences Cronbach's Alpha. By removing the pilot questions from the analysis, the reliability has dropped. The individual subscales do not have enough items included to use a .70 level of acceptability. They must be analyzed subjectively with numeric assistance to discern whether or not they fit.

For pre-service teachers taking the Educational Technology Assessment in the state of Idaho, an overall score of 75% or better is considered passing; the same criteria for passing has been adopted both nationally and internationally. The ETA was used in the current study to determine growth in the above mentioned target areas. Therefore, having a teacher who passed the test with a 75% will not be as important as seeing individual and overall growth from the first session to the last.

Summary

This literature review examined the development and research associated with two student technology attitude surveys. The Pupils' Attitude Towards Technology and the Computer Attitude Questionnaire were chosen for use in this research project. Both instruments have been used in several different capacities, and have proven to be sound instruments for measuring students' attitudes with regards to technology. Due to a time limitation, teacher attitudes were not tracked. This review also explored the literature connecting students' grades, attendance, and time-on-task to the use of technology in the classroom. Grades, attendance, and time-on-task were tracked throughout the course of this study to try to identify patterns of growth in each.

Technology skills assessment scores were collected and analyzed for statistically significant growth throughout the duration of the study. Two separate technology assessments were discussed, the Educational Technology Assessment for teachers and the Student Technology Assessments for students. The development of the two assessments is discussed in addition to the statistics for reliability of the instrument.

SECTION III
Methods

Research Design

A longitudinal design was used to examine the effects of the teacher training and professional development process. There was a total of five data collection points over 18 months. This research study incorporated elements of both qualitative and quantitative research techniques. Beginning in January 2000, baseline data was collected. A researcher returned to the sites once every quarter, or approximately every three months. This study examined the initial growth of teachers and students from the early stages of the schools' involvement in a technology training and professional development program.

Between data collection sessions, teachers and students were exposed to a technology training program designed to increase both student and teacher aptitude and computer use. Teachers were expected to learn a tool, learn how to integrate it into the classroom, and finally introduce this tool in the classroom through a well-designed technology supported lesson plan. This process repeated itself until all of the tools were introduced. A complete schedule detailing teacher and student training can found in Appendix A.

Participants

Participants in this study were 5th grade students and teachers from three different locations (See Appendix C for complete school descriptions):

- Chicago, Illinois;
- Kent, Washington; and
- Raleigh, North Carolina.

Two different sets of fifth grade students participated in the study. As students moved from fifth to sixth grade, this study stopped tracking the first cohort of students and began again with another cohort of fifth grade students. This was possible since the technology training and integration occurred at all grade levels, and the new students coming into fifth grade were exposed to the same program the prior year. The teacher population remained constant throughout the duration of the program.

Students and teachers were both ethnically and socio-economically diverse. There were representatives from three separate regions of the United States, the West Coast, the Midwest, and the East Coast, which provided a good cross-section of the nation's public school students.

Instruments

Three instruments were given to the students during each data collection session. First, the Student Technology Assessment was given. This is a 41 question multiple choice and true/false computer knowledge test. There are seven subscales in the assessment:

- Databases
- General Computing
- Internet
- Presentation Software
- Problem Solving
- Spreadsheets
- Word Processing

Next, students were given the four-part Pupils' Attitudes Towards Technology (PATT) survey. The first part asks students for a brief description of what they think technology is. Since this was not to be used in the analysis, students were not required to complete this section. The second section asked students for demographic information. The third and fourth sections are technology related statements that were rated by the student on a five-point Likert scale.[1] They are intended to reflect the students' attitudes about computer technology.

The final instrument administered to the students was the Computer Attitude Questionnaire (CAQ). This is a 65-item, four-point Likert scale self-report questionnaire. Similar to the PATT, the CAQ is designed to measure attitudes rather than achievement.

[1] A Likert scale uses a forced decision process, where an individual must choose from the options presented to them.

Teachers were given the Educational Technology Assessment (ETA), formerly the Idaho Technology Competency Examination (ITCE). The ETA currently has 105 multiple choice and true/false questions designed to measure educators' computer competency as it relates to its uses in education. This assessment is currently used in the State of Idaho as a portion of the criteria in the teacher certification process. It has also been used for evaluation purposes throughout the United States and internationally.

Procedure

Schools were visited and data was collected approximately quarterly which resulted in a total of five data collection sessions. Exact dates and times for the data collection sessions were determined by the individual schools, and were set to best fit their instructional schedules. The researcher then traveled to the individual schools to administer the materials. Each classroom set aside approximately three hours of instructional time for the instruments, with an additional half hour set aside to make time-on-task observations. Three time-on-task observations were taken of each student during each data collection visit.

The STA was administered first. Students were given a copy of the assessment, and a bubble sheet to record their answers. All questions and possible answers were read out loud, and the students were expected to follow along. The STA has a Flesch-Kincaid reading grade level below four (3.5); however, it was assumed that not all students read at or near grade level. By reading the instruments to the students, any effect of poor reading ability was minimized. One hour of time was set aside to administer this instrument, with a target completion time of 40 minutes.

After every 10 questions, the researcher paused to be certain all students were on the same question. If any student needed a word or sentence re-read, it was done at this time. After the session was completed, students returned both their bubble sheets and the instrument to the investigator. Students were not informed of their individual scores on the STA at any time.

Day two of student contact involved the administration of the PATT. The procedure for administering this instrument differed from the STA only in that the students recorded their answers on the instrument itself. The statements were read aloud and students were given time to ask for clarification of words, or statements to be repeated. Approximately 45 minutes was set aside to administer this instrument, with a target completion time of 40 minutes.

The final day of interaction with the students involved the CAQ. Similar to the STA, students were given the instrument and a bubble sheet to fill in their answers. The Likert-type choices were printed on the questionnaires and written on the board. They were then discussed with the students to clarify the different choices and their relationships. This too was read aloud to the students, and pauses allowed students to catch up if they fell behind. A total of 45 minutes was set aside to administer this instrument, with a target completion time of 40 minutes.

Time-on-task observations were taken throughout each day in the remaining time, or on days immediately following final interaction with the students. Each room was observed for nearly thirty minutes. Observations may or may not have included a technology-supported lesson since the observations were taken at random times throughout the data collection sessions.

Each student was observed for five seconds and was either assessed a zero (off-task) or a one (on-task) for that particular observation. Students were observed on three separate occasions during this time period, for a total of three, five-second observations per student. Students were deemed on task if any one of the following scenarios existed:

- Talking with teacher or other class members about content,
- Writing responses to content,
- Asking questions about content or procedure of other students,
- Asking the teacher questions about content or procedure,
- Listening to the teacher about content,
- Listening to another student about content,
- Looking at a paper, book, or computer screen associated with content.

Any behavior that did not meet one of the above categories was classified as off-task, and the student was assessed a zero for that observation.

Several pieces of demographic and computer usage information were also collected from the students. These were collected by adding questions to the instruments to identify the following:

- Age
- Gender
- Computer usage
  - At home
  - At school
  - Types of usage
    1. Play games
    2. Surf the Internet
    3. Send e-mail
    4. Get work done

Teachers were given the Educational Technology Assessment in one of two ways: It was given on the computer in a group setting, or if the school administration was unable to assign a time that would fit all schedules, the ETA was given to teachers on an individual basis using paper and pencil. The computer assessment was the preferred mode of delivery; however, it was not always possible due to varying classroom and after school schedules. Teachers also had the option of taking the assessment during the time period when the researcher was in his/her classroom administering student instruments.

Teachers were also asked to self-report their computer usage with their students either through one-on-one interviews, or by means of a worksheet (an example of all instruments used in this study can be found in Appendix B) where they were asked to report on the previous three days of computer use in the classroom. Teachers either explained their lesson plan to the researcher through the use of the worksheet, or gave an oral account of the activities. All computer usage was given points according to the following levels of usage:

- Level 0 (no points)
  - The computer was not used.
- Level 1 (one point)
  - Teacher was using the computer to support his/her lesson with PowerPoint.
  - Students were using drill and practice software, or a word processor.
  - Students were using e-mail to write letters to other students.
  - Students were surfing the web without direction.

- Level 2 (two points)
    - The teacher was using a computer to present a database, spreadsheet, or simulation to the class.
    - Students were using e-mail to collaborate on a project with other students, participate in role-playing, or electronic databases.
    - The students were using the Internet to do research. Teacher has given students a list of web sites for them to use, or students are given specific search instructions.
- Level 3 (three points)
    - Students were working alone or collaboratively on projects that use presentation software and word processing in combination with a database, spreadsheet, the Internet, or simulation software.
    - Students were using probeware in combination with a spreadsheet.

All grade and attendance information was collected from the teachers by the administrative staff. In addition, all school and district information was provided by the administrative staff. Researchers tracked language arts, science, social studies, and mathematics grades to determine patterns of overall student growth. For the purposes of evaluation, all letter grades were given a numeric value (see Appendix D). Students' attendance was tracked by number of days missed for a given reporting period (quarterly). Researchers counted only the number of full days missed during that time.

SECTION IV

Data Analysis

Introduction

This research study focused on two groups of individuals: students and teachers. Student attitudes and computer skills were tracked throughout the study to determine if there were significant differences in either, after the introduction of a technology rich curriculum. In addition, student grades, attendance, and time-on-task were tracked for patterns of growth.

Like students, teachers took a technology competency assessment once per session, and those scores were tracked to determine if there was a statistically significant difference in scores over time. The hypothesis was that both students and teachers who were provided proper technology training would significantly improve their technological skills with respect to using computers. In addition, teachers' technology use was also examined to determine if there was a significant change in quantity and quality of use in the classroom.

The technology training was provided through professional development, enhanced student curriculum, and through integration facilitation. While the program was customized to meet the training and scheduling needs of the individual schools, all schools involved with the Model Technology Integration (MTI) School Program received the same curriculum content and teacher training methods.

There were several research questions that guided this study which were broken into two categories: teachers and students. For students, was there a significant difference in students' attitudes between data collection intervals after the integration of technology aided lesson plans in their schools? This was measured by administering two separate attitude surveys to the students, the Pupils Attitudes Towards Technology (PATT) and the Computer Attitude Questionnaire (CAQ). Also for students, was there a significant difference in their technology skills assessment scores over time, measured by the Student Technology Assessment (STA). Data was also collected on their grades, attendance, and time-on-task to determine if there were changes and/or developing patterns throughout the research study.

The impact on teachers was equally important to the success of the program. Did teachers who were trained to use and integrate technology in the classroom show statistically significant growth on a computer competency assessment? This was evaluated using the Educational Technology Assessment (ETA). Also, did technology-trained teachers show statistically significant gains in the amount and quality of technology use in the classroom? Teacher use reports were used to record this information and they were later coded for analysis.

Students

Demographics.

Approximately 250 students participated in each session. With only two classrooms, the Chicago elementary school had the fewest students. The gender ratio for students involved in this research study was as expected, with nearly a 50/50 split. The average age of each student was slightly less than 10.5 years old ($\underline{M}$=10.47), with none younger than nine or older than twelve.

Demographic and computer use questions were asked of the students to gain insight into their computer background. Overall, 85% of students indicated that there was at least one computer in the home where they spend the majority of their time. Surprisingly, 89% of the same students reported having access to the Internet while at home. Between both home and school, students reported using a computer an average of 7.2 hours per week. Table 4 provides additional computer use questions and the percentage of students in agreement.

Table 4

Percent of Students Responding Yes to Computer Use Questions

Do you use a computer:	Overall
at school?	98
to get work done?	87
to send e-mail?	69
to surf the Internet?	87
to play games?	95

Attitudes.

Two different attitude surveys, the Pupils' Attitude Toward Technology (PATT) and the Computer Attitude Questionnaire (CAQ) were used to determine whether or not a technology rich curriculum had any effect on student attitudes over time. An ANOVA was used to evaluate the data of all five sessions.

The PATT was divided into six individual subscales for analysis, and an ANOVA was run on all six to determine statistical significance (see Table 5). The *attitude, consequence,* and *difficulty,* subscales were the only individual subscales that were significant to the $p<.05$. Tukey's HSD was then run to determine where the significance could be attributed.

In the *attitude towards technology (attitude)* subscale, post hoc comparisons revealed that students' attitudes declined significantly between session one (M=1.85, SD=.63) and sessions three (M=1.66, SD=.64) and four (M=1.64, SD=.73). Students rebounded nicely in the fifth and final session, but did not return to the early ratings of sessions one and two.

Post hoc analysis of the *consequences of technology (consequences)* subscale revealed a significant ($p<.05$) improvement in ratings for session four ((M=1.30, SD=.62) over sessions one (M=1.49, SD=.60) and three (M=1.48, SD=.88). NOTE: Lower scores in this subscale indicate a student better understands the consequences of technology. The *technology is difficult (difficulty)* subscale saw a significant decline between sessions one (M=2.45, SD=.89) and four (M=2.18, SD=.97). However, students rated technology is significantly less difficult from sessions four to session five (M=2.45, SD=.92). No other significance was revealed for this instrument. Individual session means for each subscale can be found in Table 6.

Table 5

ANOVA for the Dependent Variable: PATT (Individual Subscales)

Subscale		SS	df	MS	F	p
Interest	Between Groups	4.21	4	1.05	2.32	.055
	Within Groups	564.05	1243	.45		
	Total	568.26	1247			
Attitude	Between Groups	8.52	4	2.13	4.62	.001
	Within Groups	569.86	1235	.46		
	Total	578.38	1239			
Gender	Between Groups	1.82	4	.45	1.14	.334
	Within Groups	493.24	1242	.40		
	Total	495.05	1246			
Consequence	Between Groups	5.82	4	1.46	3.10	.015
	Within Groups	572.21	1220	.47		
	Total	578.03	1224			
Difficulty	Between Groups	13.42	4	3.35	4.16	.002
	Within Groups	993.30	1233	.81		
	Total	1006.72	1237			
Concept	Between Groups	.29	4	.07	2.17	.070
	Within Groups	41.44	1240	.03		
	Total	41.73	1244			

Table 6

Session Means for the Dependent Variable: PATT (Individual Subscales)

Subscale	Session 1	Session 2	Session 3	Session 4	Session 5
Interest*	1.81	1.75	1.65	1.68	1.75
Attitude	1.84	1.81	1.66	1.64	1.77
Gender*	1.37	1.42	1.47	1.40	1.46
Consequence*	1.49	1.40	1.48	1.30	1.44
Difficulty	2.45	2.32	2.28	2.18	2.45
Concept	.51	.47	.47	.48	.48

*Low score is a positive outcome.

The second attitude survey administered to the students was the Computer Attitude Questionnaire (CAQ). While the PATT is concerned only with technological concepts, the CAQ looks beyond technology and has tried to identify constructs that may be linked to the use of technology. Like the PATT, the CAQ was divided into several subscales: *importance*, *enjoyment*, *study habits*, *motivation*, *empathy*, *creativity*, and *anxiety* (the *school* subscale was omitted from analysis due to the limited number of items). An ANOVA was used to test for statistical significance on all eight subscales. After analysis, three of the seven subscales produced a $p<.01$ (Table 7). All session averages can be found in Figure 1 and Table 8.

Table 7

ANOVA for the Dependent Variable: CAQ (Individual Subscales with p<.05)

Subscale		SS	df	MS	F	p
Enjoyment	Between Groups	3.63	4	.91	4.19	.002
	Within Groups	264.99	1225	.22		
	Total	268.62	1229			
Study Habits	Between Groups	1.40	4	.35	1.57	.181
	Within Groups	274.14	1226	.22		
	Total	275.54	1230			
Motivation	Between Groups	.90	4	.22	.84	.501
	Within Groups	328.03	1226	.27		
	Total	328.92	1230			
Empathy	Between Groups	4.63	4	1.16	4.13	.002
	Within Groups	343.13	1225	.28		
	Total	347.77	1229			
Creative	Between Groups	1.20	4	.30	1.28	.276
	Within Groups	287.09	1226	.23		
	Total	288.29	1230			
Anxiety	Between Groups	8.91	4	2.23	7.28	.000
	Within Groups	374.73	1225	.31		
	Total	383.36	1229			
Importance	Between Groups	1.01	4	.25	.85	.491
	Within Groups	362.79	1225	.30		
	Total	363.81	1229			

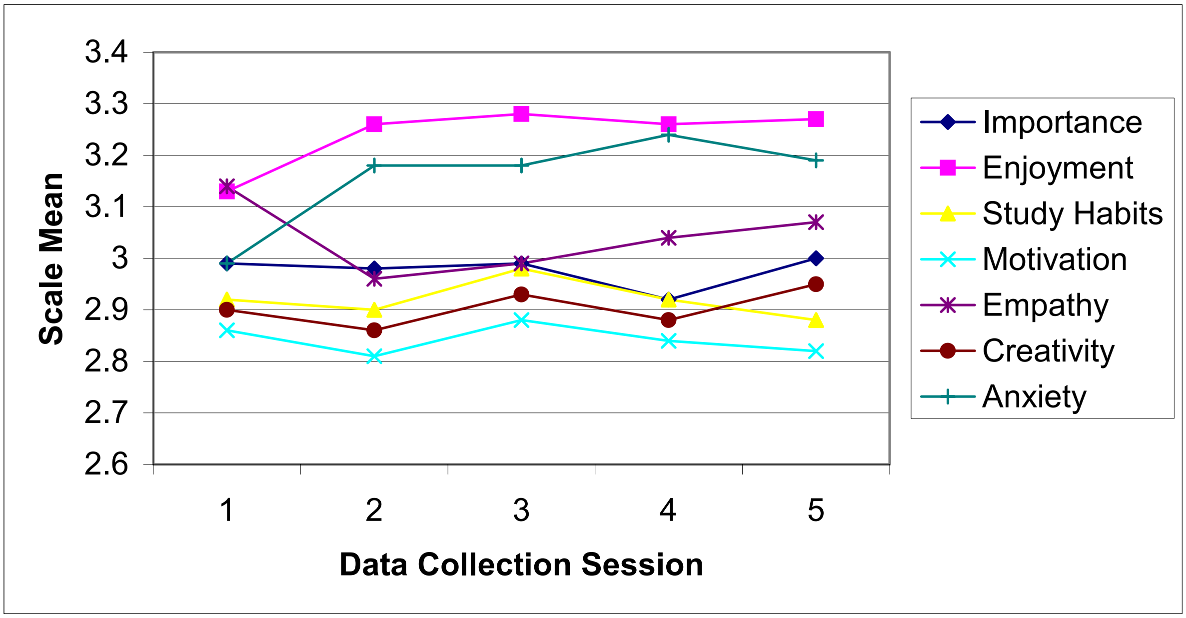

Figure 1. Average subscale scores for the CAQ.

Table 8

Session Means for the Dependent Variable: CAQ (Individual Subscales)

Subscale	Session 1	Session 2	Session 3	Session 4	Session 5
Enjoyment	3.13	3.26	3.28	3.26	3.27
Study Habits	2.92	2.90	2.98	2.92	2.88
Motivation	2.86	2.81	2.88	2.84	2.82
Empathy	3.14	2.96	2.99	3.04	3.07
Creativity	2.90	2.86	2.93	2.88	2.95
Anxiety	2.99	3.18	3.18	3.24	3.19
Importance	2.99	2.98	2.99	2.92	3.00

Post hoc analysis of the three subscales found to be statistically significant revealed some interesting results. The *enjoyment* subscale measures the extent a student enjoys the use of technology related items, and produced a positive overall outcome. Students rated using technology statistically more enjoyable in every session after the first. With an initial rating of 3.13 (SD=.52) in session one, students provided a rating of 3.27 (SD=.45) by the final session. All sessions were rated statistically higher (p<.05) than the first.

The *empathy* subscale also produced statistically significant results (p<.01). Students began with a mean empathy rating of M=3.14 (SD=.49) in the first session. This was an encouraging result, but quickly dropped to a mean of 2.96 (SD=.55) by the second session. The subscale rebounded, and by the final two sessions had a mean above 3.04

The *anxiety* subscale measures a students overall apprehension toward computers, with higher scores indicating less anxiety than lower scores. This subscale showed significant improvement during the course of the study. The initial mean rating of 2.99 (SD=.66) in session one was significantly lower (p<.001) than the average ratings in all subsequent sessions. As students continued through the pilot program they consistently rated themselves as having less anxiety the computer as compared with their initial rating.

Technology Skills Assessment.

The Student Technology Assessment (STA) was chosen to determine if there was any significant growth in student technology competency over the duration of the study. First, a correlation was run to see if students who self reported spending more time on the computer in turn had a better overall average on the STA. The average number of hours a student reported spending on a computer in a week was 7.2. The average score on the STA after combining the data from all five sessions was M=59.51 (SD = 13.06) percent. A two-tailed Pearson's R coefficient was run to determine any correlation. This test of significance returned an r=.10. While this number appears to be low, it is statistically significant to the p<.01. This indicates that as the number of hours a child self reports using a computer increases, so does their score on the STA. This serves as a validation of both students' honesty in answering the questionnaires and the effectiveness of the STA to assess a student's computer proficiency.

An ANOVA was used on the students' overall average on the assessment to determine if there were any significant differences between the five sessions (see Table 9). With an $F(4,965)=9.56$, and p<.001, post hoc analysis revealed that there was a statistically significant difference (p<.05) between the first (baseline) data collection session with an overall average of 59.70 (SD=13.74) and the last data collection session (M=64.04, SD

=12.82). This indicates that students improved their overall STA average significantly during the duration of the research study. However, Tukey's HSD also revealed that there was a significant (p<.001) performance loss from session one to session three (M=55.64, SD=12.54).

Table 9

ANOVA for the Dependent Variable: STA (Overall Average)

Subscale		SS	df	MS	F	p
Overall	Between Groups	.641	4	.16	9.56	.000
	Within Groups	16.16	965	.02		
	Total	16.80	969			

While all subscales fluctuated throughout the duration of the study, the *overall, presentation, word processing, spreadsheets, telecommunications* and *problem solving* subscales all saw growth from the first session to the last. Running ANOVAs on each of the individual subscales produced statistically significant improvement on only the *spreadsheets* subscale between sessions one and sessions five (p<.01). As can be seen in Figure 2, in addition to the overall test percentage, all individual subscales showed growth from session three to session four. The greatest gains were achieved in the *spreadsheet* subscale. The fifth and final session yielded a mean of 63.77 (SD=26.30), which significantly better (p<.01) than the first three sessions. The greatest gains were achieved between session three and four, improving from a mean of 44.69 (SD=25.06) in the third session to 66.72 (SD=29.17) in the fourth, which was significant to the p<.001 level.

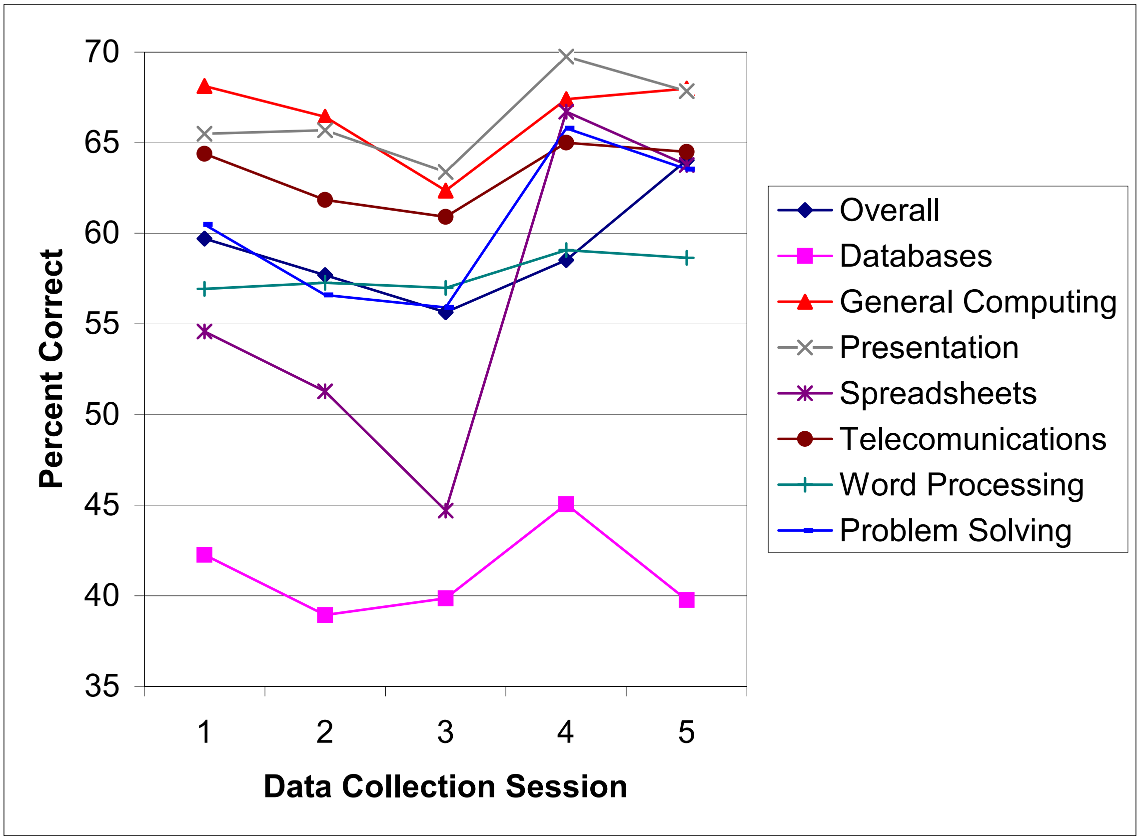

Figure 2. Average subscale scores for the STA.

The above figure indicates a general drop from session two to three, and all had a gain from session three to four. A change in student population occurred between the second and third sessions.

Table 10

<u>Session Means for the Dependent Variable: STA (Individual Subscales)</u>

Subscale	Session 1	Session 2	Session 3	Session 4	Session 5
Overall	59.70	57.69	55.64	58.53	64.04
Presentation	65.50	65.69	63.38	69.76	67.85
Word processing	56.94	57.26	56.99	59.07	58.65
Spreadsheets	54.58	51.29	44.69	66.72	63.77
Database	42.25	38.93	39.85	45.04	39.77
General Computing	68.13	66.44	62.36	67.40	67.98
Telecommunications	64.38	61.85	60.90	65.00	64.49
Problem Solving	60.49	56.59	55.90	65.80	63.53

Grades, Attendance, and Time-on-Task.

Student grades and attendance were tracked over the duration of this study to begin to identify patterns of change with the infusion of a technology rich curriculum. There were some interesting patterns that developed throughout the duration of the study.

The students' overall grade average rose significantly from data collection session one (<u>M</u>=2.65, <u>SD</u>=.88) through the final data collection (<u>M</u>=2.85, <u>SD</u>=.87, see Table 11). While there was fluctuation throughout the research study, all individual content areas saw growth in grade point averages from the first session to the last session (Figure 3). As can be seen in both Table 11 and Figure 4, data on students' attendance provided no positive growth pattern in number of days missed throughout the duration of study.

Table 11

Quarterly Overall Student Grade and Attendance Averages

Area	Session	n	M	SD
Overall GPA	1	244	2.65	0.88
	2	277	2.67	0.92
	3	236	2.81	0.85
	4	263	2.70	0.92
	5	239	2.85	0.87
Days Absent	1	262	1.62	1.99
	2	246	2.26	2.82
	3	202	2.05	3.51
	4	224	1.21	1.58
	5	242	1.87	3.50

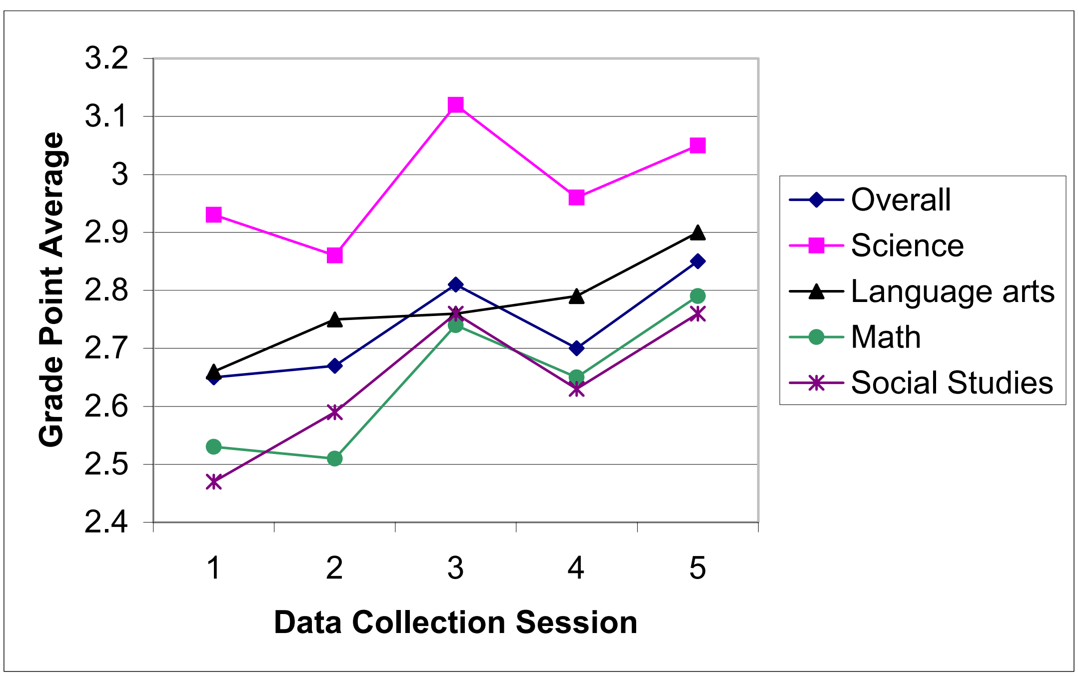

Figure 3. Quarterly student grade point averages for selected content areas.

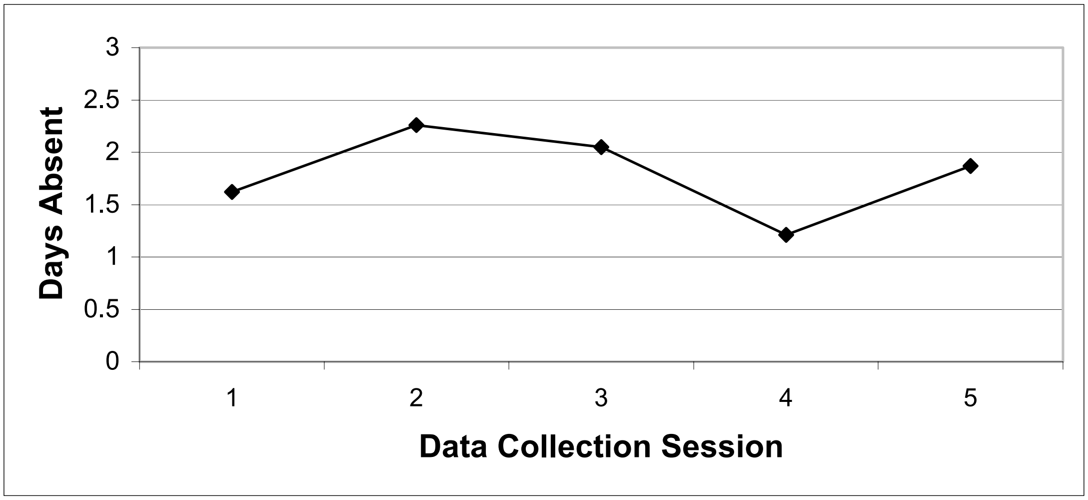

Figure 4. Average quarterly number of days absent per student.

Time-on-task data was also collected throughout the study. All data collection sessions were an improvement over the first (see Table 12), with all but the third session being a statistically significant (p<.001) improvement over the first. Even with the decline from session two to session three, the on-task percentage in session three (M=75.11, SD=.43) was a vast improvement over the first data collection session (M=71.04, SD=.45) (see Figure 5). It appeared that students were spending more time on task as they progressed through the program.

Table 12

Session Means for the Dependent Variable: TOT (in percent)

Instrument	Session 1	Session 2	Session 3	Session 4	Session 5
Time-on-task	71.04	81.97	75.11	87.48	91.48

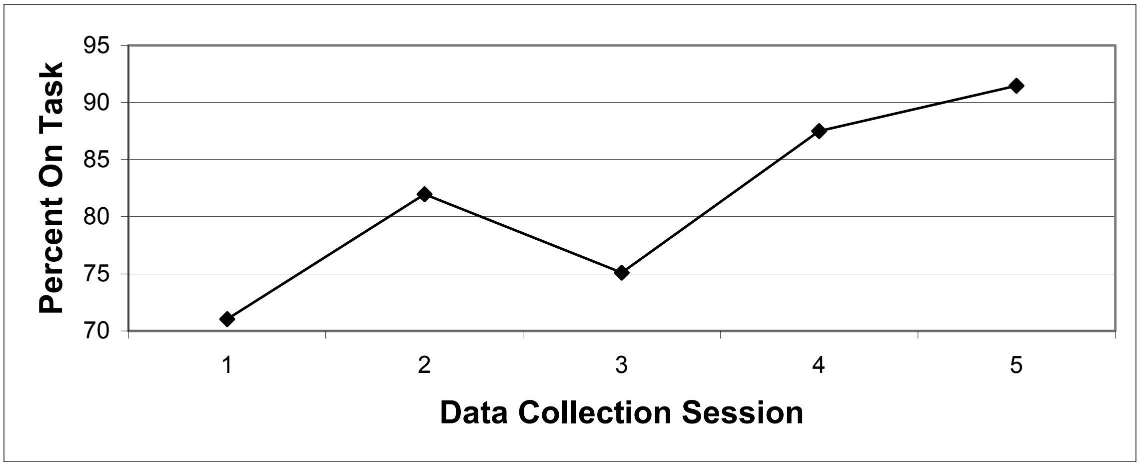

Figure 5. Percentage of on-task observations.

Teachers

In addition to the data collected on students' performance, teachers were also evaluated over the duration of the study for growth in both computer skills and computer use in the classroom.

Technology Skills Assessment.

Teachers were required to take the Educational Technology Assessment (ETA) once per data collection session, and those results were tracked over the duration of the study. An ANOVA was used to determine if there were significant differences in their overall computer aptitude over time (see Table 13). The teachers' overall average improved significantly over time ($p<.05$). While post hoc analysis only revealed statistically significance ($p<.05$) between sessions one ($M=76.10$, $SD=9.98$) and session five ($M=86.26$, $SD=4.87$) it is clear from Figure 6 that there was consistent improvement over session one in the teachers' overall ETA score (see also Table14).

Table 13

ANOVA for the Dependent Variable: ETA (Overall Average)

Subscale		SS	df	MS	F	p
Overall	Between Groups	614.81	4	153.70	2.57	.049
	Within Groups	2751.92	46	59.82		
	Total	3366.73	50			

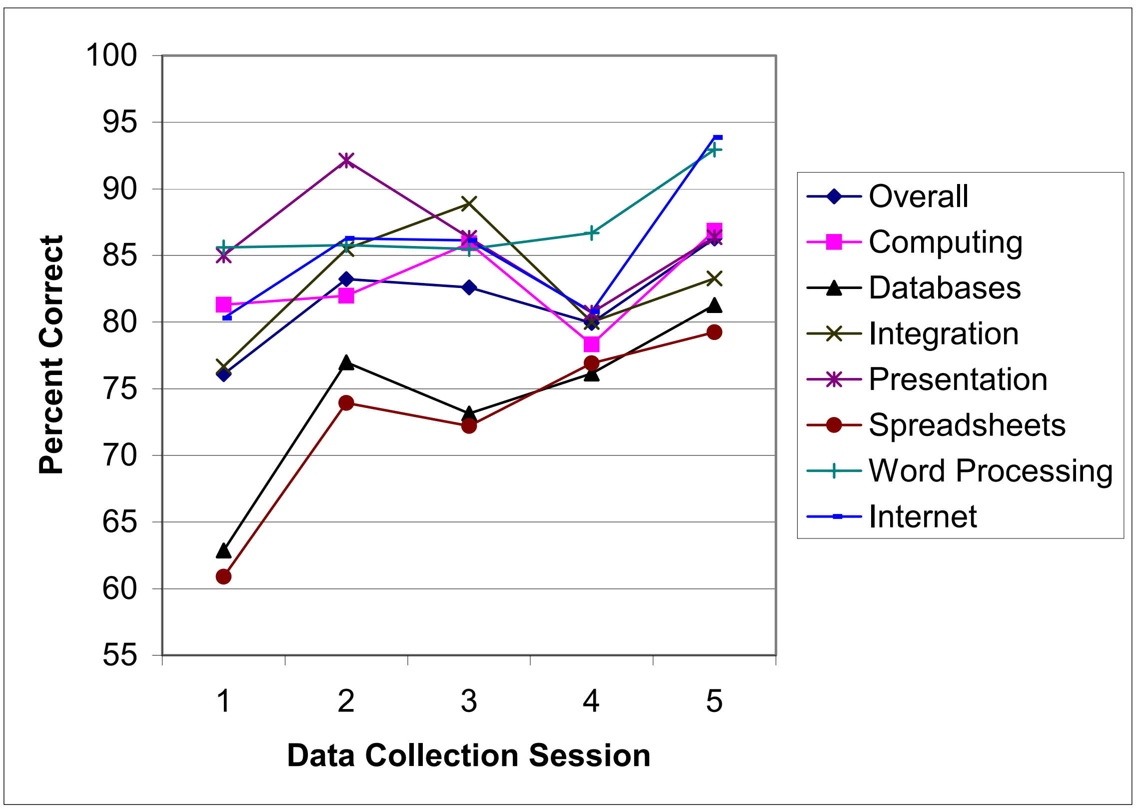

Figure 6. Average subscale scores for the ETA.

Table 14

Session Means for the Dependent Variable: ETA (Individual Subscales)

Subscale	Session 1	Session 2	Session 3	Session 4	Session 5
Overall	76.10	83.22	82.59	79.94	86.26
Computing	81.31	81.97	85.92	78.33	86.85
Database	62.88	76.98	73.15	76.15	81.28
Integration	76.67	85.47	88.89	80.00	83.26
Presentation	85.00	92.13	86.33	80.71	86.38
Spreadsheet	60.91	73.94	72.22	76.94	79.23
Word Processing	85.61	85.76	85.47	86.67	92.95
Internet	80.30	86.25	86.14	80.77	93.85

With the exception of the *database* and *Internet* (telecommunications) subscales, running an ANOVA on all individual subscales failed to provide statistical significance. The *database* subscale returned an $F(4,46)=2.92$, which was significant to the $p<.05$ level. Post hoc analysis revealed average scores on this subscale were significantly higher ($p<.01$) in the last data collection session ($M=81.28$, $SD=11.52$) than in the first ($M=62.88$, $SD=15.53$). While not statically significant, Figure 6 and Table 14 demonstrate overall growth in all sessions compared to the baseline (session one) on this instrument. Teacher aptitude in the area of technology improved over time with the integration of proper technology training.

The *Internet* subscale measures a teacher's ability to use the Internet for communication and information gathering. This subscale provided statistical significance, $F(4,46)=5.62$, $p<.01$. Tukey's post hoc analysis revealed that the mean score of 93.85 ($SD=6.07$) in session five was significantly higher than session one ($M=80.30$, $SD=9.16$). Session means for all sessions were higher than the baseline mean.

While not statistically significant, growth was demonstrated in all subscales when comparing session five means to the baseline measurements. However, no subscale showed continuous growth over all five sessions.

Teacher Use Ratings.

In addition to the technology skills assessment, teachers were evaluated for both their quantity and quality of technology use in the classroom. Teacher lessons plans were evaluated using the rubric in Appendix E. An ANOVA was once again used to determine if there were significant differences in their computer use throughout the study. This established that there was a statistically significant difference, $\underline{F}(4,148)=4.70$ ($\underline{p}<.01$) in their technology use over the duration of the research study (see Table 15).

Table 15

ANOVA for the Dependent Variable: Teacher Use Ratings (Overall Average)

Subscale		SS	df	MS	F	p
Overall	Between Groups	12.44	4	3.11	4.70	.001
	Within Groups	97.89	148	0.66		
	Total	110.33	152			

Figure 7 clearly demonstrates sustained growth from the first data collection session to the last. Compared to the initial computer use rating ($\underline{M}=.42$, $\underline{SD}=.79$), teachers had a three-fold increase ($\underline{M}=1.27$. $\underline{SD}=.78$) in technology use in the classroom by the end (see also Table 16). Overall, this instrument produced positive results.

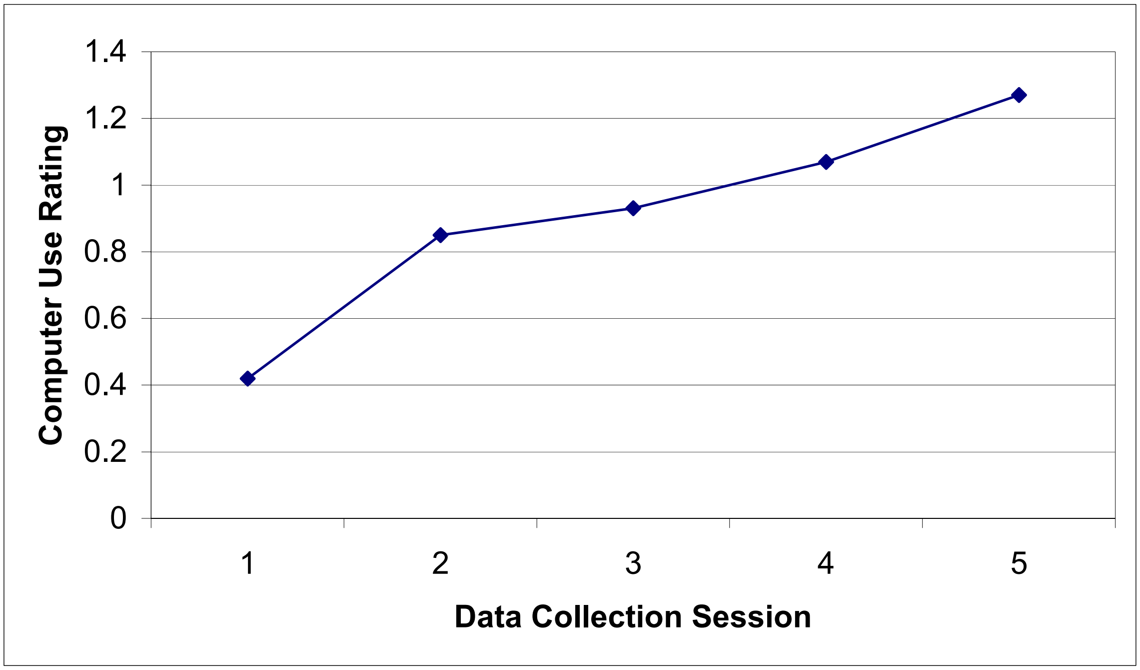

Figure 7. Average computer use ratings by session.

Table 16

Session Means for the Dependent Variable: Teacher Computer Use Ratings

Instrument	Session 1	Session 2	Session 3	Session 4	Session 5
Time-on-task	.42	.85	.93	1.07	1.27

Discussion

Two separate attitude surveys were administered to the students participating in the research study, the PATT and the CAQ. While the Model Technology Integration Program had little effect on the PATT instrument, this was not the case for the CAQ. Similar to Hopson (1998), a technology enriched learning environment increased student computer enjoyment and reduced their overall anxiety towards computers. The MTI was instrumental in lowering a students overall anxiety toward a computer. If anxiety can be lowered, a student will stand a much better chance of learning and retaining information.

Anxiety can be a barrier in any learning process, which most certainly includes computer technology. When an individual is anxious, a barrier goes up which impedes the learning process. Since computer anxiety may be harmful for learning the effective use of computers, reducing computer anxiety is an extremely important step in integrating computers in the classroom (Topper, 1994).

In addition to lowering student anxiety, the *enjoyment* subscale, which measures a student's enjoyment of computers, had an extremely positive outcome. Students rated their computer enjoyment significantly ($p<.05$) lower ($M=3.13$, $SD=.52$) in session one than all other sessions. They had an increase in enjoyment throughout the study until a slight drop off in the fourth session before rebounding in the final session. Having students who enjoy computers also removes a potential barrier, making for an easier teaching/learning environment. This finding is congruent with past research which indicated that students involved in a computer integration program will raise their level of computer enjoyment (Knezek & Christensen, 1995).

The Student Technology Assessment (STA), which was used to measure growth in student computer aptitude, proved to be a valuable assessment instrument. With an overall Cronbach's Alpha (reliability) of .76, this test exceeds industry standards for acceptability in reliability measurements (Reynaldo & Santos, 1999). The performance loss between sessions two and three can partly be explained by the change in individuals being measured. It was not a loss of performance by the group from session two, but rather a new baseline for the next group of students being investigated. While students in all grades received the same materials throughout the course of the study, students at younger ages may not have been able to comprehend the material as well as the older students.

The STA was a good predictor of a student's abilities in computer technology. While tracking the same students between sessions three and four, gains were made in all subscales, including overall average. The shift in the students being tested likely caused the decline in the test scores in session three. However, students rebounded quickly, and posted higher scores for most subscales from session one to session five. Students drastically improved their overall test scores over time while involved in the Futurekids MTI program.

Data was collected on students' grades, attendance, and time-on-task over the duration of the study to try to determine patterns of growth in each area with the implementation of a technology rich curriculum. Similar to a study done by Wenglinsky (1998) on the use of technology and math grades, an overall pattern of growth in student grades developed throughout the study. While this growth may not entirely be attributed to the program implemented in these schools, seeing a trend develop is definitely positive for future technology integration. Students had a much better overall grade point average in the final session (M=2.85, SD=.87) compared to the baseline average of 2.65 (SD=.88).

Patterns for students' absentee rate were much less conclusive. The number of days absent on average per data collection session fluctuated throughout the duration of the Model Technology Integration program. Too many additional factors go into a student's attendance records to say that this variance in attendance patterns was due to the implementation of this technology program.

Time-on-task measurements were also tracked to try to determine patterns of growth. While there was a slight drop off between session two and session three, both of these sessions showed a large improvement over the students' average time-on-task percentage in session one. Much like the grades, caution should be taken in attributing these positive results solely to the technology program. Many other factors such as task, time of day, and day of week can play a significant role in determining a student's time-on-task percentage. With a time-on-task percentage of only 71% during the first data collection session, all subsequent data collection sessions with the exception of session three were a statistically significant (p<.001) improvement.

Like the Student Technology Assessment, the Educational Technology Assessment for teachers produced strong gains from session one to session five. Aside from a modest decline on several subscales in the fourth session, most subscales revealed continued growth throughout. This trend would seem to solidify the theory that some of the performance decline in session three from the STA can be attributed to the change in student population between sessions two and three. Since the teacher pool remained constant throughout this study, no drastic performance loss was found. This is a sound measurement instrument, with sound statistical reliability. Cronbach's Alpha for the current version of the ETA is .91, which far surpasses the commonly excepted threshold of

.70. The technology integration program initiated in these three schools had a positive effect increasing teacher aptitude over time.

Finally, the quantity and quality of teacher computer use was examined to determine if there was statistically significant growth over the duration of the study. Positive growth was documented throughout as teachers continued to use more technology as they progressed through the program. Technology use ratings grew steadily, with the greatest gains between session one and session two, which indicates that teachers most likely benefited immediately from the integration of the MTI program. Teachers used the computer with the students in the classroom more often, and in a more sophisticated manner after their initial exposure to the Futurekids curriculum. This increasing integration of technology continued for the remainder of the study, producing a statistically significant increase over time.

SECTION V
Summary, Conclusions, and Recommendations

Summary

This research studied the effects of a pilot technology training, integration, and student curriculum package in selected elementary schools in the United States. Fifth grade was chosen at random to study the effectiveness of this program. Both students and teachers were investigated over the course of 18 months. The following research questions guided this study:

- After the integration of technology-aided lesson plans was there a significant difference in students' attitudes and technology skills assessment scores between data collection intervals?
- What were the patterns of grades, time-on-task, and attendance of students who have been exposed to a technology rich curriculum?
- Did teachers who are trained to use and integrate technology in the classroom show significant gains on a computer competency assessment?
- Did technology-trained teachers show significant gains in the amount and quality of technology use in the classroom?

Baseline data was collected from the students and teachers during data collection session one. The number of days spent at each school by the researcher varied since there were a different number of classrooms at each location. After all data was collected, a pilot program of professional development, integration training, and student curriculum was introduced in each school. Data was then collected four additional times, approximately quarterly, to measure the effects of this pilot technology program.

During data collection sessions, three separate times were set aside to administer instruments to the students. Time-on-task measurements were taken during an observation period, and grade and attendance data were collected from the administration. Also, teachers were required to take a computer competency test either during student interaction time or at a scheduled appointment time. Finally, teachers were required to report the quantity and types of computer usage in their lesson plans from the prior three school days either through an interview or a worksheet distributed by the researcher. All data was returned and input for data analysis.

Conclusions

Several conclusions can be drawn from the analysis performed on the data. A technology training and integration program similar to the Model Technology Integration pilot program offered by Futurekids:

1. lowered student anxiety towards computers;
2. increased a student's overall enjoyment of computers;
3. increased student technology aptitude over time;
4. may have played a role in increasing students' grades in subject areas outside of computer technology, including overall GPA;
5. did not appear to be a determining factor in a student's attendance;
6. had a positive effect on students time-on-task percentage;
7. increased teacher technology aptitude over time;
8. increased the quantity and quality of teacher computer use in the classroom

In addition, there was a significant correlation between students' overall score on the Student Technology Assessment, and their self-reported average number of hours spent on a computer per week.

Recommendations for Further Research

Additional research needs to be conducted to determine the effects of a technology rich curriculum on students and teachers. There are several recommendations for future research. First, the study should be designed so that the same student population is tracked throughout the entire duration. The change in the students may have weakened some data that would have otherwise been strong.

It is also recommended that a similar study be conducted with a control group included. Ideally there should be a group of students and teachers involved that are not exposed to the treatment (technology integration, student curriculum, etc.). If at all possible, these students and teachers would come from within the same school. This would make it more feasible to attribute the differences in the data to the infusion of technology, given that all other variables would remain constant. If a school different from the treatment school were used, variables that are unknown to the researcher may be introduced and act to taint the data and/or results.

If similar research were to be performed, a change should be made with the implementation of attitude instruments. Limiting the student attitude surveys to one would appear to be more effective. Students appeared to lose interest when presented with a second attitude assessment. Future research should also look to identify changes in teacher attitudes.

A research study of this magnitude not only leaves the door open for further investigation, but also opens new doors for discovery in areas that were not investigated. Adding a control group in connection with replication of this study could be very powerful, helping to provide conclusive data concerning the effects of the technology training, integration, and the curriculum package under investigation.

Limitations

While every precaution was taken to produce a sound research study, there are some limitations that warrant discussion. The most dominant limitation to this study was that the same students could not be tracked over the full duration of the study. Unfortunately, one of the schools selected was only a K-5, which meant the 5th graders went to different schools after completion of their fifth grade year. Therefore, research had to continue with a new group of fifth grade students.

Another limitation to this study was the time allowed to administer instruments to the teachers. Time was not available to track changes in teacher attitude even though it has been documented that positive attitudes may play a significant role in the successful implementation of technology in the classroom (Woodrow, 1992). The amount of available time with teachers was also a factor in gathering qualitative information from teachers on their perceptions of student growth as a result of the infusion of technology. More information would have helped to triangulate the data collected from student surveys.

Data analysis presented here may not be representative of all fifth grade students. Since all schools participating in the research study were public schools, generalizations to private institutions may be beyond the scope of this analysis. The data collected for grades, attendance, and time-on-task also proved to be a limitation of this study. Given the absence of a control group and no way to control for all extraneous variables, there was no way to report that any growth in those target areas was due solely to the infusion of a technology rich curriculum. Many other factors contribute to a student's overall grade in a given subject, attendance record, or time-on-task measurements.

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APPENDIX A

Professional Development Schedule

SAMPLE PROFESSIONAL DEVELOPMENT SCHEDULE

Week	Activity	Unit
02-07-00	Professional Development	Computer Basics
02-15-00	Professional Development	Operating Systems
02-22-00	Professional Development	Telecommunications
02-28-00	Professional Development	Word processing
03-06-00	Professional Development	Graphics
03-13-00	Student Curriculum Training	Word processing/Graphics
03-20-00 through 05-08-00	Student Curriculum Implementation	Word processing/Graphics
04-24-00 through 05-05-00	Integration Training	Word processing/Graphics
05-08-00 through 06-05-00	Integration Implementation	Word processing/Graphics
08-14-00 through 08-28-00	Professional Development	Databases
09-04-00	Student Curriculum Training	Databases
09-11-00 through 10-30-00	Student Curriculum Implementation	Databases
10-09-00 through 10-30-00	Integration Training	Databases
11-06-00 through 11-27-00	Integration Implementation	Databases
12-4-00	Professional Development & Student Curriculum Training	Spreadsheets
12-11-00 through 01-29-01	Student Curriculum Implementation	Spreadsheets
01-15-01 through 01-29-01	Integration Training	Spreadsheets
02-05-01 through 02-26-01	Integration Implementation	Spreadsheets
03-05-01	Professional Development	Multimedia
03-12-01	Student Curriculum Training	Multimedia
03-19-01 through 05-07-01	Student Curriculum Implementation	Multimedia
04-23-01 through 05-07-01	Integration Training	Multimedia
05-14-01 through 06-04-01	Integration Implementation	Multimedia

APPENDIX B

Instruments

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PUPILS' ATTITUDE TOWARDS TECHNOLOGY

Developed by: Virginia Tech - Technology Education and Eindhoven University, The Netherlands

We are interested in your opinion on technology. Therefore, we would like you to answer some questions on this subject. This is not a test. There are no right or wrong answers. You are not to be graded on this. Do not take too much time for one question. You should only need about 25 minutes for the whole questionnaire. The first set of questions are about you so we can get to know you better. These are followed by statements about technology. Indicate to what extent you agree or disagree with them. In the last set of statements you only have to indicate agree, disagree or don't know.

PATT USA

Please give a short description of what you think technology is:

WRITE ONLY INSIDE THIS BLOCK

USE NO. 2 PENCIL ONLY

WRONG	1 Ⓐ ⓉⒶ Ⓝ ⓉⒹ Ⓓ
WRONG	2 Ⓐ ⓉⒶ Ⓝ ⓉⒹ Ⓓ
WRONG	3 Ⓐ ⓉⒶ Ⓝ ⓉⒹ Ⓓ
RIGHT	4 Ⓐ ● Ⓝ ⓉⒹ Ⓓ

1. Are you a boy or a girl? .... 1. Ⓑ Boy Ⓖ Girl
2. How old are you? .... 2. ⑫ or younger ⑬ ⑭ ⑮ ⑯ or older
3. What is your grade in school? .... 3. ⑥ ⑦ ⑧

	Very Much	Much	Little	Nothing
4. If your father has a job, indicate to what extent it has to do with technology..... 4.	VM	M	L	N
5. If your mother has a job, indicate to what extent it has to do with technology.... 5.	VM	M	L	N

6. Do you have technical toys, like Tinkertoy, Erector Set or LEGO at home? .... 6. Ⓨ Yes Ⓝ No
7. Is there a technical workshop in your home? .... 7. Ⓨ Yes Ⓝ No
8. Is there a personal computer in your home? .... 8. Ⓨ Yes Ⓝ No
9. Do you think you will choose a technological profession? .... 9. Ⓨ Yes Ⓝ No
10. Do you have brothers or sisters that have a technological profession or that are studying for it? .... 10. Ⓨ Yes Ⓝ No
11. Are you taking or have you taken Technology Education/Industrial Arts? .... 11. Ⓨ Yes Ⓝ No

	AGREE	TEND TO AGREE	NEUTRAL	TEND TO DISAGREE	DISAGREE
12. When something new is discovered, I want to know more about it immediately.... 12.	A	TA	N	TD	D
13. Technology is as difficult for boys as it is for girls. .... 13.	A	TA	N	TD	D
14. Technology is good for the future of this country. .... 14.	A	TA	N	TD	D
15. To understand something of technology you have to take a difficult training course. .... 15.	A	TA	N	TD	D
16. At school you hear a lot about technology. .... 16.	A	TA	N	TD	D
17. I will probably choose a job in technology. .... 17.	A	TA	N	TD	D
18. I would like to know more about computers. .... 18.	A	TA	N	TD	D
19. A girl can very well have a technological job. .... 19.	A	TA	N	TD	D
20. Technology makes everything work better. .... 20.	A	TA	N	TD	D
21. You have to be smart to study technology. .... 21.	A	TA	N	TD	D
22. I would not like to learn more about technology at school. .... 22.	A	TA	N	TD	D
23. I like to read technological magazines. .... 23.	A	TA	N	TD	D
24. A girl can become a car mechanic. .... 24.	A	TA	N	TD	D
25. Technology is very important in life. .... 25.	A	TA	N	TD	D
26. Technology is only for smart people. .... 26.	A	TA	N	TD	D
27. Technology lessons are important. .... 27.	A	TA	N	TD	D
28. I will not consider a job in technology. .... 28.	A	TA	N	TD	D
29. There should be less TV and radio programs about technology. .... 29.	A	TA	N	TD	D
30. Boys are able to do practical things better than girls. .... 30.	A	TA	N	TD	D
31. Everyone needs technology. .... 31.	A	TA	N	TD	D
32. I would rather not have technology lessons at school. .... 32.	A	TA	N	TD	D
33. I do not understand why anyone would want a job in technology. .... 33.	A	TA	N	TD	D
34. If there was a school club about technology I would certainly join it. .... 34.	A	TA	N	TD	D
35. Girls are able to operate a computer. .... 35.	A	TA	N	TD	D
36. Technology has brought more good things than bad. .... 36.	A	TA	N	TD	D
37. You have to be strong for most technological jobs. .... 37.	A	TA	N	TD	D
38. Technology at home is something schools should teach about. .... 38.	A	TA	N	TD	D
39. I would enjoy a job in technology. .... 39.	A	TA	N	TD	D
40. I think visiting a factory is boring. .... 40.	A	TA	N	TD	D
41. Boys know more about technology than girls do. .... 41.	A	TA	N	TD	D
42. The world would be a better place without technology. .... 42.	A	TA	N	TD	D

Over Please

43.	To study technology you have to be talented.	43.	A	TA	N	TD	D
44.	I should be able to take technology as a school subject.	44.	A	TA	N	TD	D
45.	I would like a career in technology later on.	45.	A	TA	N	TD	D
46.	I am not interested in technology.	46.	A	TA	N	TD	D
47.	Boys are more capable of doing technological jobs than girls.	47.	A	TA	N	TD	D
48.	Using technology makes a country less prosperous.	48.	A	TA	N	TD	D
49.	You can study technology only when you are good at both mathematics and science.	49.	A	TA	N	TD	D
50.	There should be more education about technology.	50.	A	TA	N	TD	D
51.	Working in technology would be boring.	51.	A	TA	N	TD	D
52.	I enjoy repairing things at home.	52.	A	TA	N	TD	D
53.	More girls should work in technology.	53.	A	TA	N	TD	D
54.	Technology causes large unemployment.	54.	A	TA	N	TD	D
55.	Technology does not need a lot of mathematics.	55.	A	TA	N	TD	D
56.	Technology as a subject should be taken by all pupils.	56.	A	TA	N	TD	D
57.	Most jobs in technology are boring.	57.	A	TA	N	TD	D
58.	I think machines are boring	58.	A	TA	N	TD	D
59.	Girls prefer not to go to a technical school.	59.	A	TA	N	TD	D
60.	Because technology causes pollution, we should use less of it.	60.	A	TA	N	TD	D
61.	Everybody can study technology.	61.	A	TA	N	TD	D
62.	Technology lessons help to train you for a good job.	62.	A	TA	N	TD	D
63.	Working in technology would be interesting.	63.	A	TA	N	TD	D
64.	A technological hobby is boring.	64.	A	TA	N	TD	D
65.	Girls think technology is boring.	65.	A	TA	N	TD	D
66.	Technology is the subject of the future.	66.	A	TA	N	TD	D
67.	Everybody can have a technological job.	67.	A	TA	N	TD	D
68.	Not everyone needs technology lessons at school.	68.	A	TA	N	TD	D
69.	With a technological job your future is promised.	69.	A	TA	N	TD	D

FROM NOW ON YOU ONLY HAVE THREE CHOICES:

			AGREE	DISAGREE	DON'T KNOW
70.	When I think of technology I mostly think of computers.	70.	A	D	DK
71.	I think science and technology are related.	71.	A	D	DK
72.	In technology, you can seldom use your imagination.	72.	A	D	DK
73.	I think technology has little to do with our energy problem.	73.	A	D	DK
74.	When I think of technology, I mostly think of equipment.	74.	A	D	DK
75.	To me technology and science are the same.	75.	A	D	DK
76.	In my opinion, technology is not very old.	76.	A	D	DK
77.	In technology, you can think up new things.	77.	A	D	DK
78.	Working with information is an important part of technology.	78.	A	D	DK
79.	Technology is as old as humans.	79.	A	D	DK
80.	Elements of science are seldom used in technology.	80.	A	D	DK
81.	You need not be technological to invent a new piece of equipment.	81.	A	D	DK
82.	Technology has a large influence on people.	82.	A	D	DK
83.	I think technology is often used in science.	83.	A	D	DK
84.	Working with your hands is part of technology.	84.	A	D	DK
85.	In everyday life, I have a lot to do with technology.	85.	A	D	DK
86.	In technology, there is little opportunity to think up things yourself.	86.	A	D	DK
87.	Science and technology have nothing in common.	87.	A	D	DK
88.	The government can have influence on technology.	88.	A	D	DK
89.	I think the conversion of energy is also part of technology.	89.	A	D	DK
90.	In technology, you use tools.	90.	A	D	DK
91.	Technology is meant to make our life more comfortable.	91.	A	D	DK
92.	When I think of technology, I mainly think of computer programs.	92.	A	D	DK
93.	Only technicians are in charge of technology.	93.	A	D	DK
94.	Technology has always to do with mass production.	94.	A	D	DK
95.	In technology, there are less opportunities to do things with your hands.	95.	A	D	DK
96.	Working with materials is an important part of technology.	96.	A	D	DK
97.	Technology has little to do with daily life.	97.	A	D	DK
98.	When I think of technology I mainly think of working with wood.	98.	A	D	DK
99.	Technology can mainly be found in industry.	99.	A	D	DK
100.	There is a relationship between technology and science.	100.	A	D	DK

COMPUTER ATTITUDE QUESTIONNAIRE

A= Strongly Disagree

B= Disagree

C= Agree

D= Strongly Agree

1. I enjoy doing things on a computer.
2. I am tired of using a computer.
3. I will be able to get a good job if I learn how to use a computer.
4. I concentrate on a computer when I use one.
5. I enjoy computer games very much.
6. I would work harder if I could use computers more often.
7. I know that computers give me opportunities to learn many new things.
8. I can learn many things when I use a computer.
9. I enjoy lessons on a computer.
10. I believe that the more often teachers use computers, the more I will enjoy school.
11. I believe that it is very important for me to learn how to use a computer.
12. I feel comfortable working with a computer.
13. I get a sinking feeling when I think of trying to use a computer.
14. I think that it takes a long time to finish when I use a computer.
15. Computers do not scare me at all.
16. Working with a computer makes me nervous.
17. Using a computer is very frustrating.
18. I will do as little work with computers as possible.
19. Computers are difficult to use.
20. I can learn more from books than from a computer.
21. I study by myself without anyone forcing me to study.

22. If I do not understand something, I will not stop thinking about it.
23. When I do not understand a problem, I keep working until I find the answer.
24. I review my lessons every day.
25. I try to finish whatever I begin.
26. Sometimes, I change my way of studying.
27. I enjoy working on a difficult problem.
28. I think about many ways to solve a difficult problem.
29. I never forget to do my homework.
30. I like to work out problems which I can use in my life every day.
31. If I do not understand my teacher, I ask him/her questions.
32. I listen to my teacher carefully.
33. If I fail, I try to find out why.
34. I study hard.
35. When I do a job, I do it well.
36. I feel sad when I see a child crying.
37. I sometimes cry when I see a sad play or movie.
38. I get angry when I see a friend who is treated badly.
39. I feel sad when I see old people alone.
40. I worry when I see a sad friend.
41. I feel very happy when I listen to a song I like.
42. I do not like to see a child play alone, without a friend.
43. I feel sad when I see an animal hurt.
44. I feel happy when I see a friend smiling.
45. I am glad to do work that helps others.
46. I examine unusual things.
47. I find new things to play with or to study, without any help.
48. When I think of a new thing, I apply what I have learned before.
49. I tend to consider various ways of thinking.
50. I create many unique things.
51. I do things by myself without depending upon others.

52. I find different kinds of materials when the ones I have do not work or are not enough.
53. I examine unknown issues to try to understand them.
54. I make a plan before I start to solve a problem.
55. I invent new games and play them with my friends.
56. I invent new methods when one way does not work.
57. I choose my own way without imitating methods of others.
58. I tend to think about the future.
59. I really like school.
60. School is boring
61. I would like to work in a school when I grow up.
62. When I grow up I would not like to work in a school.
63. Do you use a computer at home?
64. Do you have World Wide Web (WWW) (Internet) access at home?

SAMPLE STA QUESTIONS

1. You can rename a file.
   a) True
   b) False

2. In presentation software, you can make the text and pictures move. What do we call this?
   a) Animation
   b) Formatting
   c) Editing
   d) Alignment

3. When you use double-space, the word processor:
   a) puts an extra space between words.
   b) leaves a blank line between paragraphs.
   c) leaves a blank line between all lines of text.
   d) makes a page break.

4. What is another name for an Internet address?
   a) E-mail
   b) Domain name
   c) URL
   d) Modem

5. You are allowed to make as many copies of a piece of software that you want, as long as you buy it first.
   a) True
   b) False

6. Graphic is another name for a:
   a) picture.
   b) letter.
   c) web page.
   d) book.

7. It is possible to put a picture or clip art into a report using a word processor?
   a) True
   b) False

8. What do we call junk mail over the Internet?
   a) Snail mail
   b) SPAM
   c) Elephant soup
   d) URL

9. A database allows you to add formulas.
   a) True
   b) False

10. You have written 5 pages in a word processing program. You would like to see what the pages look like before you print them out. What menu item should you go to?
    a) Print preview
    b) Print
    c) Settings
    d) Format

SAMPLE ETA QUESTIONS

1. The greatest amount of data may be stored ___________.
   a) on a hard drive.
   b) in RAM.
   c) on a floppy disk.
   d) in ROM.

2. Students need to calculate the population statistics in their community for a report on the local economy and employment. The best tool for this activity would be
   a) a local area network.
   b) desktop publishing software.
   c) a spreadsheet.
   d) a database.

3. One of the first steps in organizing an electronic presentation is to
   a) use a spreadsheet to structure the concepts.
   b) use a "storyboard" to outline concepts.
   c) use a database to summarize topic facts.
   d) start experimenting with a screen design on the computer.

4. When an item is cut from a document it is
   a) deleted permanently from the document.
   b) saved to the clipboard.
   c) moved to the end of the document.
   d) put in the recycle bin or trash can.

5. All the students' names in a class have been entered into a spreadsheet application alphabetically listing their gender and grade level. To re-arrange the students by grade level use a __________ command.
   a) range
   b) function
   c) query
   d) sort

6. An appropriate use of a database for students would do the following EXCEPT
   a) determine what type of transportation to buy.
   b) locate where birds nest for the winter.
   c) determine how steam engines work.
   d) determine what fruits are grown in Florida.

7. A search engine allows
   a) a search of the Internet by topic.
   b) the computer to be re-started.
   c) a search to be slowed down so that topics are viewed more easily.
   d) all of the above

8. Skills needed to effectively sort and query a database include
   a) accessing search engines and identifying key words.
   b) writing a formula and explaining a hypothesis.
   c) creating and presenting an outline.
   d) asking related questions, finding answers, and making inferences.

9. In an electronic presentation which file type could be a video clip?
   a) .jpg
   b) .vcr
   c) .tif
   d) .mpg

10. To include the same piece of information on each page of a document,
   a) create a header and/or footer.
   b) format a lead and/or closing paragraph.
   c) use commercially preprinted paper.
   d) merge your data with a database.

TEACHER TECHNOLOGY USE FORM

DATE (City)
Teacher Computer Use Evaluation

Teacher Name:

Please provide a brief description of any computer use with your students in the last three academic days (omitting field trips and any other special events). Please list each day separately and be as clear and accurate as possible. If you did not use computers with your students during this time that is fine, just indicate this below. Please use additional paper if there is not enough space here.

Your participation helps to make this study more accurate and valid. Thank you for your time.

Day One:

Day Two:

Day Three:

TIME-ON-TASK FORM

TOT Observations

Site:
Teacher/ Classroom:
Date/Time:

Total Observations:
ON TASK=
Off task =
ON TASK %:

Student	Observation 1 Task:	Observation 2 Task:	Observation 3 Task:
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
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30			

APPENDIX C

School Demographics

Three schools were chosen to participate in the Model Technology Integration (MTI) School Program. The following is a brief demographic description of each school along with the school computer hardware inventory.

Chicago, Illinois
Grade Range: K-8
Total Enrollment: 602
Ethnic Minority ratio: 74%
Percent of free and reduced lunches: N/A
Total classrooms: 28
Total 5th grade classrooms: 2
Total # of computers in school available for student use: 85
Number of labs (# of Computers in labs): 1 (18)
Average # of computers per class: 2
Percent Macintosh: 92
Percent IBM based: 8

Kent (Seattle), Washington
Grade Range: K-6
Total Enrollment: 643
Ethnic Minority ratio: 13%
Percent of free and reduced lunches: N/A
Total classrooms: 27
Total 5th grade classrooms: 3
Total # of computers in school available for student use: 83
Number of labs (# of Computers in labs): 1 (32)
Average # of computers per class: 3
Percent Macintosh: 98
Percent IBM based: 2

Raleigh, North Carolina
Grade Range: K-5
Total Enrollment: 912
Ethnic Minority ratio: 48.9%
Percent of free and reduced lunches: 31%
Total classrooms: 38
Total 5th grade classrooms: 5
Total # of computers in school available for student use: 185
Number of labs (# of Computers in labs): 1 (30)
Average # of computers per class: 3
Percent Macintosh: 0
Percent IBM based: 100

* In the last year involved with the research study, the Raleigh school had 139 students leave the school while admitting 220 new students. This is over a 35% change in student population over the course of one year.

APPENDIX D

Grade Conversion Chart

Grades were converted from letters to numbers using the follow scale.

4.0 = A+, A

3.7 = A-

3.3 = B+

3.0 = B

2.7 = B-

2.3 = C+

2.0 = C

1.7 = C-

1.3 = D+

1.0 = D

0.7 = D-

0.0 = F

APPENDIX E

Teacher Computer Use Rubric

Level 0 (no points)

- The computer was not used.

Level 1 (one point)

- Teacher is using the computer to support his/her lesson with PowerPoint.
- Students are using drill and practice software, or a word processor.
- Students are using e-mail to write letters to other students.
- Students are surfing the web without direction.

Level 2 (two points)

- The teacher is using a computer to present a database, spreadsheet, or simulation to the class.
- Students are using e-mail to collaborate on a project with other students, participate in role-playing, or electronic databases.
- The students are using the Internet to do research. Teacher has given students a list of web sites for to use, or students are given specific search instructions.

Level 3 (three points)

- Students are working alone or collaboratively on projects that use presentation software and word processing in combination with database, spreadsheets, the Internet, or a simulation.

APPENDIX F

Participant Comments

Participant Comments and Feedback

The final component of data collection for the Futurekids MTI program was a questionnaire intended to allow teachers and other participants the opportunity to respond to the Futurekids program in their own words. In total, 54 participants representing all three schools responded to the questionnaire. Of the 54 responses, 44 (81%) of these participants had been in the program from the beginning, and ten participants had been involved for at least one semester.

Participants were asked to rate the program on a five-point Likert scale with five being the best and one being the worst. The mean overall rating of the program given by those who responded was 4.13. When asked if they would participate in the program again, 37 participants responded, "Yes", ten responded, "No", and seven did not respond. Of the seven who responded "No," three of them stated that they felt they had received sufficient training from the program, two of them cited that the Futurekids program was too time (labor) intensive, and three of them cited dissatisfaction with the Futurekids curriculum itself. Of the 37 that responded, "Yes," 16 of them explained that either the teacher or the students (or both) learned a lot from the program, and they would participate in the program in the future if given the chance.

Participants from all locations, when asked about their favorite part of the program, repeatedly gave the following responses:

- The technology trainer was excellent.
- The Integrated Unit Planning was powerful and positive.
- Multimedia units were positive.
- Team planning was powerful and positive.

Sample responses to the question: "What was your favorite component of the MTI program?"

- "Our instructor was great! She was knowledgeable and always willing to help during class. Working with other teachers at our grade level to create units was also enjoyable and informative" (Teacher, Raleigh, NC)

- "I really enjoyed the chance to take my students down [to the computer lab] after learning the programs myself. Teaching the concepts helps drive it home for me." (Special Education Teacher, Chicago, IL)
- "I enjoyed creating the integration units with my teammates." (Teacher, Kent, WA)

Participants from all locations, when asked about their least favorite part of the program, repeatedly gave the following responses:

- Futurekids lesson manual and programs too difficult to work with, the quality was inconsistent.
- Database lessons were unsuccessful.
- Lessons not well matched to students' grade level, ability, and other classroom work.
- The program itself was too time consuming.

Sample responses to the question: "What is your *least* favorite part of the MTI program?"

- "I don't have the time or the computers in my classroom to use the program to it's fullest." (Teacher, Kent, WA)
- "Some of the training materials for the students were not interesting and not connected to the classroom learning." (Tech Coordinator, Chicago, IL)
- "The programs had some great lessons – then some that were pointless. Some of the lessons fit our curriculum well, others were a waste of time that we could have been using for other activities." (Teacher, Raleigh, NC)

The final component of the questionnaire was an opportunity for participants to offer suggestions and other comments. The following suggestions were made repeatedly:

- Lessons should fit existing state curriculum standards by grade level.
- Lessons should be more age/ability appropriate.
- Lessons should be more flexible to meet the needs of the individual teacher/classroom.

- Futurekids workbook and programs are cumbersome – simplify directions and steps for opening/saving work.
- Improve database unit.
- The technology trainers are necessary to the program's success, and universally appreciated by the participants.