Center for Research in Educational Policy

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# Freedom to Learn Program

## Michigan 2005-2006 Evaluation Report

## Prepared for Freedom to Learn and the One-to-One Institute


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# Executive Summary

## Introduction

This report summarizes the 2005-2006 evaluation results of the Michigan Freedom to Learn (FTL) program. The major goal of the FTL program is to improve student learning and achievement in Michigan schools through the integration of 21st Century technology tools with teaching and learning in K-12 classrooms. A key component of FTL was a rigorous and comprehensive evaluation study designed to gauge the impacts of the program relative to its primary goals.

## Goals

The FTL Program goals are listed below. The evaluation was structured to assess the degree to which each program goal was achieved.

GOAL 1 Enhance student learning and achievement in core academic subjects with an emphasis on developing the knowledge and skills requisite to the establishment of a 21st Century workforce in Michigan.

GOAL 2 Provide greater access to equal educational opportunities statewide through ubiquitous access to technology.

GOAL 3 Foster effective use of the wireless technology through systematic professional development for teachers, administrators and staff.

GOAL 4 Empower parents and caregivers with the tools to become more involved in their children's education.

GOAL 5 Support innovative structural changes in participating schools and sharing of best practices through the creation of human networks among Program participants.

## Participants

The FTL program was implemented in 195 Michigan schools during 2005-2006. FTL students (5,770), teachers (380), Lead Teachers (75), and parents/caregivers of FTL students (1,241) completed 7,466 surveys. A total of 485 hours of direct classroom observations were conducted in 826 FTL classrooms.

## Design

This study used a global descriptive design that employed a mixed-methods approach (Johnson & Onwuegbuzie, 2004) that utilized a number of validated data collection instruments.

## Measures

### Direct Classroom Observation Measures

- School Observation Measure (SOM©): Measures usage of 24 instructional strategies.
- Survey of Computer Use (SCU©): Measures student use of technology and software.
- Rubric for Student-Centered Activities (RSCA©): Measures the frequency, strength of application, and use of technology to support seven student-centered activities.

### FTL Program Evaluation Surveys

- FTL Student Survey: Collects student impressions regarding impact of laptop use on learning, enjoyment of using laptops, subject areas of laptop work, and most commonly used software.
- FTL-Teacher Technology Questionnaire (FTL-TTQ©): Collects teacher agreement regarding: impact of laptop use on students and instruction, teacher readiness to integrate student use of laptops, support for the laptop program, and Lead Teacher effectiveness.
- FTL Lead Teacher Survey (FTL-LT): Collects Lead Teacher perceptions of teacher, parent and administrator support and participation and overall impact of FTL on students.
- FTL Parent Surveys: Collects parents' impressions regarding student use and enjoyment of using laptops and participation in school sponsored laptop programs.

### Student Performance-Based Assessment

A Problem-Solving Task and Technology Task were administered to 6th grade students to examine the impact of FTL on student ability to solve problems and to generate computer products that reflect problem-solving solutions.

### Student Academic Achievement

The English, math, reading and writing Michigan Educational Assessment Program (MEAP) scores of 7th grade students enrolled in FTL schools considered to be implementing the program effectively were compared to achievement outcomes of 7th grade students in comparable schools using a series of 2x2 chi-square frequency analyses.

## Procedures

Multi-class (3-hour visit involving 15-minute observations in 10 classrooms per school) and targeted (prearranged one-hour session) observations were conducted during late spring 2006. The FTL surveys and performance-based assessments were also administered during late spring 2006.

## Results

### Direct Classroom Observation Results

***Multi-Class Observations***. Data from unannounced, random visits to 599 FTL classrooms revealed that teachers used both traditional and student-centered strategies. The most highly significant difference favoring FTL over national norms was student use of the laptops as a learning tool (*ES* = +1.07). Also noteworthy were the significant differences in FTL teacher use of independent inquiry, project-based learning, meaningful laptop lessons, and higher quality hands-on activities. The data also revealed that the FTL students used the Internet, word processing, and presentation software significantly more than students represented by the national norm.

***Targeted Observations***. Data from 227 targeted visits to FTL classrooms also revealed highly significant differences favoring FTL over national norm students for use of laptops as a learning tool (*ES* = +1.42) and for instructional delivery. FTL students used the following software significantly more than students using computers in classes represented by the norm: Internet browsers; word processing; CD references; presentation; and spreadsheets. But even more importantly, FTL students were more frequently engaged in meaningful computer activities, independent research, and project-based learning in classes with teachers acting as a facilitator.

**Survey Results**

***Student Survey***. Overall, responses from 5,770 FTL students were very positive with regard to using laptops at school. In particular, almost all of the students liked using the laptops and wanted to use them again next year. There was also agreement that use of the laptops had improved their Internet research skills, made it easier to do school work, made them more interested in learning, and would help them get better jobs in the future. Fewer students agreed that laptops made them want to get better grades, helped them to remember more and do better on tests, or improved their writing.

***Teacher Survey***. The FTL-TTQ was completed by total of 380 FTL teachers from 77 schools. When comparing the FTL results with the national norms, FTL teacher responses were significantly more positive on four of the five TTQ categories: Impact on Classroom Instruction; Impact on Students; Teacher Readiness to Integrate Technology; and Technical Support. Strikingly, the FTL teachers showed significantly greater confidence that they knew how to meaningfully integrate laptop use into lessons, align use of the laptops with curriculum standards, and had adequate computer skills to conduct lessons with students using laptops. FTL Teachers were in general agreement that Lead Teachers had been a valuable asset to their school's FTL program. There was moderate agreement that the teachers had frequently participated in professional development (PD) provided by their Lead Teacher and that the PD had helped them to improve integration lessons.

***Lead Teacher Survey***. Most of the 75 FTL Lead Teachers from 63 schools agreed that the FTL program had a positive impact on students' ability and comfort level with technology and that use of the laptops had increased student motivation to learn, teacher use of student-centered activities, and student-to-teacher interactions. Lead Teachers also agreed that FTL-provided professional development had been effective, with nearly 60% indicating that they provided teacher training to the FTL teachers in their school. Fewer agreed that administrators participated in FTL training or that the community/parents were involved in the FTL program.

***Parent Survey***. A total of 1,241 parents/guardians of FTL students in 90 schools completed the paper-based survey. Overall, parent responses were positive and reflected general agreement that using laptop computers had improved their child's research skills and had increased their child's interest and achievement in school. There was slightly less overall agreement that using laptops had improved their child's writing skills. Less than 20% of the parents had participated in FTL-sponsored activities.

**Student Performance-Based Assessment**

Across all problem-solving areas, the FTL means scores were higher or equal to those of the control group. FTL program students exhibited significantly higher ability in demonstrating understanding of the problem and in identifying what needs to be known to solve the problem. The Technology Task analyses showed highly significant advantages for the FTL Program students with regard to completing Presentation and Internet tasks.

**Student Academic Achievement**

School-level student English, math, reading and writing MEAP scores were compared using a series of 2x2 chi-square frequency analyses. The student outcomes for one pair of schools were not significantly different. Among the remaining seven pairs, four FTL schools outperformed their matched comparison schools in math and writing, while three comparison schools outperformed the FTL schools in math, English, and writing.

## Conclusions

The conclusions of the present study are presented in association with each of the FTL program goals in the following section.

**GOAL 1. Enhance student learning and achievement in core academic subjects with an emphasis on developing the knowledge and skills requisite to the establishment of a 21st Century workforce in Michigan.**

The results suggest that FTL students have greater advantages than non-FTL students with regard to developing the knowledge and skills needed to achieve success in the 21st Century workforce and equal to or enhanced advantages for increased learning and achievement. FTL students as compared to control students exhibited significantly greater ability to locate and utilize Internet resources, develop computer-based presentations and solve problems. The FTL students indicated that they were more interested in learning and felt they would get better jobs in the future as a result of using the laptops. Similarly, the FTL teachers agreed to a significantly higher degree than did teachers represented by the national norms that computer use had a positive impact student learning and achievement. Additionally, observations showed that FTL students were engaged in meaningful computer learning activities significantly more than students represented in the national norms.

**GOAL 2. Provide greater access to equal educational opportunities statewide through ubiquitous access to technology.**

FTL, as documented in this evaluation report, has made significant strides toward providing greater access to equal educational opportunities to students in FTL classrooms. This is evidenced by the program providing laptop computers to students in 195 schools and by data from over 5,700 FTL students who reported that they are very glad that they get to use laptop computers and want to use them again next year. Nearly all students reported that using laptop computers increased their research skills, made schoolwork easier and made them learn more and do better on tests. Similarly, the FTL teachers reported that having laptops had increased their use of student-centered practices, increased student motivation and learning, and improved student computer skills as well as their own personal technology skills. FTL vs. national norm classroom observation data show that computer activities in FTL lessons were significantly more meaningful and that FTL students more frequently used the laptops as learning tools. Collectively, these data present triangulated evidence that FTL provided greater access to equal educational opportunities in Michigan through ubiquitous access to technology.

**GOAL 3. Foster effective use of the wireless technology through systematic professional development (PD) for teachers, administrators and staff.**

There was moderate agreement among the 380 FTL teachers that they had received adequate training to integrate laptops into their instruction, that the quality of laptop lessons was improved as a result of the FTL PD, and that they more frequently integrated laptops into their instruction. Evidence of PD effectiveness was seen during classroom observations in which FTL teachers implemented lessons that were significantly more meaningful, more student-centered, and more often used laptops as tools for learning than did teachers represented by national norms. The results suggest that the PD focus and approach for preparing teachers to integrate effective use of laptops is successful. However, the moderate responses from teachers suggest that the frequency and amount of professional development needs to be increased. Regarding administrators, Lead Teachers from 63 schools reported less administrator participation in FTL PD during 2005-2006 although many administrators modeled the use of technology and were involved in the FTL program.

**GOAL 4. Empower parents and caregivers with the tools to become more involved in their children's education.**

Direct information from over 1,200 parents/caregivers representing approximately half of the FTL schools revealed that parents were supportive of their children using laptops at school. Almost all parents agreed that laptop use had improved their child's research skills and increased their interest and achievement in school. However, very few of the parents reported participation in FTL-sponsored computer training. Similar results are seen in survey responses from FTL teachers and Lead Teachers who generally agreed that parents supported the FTL program, while parental involvement with FTL was minimal.

**GOAL 5 Support innovative structural changes in participating schools and sharing of best practices through the creation of human networks among Program participants.**

Data from this evaluation reveal that the FTL program enabled and supported participating schools to achieve significantly more innovative structural changes during 2005-2006 than schools represented in the national norms. This was evidenced by observing significantly more student-centered activities that engaged students in independent research through the use of laptops as tools. It was also evidenced in FTL students demonstrating significantly higher problem solving, Internet and presentation software ability than matched-control students. Additional evidence is seen in FTL teachers being significantly more confident about meaningfully integrating technology than national norm teachers. Collectively, data from observations, surveys, performance-based assessments, and achievement analyses suggest that the two-year FTL program has been a catalyst for innovative technology interventions that have improved educational opportunities for Michigan's students, while the data also reveal room for continued growth and improvement.

**MICHIGAN FREEDOM TO LEARN**

# 2004-2005 Evaluation Report

This report summarizes the 2005-2006 evaluation results of the Michigan Freedom to Learn (FTL) program. The purpose of the evaluation was threefold: (a) to use rigorous research to assess the effects of FTL in raising student achievement as a function of students becoming more proficient and engaged in using technology as a tool for learning, (b) to provide formative evaluation data to the participant schools to serve as a basis for improvement planning and as documentation of their accomplishments to demonstrate progress; and (c) to provide cumulative evidence of the implementation progress and outcomes of the participant schools.

The major goal of the FTL program is to improve student learning and achievement in Michigan schools through the integration of 21st Century technology tools with teaching and learning in K-12 classrooms. A key component of FTL was to obtain valid data from a rigorous and comprehensive evaluation study to gauge the impacts of the program relative to its primary goals. This year's evaluation involved 195 schools that were awarded Freedom to Learn grants. The primary intervention of the program consisted of providing laptop computers for students in participating schools. In addition, FTL teachers, Lead Teachers, and administrators were provided with extensive professional development opportunities.

## Research Goals

The FTL Program goals are listed below. The evaluation was structured to examine the degree to which each program goal was achieved.

GOAL 1 Enhance student learning and achievement in core academic subjects with an emphasis on developing the knowledge and skills requisite to the establishment of a 21st Century workforce in Michigan.

GOAL 2 Provide greater access to equal educational opportunities statewide through ubiquitous access to technology.

GOAL 3 Foster effective use of the wireless technology through systematic professional development for teachers, administrators and staff.

GOAL 4 Empower parents and caregivers with the tools to become more involved in their children's education.

GOAL 5 Support innovative structural changes in participating schools and sharing of best practices through the creation of human networks among Program participants.

# Participants

A total of 195 schools received Freedom to Learn grants for the 2005-2006 school year. The schools represented both private and public districts from across the entire state. In addition, the participant schools included those from rural Michigan as well as all major metropolitan areas. Although the participating schools included elementary, middle and high schools, initial implementation primarily occurred at the 6th grade level.

Approximately 46% (90 of 195) of the schools participated in one or more aspects of the FTL program evaluation. Specifically, 380 FTL teachers and 5,770 students from 76 schools and Lead Teachers at 63 schools completed online FTL surveys, while 1,241 parents/caregivers of FTL students

from 90 schools completed paper-based surveys. Direct classroom observations were conducted in 826 FTL classrooms.

# Design

A global descriptive design was used for the evaluation. This design employed a mixed-methods approach (Johnson & Onwuegbuzie, 2004) to examine the processes and products that resulted from students using laptops to improve learning. Validated survey and observation instruments, student performance-based assessments, and student level Michigan Educational Assessment Program (MEAP) scores served as the critical data sources in the comprehensive evaluation model. Details of the instrumentation and administration procedures are listed below.

## Measures and Procedures

Four measurement strategies were used to collect the evaluation data: direct classroom observations, surveys, student problem solving and computer skills assessments, and student academic performance.

### Direct Classroom Observation Measures

Lead Teachers and independent external researchers completed extensive training to conduct both multi-class and targeted classroom observations of FTL classrooms. The training prepared them to collect frequency data regarding observed instructional practices with three data collection instruments: the School Observation Measure (SOM©), the Survey of Computer Use (SCU©) and the Rubric for Student-Centered Activities (RSCA©). The RSCA was only used for multi-class observations. The SOM was used to collect data regarding overall classroom activities; the SCU was used to assess student use of computers, while the RSCA was used to measure the strength of application and use of technology to support student-centered activities. The classroom observation instruments are described below.

***SOM.*** The SOM was developed to determine the extent to which different common and alternative teaching practices are used throughout an entire school (Ross, Smith, & Alberg, 1999). The standard or *multi-class* SOM procedure involves observers' visiting 10-12 randomly selected classrooms, for 15 minutes each, during a three-hour visitation period. The procedure used for the current study involved randomly visiting all FTL classrooms in schools with 3 or more FTL classes. The observer examined classroom events and activities descriptively, not judgmentally. Notes were taken relative to the use or nonuse of 24 target strategies. The notes form also contained two global items that use a three-point scale (low, moderate, high) to rate, respectively, the use of academically focused instructional time and degree of student attention and interest. At the conclusion of the three-hour visit, the observer summarized the frequency with which each of the 24 strategies was observed across all classes in general on a data summary form. The frequency was recorded via a 5-point rubric that ranges from (0) Not observed to (4) Extensively. The same 5-point scale was used to summarize how frequently *high* academically focused class time and *high* student interest/attention were observed.

*Targeted* observations were conducted to examine classroom instruction during prearranged 45- to 60-minute sessions in which randomly selected FTL teachers implemented a prepared lesson that integrated the use of laptops. Notes forms were completed every 15 minutes of the lesson and were then summarized on a SOM Data Summary Form.

To ensure the reliability of data, observers received a manual providing definitions of terms, examples and explanations of the target strategies, and a description of procedures for completing the instrument. The target strategies include traditional practices (e.g., direct instruction and independent seatwork) and alternative, predominately student-centered methods associated with educational reforms (e.g., cooperative learning, project-based learning, inquiry, discussion, using technology as a learning tool). The strategies were identified through surveys and discussions involving policy makers, researchers, administrators, and teachers, as those most useful in providing indicators of schools'

instructional philosophies and implementations of commonly used reform designs (Ross, Smith, Alberg, & Lowther, 2001).

After receiving the manual and instruction in a group session, each observer participated in sufficient classroom-based practice exercises to ensure that his/her data were comparable with those of experienced observers. In a 2004 reliability study reported by Sterbinsky, Ross and Burk, observer ratings were within one category for 96% of the multi-class observations and for 91% of the targeted observations.

***SCU.*** A companion instrument to SOM is the Survey of Computer Use (SCU) (Lowther & Ross, 2001). The SCU was completed as part of the SOM observation sessions, during which SCU data were also recorded in 15-minute intervals and then summarized on an overall data form.

The SCU was designed to capture exclusively student access to, ability with, and use of computers rather than teacher use of technology by recording four types of data: (a) computer capacity and currency, (b) configuration, (c) student computer ability and (d) student activities while using computers. Computer capacity and currency is defined as the age and type of computers available for student use and whether or not Internet access was available. Configuration refers to the number of students working at each computer (e.g., alone, in pairs, in small groups). Student computer ability was assessed by recording the number of students who were computer literate (i.e., easily used software features/menus) and the number of students who easily used the keyboard.

The next section of the SCU focuses on student use of computers with regard to: the types of activities, the subject areas of activities, and the software being used. The computer activities are divided into four categories based on the type of software tool: production tools, Internet/research tools, educational software, and testing software. Within each category, primary types of software are identified. For example, under Production Tools, the software includes: word processing, databases, spreadsheets, draw/paint/graphics, presentation (e.g., *PowerPoint*®), authoring (e.g., KidPix®), concept mapping (e.g., Inspiration), and planning (MS Project®). For the Internet/Research Tools, three types of software are included: Internet browser, CD reference materials, and communications (e.g., email, listservs, and chat rooms). The Educational Software also has three types of software: drill/practice/tutorial, problem-solving (e.g., Riverdeep™) and process tools (e.g., Author's Toolkit™). Testing Software has individualized/tracked (Accelerated Reader™) and generic types. With this type of recording system, several activities can be noted during the observation of one student working on a computer. For example, if a student gathered data from the Internet, created a graph from the data, and then imported the graph into a *PowerPoint* presentation, the observer would record three types of software tools as being observed: Internet browser, spreadsheet, and presentation.

This section of the SCU ends by identifying the subject area of each computer activity. The categories include: language arts, mathematics, science, social studies, other, and none. The computer activities and software being used are summarized and recorded using a five-point rubric that ranges from (0) Not Observed to (4) Extensively observed. The final section of the SCU is an "Overall Rubric" designed to assess the degree to which the activity reflects "meaningful use" of computers as a tool to enhance learning. The rubric has four levels: 1 – Low-level use of computers, 2 – Somewhat meaningful, 3 – Meaningful, and 4 - Very meaningful. Reliability data for the SCU (Sterbinsky & Burke, 2004) show that observer ratings were within one category for 97% of the multi-class observations and for 91% of the targeted observations.

***RSCA.*** The Rubric for Student-Centered Activities was developed by CREP (Lowther, Ross, & Plants, 2000) as an extension to SOM and SCU. The RSCA was used by observers to more closely evaluate the degree of learner engagement in seven selected areas considered fundamental to the goals of increasing student-centered learning activities (cooperative learning, project-based learning, higher-level questioning, experiential/hands-on learning, student independent inquiry/research, student discussion, and students as producers of knowledge using technology). These strategies reflect emphasis on higher-order learning and attainment of deep understanding of content and whether or not technology was utilized as a component of the strategy. Such learning outcomes seem consistent with

those likely to be engendered by well-designed, real-world linked exercises, projects, or problems utilizing technology as a learning tool. Each item includes a two-part rating scale. The first is a four-point scale, with 1 indicating a very low level of application, and 4 representing a high level of application. The second is a Yes/No option to the question: "Was technology used?" with space provided to write a brief description of the technology use. The RSCA was completed as part of SOM/SCU observation periods. The RSCA reliability results indicate that observer ratings were within one category for 97% of the multi-class observations and for 90% of the targeted observations (Sterbinsky & Burke, 2004).

**FTL Surveys**

FTL program evaluation surveys were administered to four FTL groups: students, teachers, Lead Teachers, and parents of FTL students. All surveys except the Parent Surveys were administered in an on-line format that was delivered via CREP's Survey Management System (SMS). Parent Surveys were administered using paper-based instruments distributed by the FTL teachers. Brief descriptions of each survey are below.

**FTL Program Evaluation Surveys**

***FTL Student Survey.*** The FTL Student survey presented students with 16 statements regarding classroom use of FTL laptops. Students were asked to use a three-level scale (Yes, Some, No) to rate their level of agreement with each statement. The statements elicited student impressions regarding the laptops improving student learning and achievement, enjoyment of using the laptops, and desire for continued use next year. Students were then asked to indicate the degree to which they completed laptop activities alone or with other students, the typical subject areas of laptop work, and which software they most commonly used.

***FTL-TTQ©.*** The Freedom to Learn Teacher Technology Questionnaire (FTL-TTQ) is an adaptation of a five-part validated Teacher Technology Questionnaire (TTQ). The adaptation from TTQ to FTL-TTQ involved replacing the terms "computers" or "technology" with "FTL laptop computers" in the 20 items. The FTL-TTQ was used to collect teacher perceptions of the FTL program. In the first section, teachers rated their level of agreement with 20 statements regarding five technology-related areas: impact of laptop use on classroom instruction, impact of laptop use on students, teacher readiness to integrate student use of laptops, overall support for the laptop program in the school, and technical support for the laptop program. Items were rated with a five-point Likert-type scale that ranged from (1) Strongly Disagree to (5) Strongly Agree.

The second section was used to collect teacher perceptions regarding Lead Teacher effectiveness. Items focused on participation in professional development provided by the Lead Teacher, impact of Lead Teacher training on the frequency and quality of laptop lessons, and overall value of having a Lead Teacher.

***FTL Lead Teacher Survey (FTL-LT).*** The FTL-LT was used to collect Lead Teacher perceptions of the FTL program. Lead teachers used a five-point Likert-type scale that ranged from (1) Strongly Disagree to (5) Strongly Agree to rate their level of agreement with 24 statements concerning various aspects of the FTL program. The statements concerned administration support and participation, parent support, teacher collaboration and acceptance, and overall impact of FTL on student ability, motivation and achievement. In addition Lead Teachers were asked about types of support and professional development activities they provided to program participants.

***FTL Parent Survey.*** The FTL Parent survey was used to collect parents' perceptions of the benefits of their child using laptops at school. Specifically, parents are asked to indicate the degree (a lot, some, not at all, or not sure) that using laptops had changed their child's interest in school, research skills, achievement, writing skills, involvement in project-type school work, or the ability to work with other students. The survey also asks parents about their participation in activities sponsored by FTL.

**Student Performance-Based Assessment**

A Problem-Solving Task and Technology Task were administered to 6th grade students to examine the impact of FTL on student ability to solve problems and to generate computer products that reflect problem-solving solutions. These student products contained no identifying information to classify them as FTL Program or Control, which allowed trained researchers to employ a "blind" review process to assess student performance. Student Performance-Based Assessment materials are described below.

***Student Problem-Solving Task.*** The purpose of the Student Problem-Solving Task (Ross, Morrison, & Lowther, 2001) was to assess student ability to comprehend problems and formulate solutions. Students were given a task sheet that presented a problem situation regarding recycling cans in a park and instructions for them to describe different aspects of how they would solve the problem.

FTL Program and Control teachers received written instructions for administering the problem-solving task that indicated students should use computers (Microsoft Word®) to complete the task within a 45-minute timeframe. Teachers were asked to read a statement to students at the beginning of the assessment that indicated they should work alone, not include their name on any documents, and do their best work. Trained reviewers judged the students' responses on a rubric composed of 7 Components x 3 Performance Levels. Components consisted of 1) understands problem, 2) identifies what is known about problem, 3) identifies what needs to be known to solve the problem, 4) determines how the data need to be manipulated to solve the problem, 5) describes use of technology, 6) describes how to present findings, and 7) collaborative learning. Data were also collected regarding student experience (none, some, a lot), frequency of use (never, once in a while, a lot), and perceived skill level (none, moderate, excellent) with Microsoft Word.

***Student Technology Task.*** The intent of the Student Technology Task (Lowther & Marvin, 2004) was to determine the degree of proficiency with which 22 basic computer tasks that reflect the National Education Technology Standards (NETS) for Students in grades 6-8 (ISTE, 2000) could be completed. The performance task categories and number of items per category are as follows: spreadsheets (10), presentations (10), and Internet (2). Items assessing word processing (e.g., bolding text) were embedded within the spreadsheet and presentation categories, as these skills are similarly performed in *Excel*® and *PowerPoint*®. Before students started the Technology Task, teachers were asked to read a statement to students indicating they should work alone, not include their name on any documents, and do their best work.

Students were provided with a set of detailed instructions for "what" needed to be done to complete each task, but were not given any guidance on "how" to finish the step-by-step procedures. For example, instructions within the spreadsheet task state, "After you have entered the data into the spreadsheet, enter or select an *Excel* formula that calculates the average number of cans..." rather than "…select the Function ($f$x) key and select "Average" from the list of options."

The spreadsheet task required the students to use basic spreadsheet functions to create a chart. Specifically, the students were asked to enter data into *Excel*, use an *Excel* formula to calculate averages, and create a chart according to a number of specified requirements. The presentation task required students to create a three slide *PowerPoint* presentation with specified text and graphics. The students were asked to insert the *Excel* graph created in the spreadsheet task onto the third slide of the *PowerPoint* presentation. The Internet items (2) were embedded within the presentation tasks as students were asked to obtain content and an image from a researcher-developed website on the Internet for use in the presentation. The Student Technology Task also included six items related to the computer background of the students with regard to *Excel* spreadsheet and *PowerPoint* presentation software. In particular, the students were asked how much experience they had with the software (none, some, a lot), how often they used it (never, once in a while, a lot), and their perceived skill level (none, moderate, excellent).

Trained reviewers used a rubric to assess the two student Technology Task products (spreadsheet and presentation) on the degree to which they completed each task as described: No (0) = Did not complete task as described; Somewhat (1) = Partially completed task as described; and Yes (2) = Completed task as described. Detailed descriptions were included for the "No" and "Yes" rating of each task, while the "somewhat" rating was to be recorded by the reviewer to capture the uniqueness of "partially completed" responses.

**Student Academic Performance**

The subjects of this analysis were 7th graders enrolled in schools that were participating in the Freedom to Learn (FTL) Program. FTL program staff identified eight schools that were considered to be implementing the program effectively. Comparisons of school-level student achievement outcomes were made with comparable schools. These comparison schools were chosen based on key school characteristics:

- Micro-environment: preferably schools within the same district or in a neighborhood district
- SES indicator: percent free/reduced price lunch within range of (+/-10%)
- Ethnicity: percent minority within range of (+/-10%) predominant race and ethnicity of FTL school
- Performance indicator 1: Reading percent proficient within range of (+/-5%)
- Performance indicator 2: Mathematics percent proficient within range of +/-5%)
- Grade Level: similar grade spans
- School size: within 100 students of enrollment size
- Special Education: percent special education students within range of (+/-10%)

Information gleaned from the website, www.schoolmatters.com, was used to select the comparison schools based on the above criteria.

A series of 2x2 chi-square frequency analyses were conducted comparing FTL and comparison schools, to investigate the association between the program and students' achievement in four subjects: English, Math, Reading and Writing[1].

## Data Collection

A data collection summary for the FTL program evaluation is presented in Table 1. A total of 485 hours of direct classroom observations were conducted in 826 FTL classrooms. Collectively, FTL participants completed 7,466 evaluations surveys. Of those, 6,225 were completed via CREP's online Survey Management System, while 1,241 parents completed paper-based evaluations.

[1] Michigan Educational Assessment Program (MEAP), (n.d.) Retrieved December 15, 2006 from http://www.michigan.gov/mde

**Table 1. Data Collection Summary**

| Type | Instrument | Number Collected | Number of Schools | Procedure |
|---|---|---|---|---|
| Multi-Class Observations | SOM<br>SCU<br>RSCA | 86<br>86<br>599 | 86<br>86<br>86 | Multi-class observations were three- hour sessions in which external researchers observed about 10 randomly selected classes for 15 minutes each. The purpose was to obtain a program-wide perspective on common teaching practices and the use of technology in FTL classrooms.<br>One multi-class observation was conducted in FTL schools with 3 or more FTL teachers. |
| Targeted Classroom Observations | SOM<br>SCU | 227<br>227 | 65<br>65 | Target observations were pre-arranged one-hour sessions in which FTL teachers demonstrated a prepared lesson using FTL laptops. Note forms were completed every 15 minutes of the lesson. Up to four targeted observations were conducted by Lead Teachers trained as a Site Researcher in FTL schools with two or more FTL teachers. |
| Teacher Surveys | TTQ | 380 | 77 | Administered on line and made available to all FTL schools with a Lead Teacher |
| Student Survey | Student Laptop Survey | 5,770 | 76 | Administered on line and made available to all FTL schools with a Lead Teacher |
| Parent Survey | Parent Laptop Survey | 1,241 | 90 | Paper-based copies administered to parents from one 6th grade Lead Teacher class at all FTL schools |
| Lead Teacher Survey | Lead Teacher Survey | 75 | 63 | Administered on line and made available to all FTL schools with a Lead Teacher |
| Student Performance-Based Assessment | Problem-Solving Skills | FTL = 11<br>Control = 21 | FTL = 1<br>Control = 2 | The Problem-Solving Task was administered to 1 FTL Program and 2 Control 6th grade classes from a randomly selected school. |
| | Technology Skills | FTL = 27<br>Control = 24 | FTL = 1<br>Control = 2 | The Technology Task was administered to 2 FTL Program and 2 Control 6th grade classes from 2 randomly selected schools. |
| 7th Grade Student Achievement | English | FTL = 669<br>Control = 714 | FTL = 8<br>Control = 8 | Student achievement analyses were conducted to compare the English, mathematics, reading, and writing performances of FTL program vs. control students. |
| | Mathematics | FTL = 668<br>Control = 714 | | |
| | Reading | FTL = 670<br>Control = 715 | | |
| | Writing | FTL = 673<br>Control = 715 | | |

# Results

The results of the study are presented below by measurement strategy. In the Conclusion section, findings are synthesized across instruments to address achievement of FTL program goals. Regardless of design employed, Effect Sizes (ES) were computed using Cohen's d formula (Cohen, 1988) to determine the educational importance of differences. An ES indicates the number of standard deviations by which the "treatment" group surpasses the "control" group. According to Cohen, an ES having an absolute value greater than 0.25 is considered educationally important.

## Multi-Class Observation Results

A total of 86 multi-class observations were conducted in 86 FTL schools, which yielded 246 hours of direct observation in 599 FTL classrooms. The SOM, SCU, and RSCA instruments were used to collect data from each classroom. Results from the multi-class visits are presented below by observation instrument.

### Multi-Class SOM

Data from unannounced, random visits to 599 FTL classrooms revealed that teachers used both traditional and student-centered strategies (see Table 2). For example, direct instruction was seen occasionally to extensively during 82.6% of the visits, while independent seatwork was seen during 73% of the visits. Yet, teachers were also observed serving as facilitators and coaches in 75.5% of the visits. Furthermore, the FTL teachers occasionally to extensively used student-centered practices such as independent research (43.0%), student discussion (38.4%), project-based learning (34.9%), cooperative learning (32.6%), and use of higher-level instructional feedback (38.4%) and questioning (38.3%).

The most frequently observed student activity was use of laptops as a learning tool, which was occasionally to extensively observed in 66.3% of the visits. Students were observed using their laptops as a delivery tool less frequently (35% of the visits). A high level of academic focus (97.7%) and a high level of student attention (89.6%) were occasionally to extensively observed during nearly all of the visits.

**Table 2. Multi-Class SOM Data Summary**

2004-2005 FTL *n* = 6 schools (60 6th grade classrooms)
2005-2006 FTL *n*= 86 schools (599 classrooms from multiple grades); Norm *N* = 552 schools (5,552 classrooms)

| The extent to which each of the following was observed in the classroom. | | Percent Observed | | | FTL | | National Norm | |
|---|---|---|---|---|---|---|---|---|
| | | None or Rarely | Occasionally | Frequently or Extensively | Mean | Standard Deviation | Mean | Standard Deviation |
| ***Instructional Orientation*** | | | | | | | | |
| Direct instruction (lecture) | 04-05 | 50.0 | 16.7 | 33.4 | 2.00 | 1.27 | 2.85 | 0.98 |
| | 05-06 | 17.5 | 29.1 | 53.5 | 2.53 | 1.08 | 2.77 | 1.01 |
| Team teaching | 04-05 | 83.4 | 0.0 | 16.7 | 0.67 | 1.21 | 0.58 | 0.79 |
| | 05-06 | 88.4 | 7.0 | 4.7 | 0.59 | 0.82 | 0.81 | 0.94 |
| Cooperative/collaborative learning | 04-05 | 66.7 | 33.3 | 0.0 | 1.17 | 0.75 | 0.90 | 0.87 |
| | 05-06 | 66.3 | 22.1 | 10.5 | 1.06 | 1.12 | 1.08 | 0.98 |
| Individual tutoring | 04-05 | 100.0 | 0.0 | 0.0 | 0.33 | 0.52 | 0.68 | 0.97 |
| (teacher, peer, aide, adult volunteer) | 05-06 | 64.0 | 19.8 | 16.3 | 1.03 | 1.22 | 0.77 | 0.94 |
| ***Classroom Organization*** | | | | | | | | |
| Ability groups | 04-05 | 100.0 | 0.0 | 0.0 | 0.50 | 0.55 | 0.84 | 1.25 |
| | 05-06 | 91.8 | 7.0 | 1.2 | 0.34 | 0.71 | 1.16 | 1.33 |
| Multi-age grouping | 04-05 | 100.0 | 0.0 | 0.0 | 0.17 | 0.41 | 0.56 | 1.08 |
| | 05-06 | 87.2 | 7.0 | 5.8 | 0.52 | 0.98 | 0.58 | 1.03 |
| Work centers (for individuals or groups) | 04-05 | 100.0 | 0.0 | 0.0 | 0.33 | 0.52 | 1.16 | 1.16 |
| | 05-06 | 95.3 | 2.3 | 2.3 | 0.27 | 0.62 | 1.35 | 1.14 |
| ***Instructional Strategies*** | | | | | | | | |
| Higher level instructional feedback (written or verbal) | 04-05 | 66.7 | 33.3 | 0.0 | 1.17 | 0.75 | 1.34 | 1.56 |
| to enhance student learning | 05-06 | 61.6 | 23.3 | 15.1 | 1.34 | 1.13 | 1.44 | 1.15 |
| Integration of subject areas | 04-05 | 66.7 | 16.7 | 16.7 | 1.00 | 1.27 | 0.52 | 0.82 |
| (interdisciplinary/thematic units) | 05-06 | 83.8 | 8.1 | 8.1 | 0.72 | 1.00 | 0.54 | 0.80 |
| Project-based learning | 04-05 | 100.0 | 0.0 | 0.0 | 0.67 | 0.52 | 0.42 | 0.68 |
| | 05-06 | 64.0 | 18.6 | 16.3 | 1.16 | 1.18 | 0.45 | 0.76 |
| Use of higher-level questioning strategies | 04-05 | 66.7 | 16.7 | 16.7 | 1.17 | 1.17 | 1.54 | 1.15 |
| | 05-06 | 61.7 | 27.9 | 10.4 | 1.28 | 0.99 | 1.63 | 1.12 |

| The extent to which each of the following was observed in the classroom. | | Percent Observed | | | FTL | | National Norm | |
|---|---|---|---|---|---|---|---|---|
| | | None or Rarely | Occasionally | Frequently or Extensively | Mean | Standard Deviation | Mean | Standard Deviation |
| Teacher acting as a coach/facilitator | 04-05 | 33.4 | 16.7 | 50.0 | 2.50 | 1.76 | 2.19 | 1.20 |
| | 05-06 | 24.4 | 20.9 | 54.6 | 2.42 | 1.24 | 2.29 | 1.18 |
| Parent/community involvement in learning activities | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.27 | 0.58 |
| | 05-06 | 98.9 | 0.0 | 1.2 | 0.08 | 0.38 | 0.31 | 0.60 |
| ***Student Activities*** | | | | | | | | |
| Independent seatwork (self-paced worksheets, individual assignments) | 04-05 | 50.0 | 0.0 | 50.0 | 1.83 | 1.33 | 2.50 | 0.98 |
| | 05-06 | 26.8 | 37.2 | 36.0 | 2.10 | 1.14 | 2.41 | 0.98 |
| Experiential, hands-on learning | 04-05 | 50.0 | 33.3 | 16.7 | 1.50 | 1.05 | 1.09 | 0.97 |
| | 05-06 | 79.1 | 16.3 | 4.6 | 0.86 | 0.94 | 1.20 | 1.00 |
| Systematic individual instruction (differentiated assignments geared to individual needs) | 04-05 | 100.0 | 0.0 | 0.0 | 0.17 | 0.41 | 0.32 | 0.69 |
| | 05-06 | 95.3 | 3.5 | 1.2 | 0.35 | 0.61 | 0.44 | 0.76 |
| Sustained writing/composition (self-selected or teacher-generated topics) | 04-05 | 100.0 | 0.0 | 0.0 | 0.80 | 0.45 | 0.67 | 0.87 |
| | 05-06 | 83.7 | 11.6 | 4.7 | 0.62 | 0.87 | 0.75 | 0.86 |
| Sustained reading | 04-05 | 83.3 | 16.7 | 0.0 | 0.67 | 0.82 | 1.01 | 0.97 |
| | 05-06 | 86.1 | 10.5 | 3.5 | 0.62 | 0.86 | 1.08 | 0.98 |
| Independent inquiry/research on the part of students | 04-05 | 33.4 | 33.3 | 33.3 | 1.83 | 1.17 | 0.40 | 0.70 |
| | 05-06 | 57.0 | 26.7 | 16.3 | 1.34 | 1.04 | 0.32 | 0.65 |
| Student discussion | 04-05 | 33.3 | 50.0 | 16.7 | 1.83 | 0.75 | 0.98 | 1.08 |
| | 05-06 | 61.7 | 25.6 | 12.8 | 1.21 | 1.09 | 0.89 | 1.11 |
| ***Technology Use*** | | | | | | | | |
| Computer for instructional delivery (e.g. CAI, drill & practice) | 04-05 | 83.3 | 16.7 | 0.0 | 0.83 | 0.75 | 0.89 | 1.0 |
| | 05-06 | 65.1 | 19.8 | 15.2 | 1.20 | 1.07 | 0.96 | 0.97 |
| Technology as a learning tool or resource (e.g. Internet research, spreadsheet or database creation) | 04-05 | 66.7 | 33.3 | 0.0 | 1.17 | 0.75 | 0.89 | 1.06 |
| | 05-06 | 33.7 | 22.1 | 44.2 | 2.09 | 1.20 | 0.80 | 0.98 |
| ***Assessment*** | | | | | | | | |
| Performance assessment strategies | 04-05 | 83.4 | 16.7 | 0.0 | 0.50 | 0.84 | 0.37 | 0.72 |
| | 05-06 | 96.5 | 2.3 | 1.2 | 0.28 | 0.57 | 0.50 | 0.83 |
| Student self-assessment (portfolios, individual record books) | 04-05 | 83.4 | 16.7 | 0.0 | 0.50 | 0.84 | 0.26 | 0.60 |
| | 05-06 | 93.0 | 4.7 | 2.4 | 0.30 | 0.72 | 0.32 | 0.65 |
| ***Summary Items*** | | | | | | | | |
| High academically focused class time | 04-05 | 33.3 | 16.7 | 50.0 | 2.17 | 0.98 | 3.14 | 0.95 |
| | 05-06 | 2.3 | 15.1 | 82.6 | 3.22 | 0.79 | 3.33 | 0.80 |
| High level of student attention, interest, engagement | 04-05 | 16.7 | 16.7 | 66.7 | 2.67 | 1.03 | 2.93 | 0.93 |
| | 05-06 | 10.5 | 19.8 | 69.8 | 2.87 | 0.98 | 3.12 | 0.83 |

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively

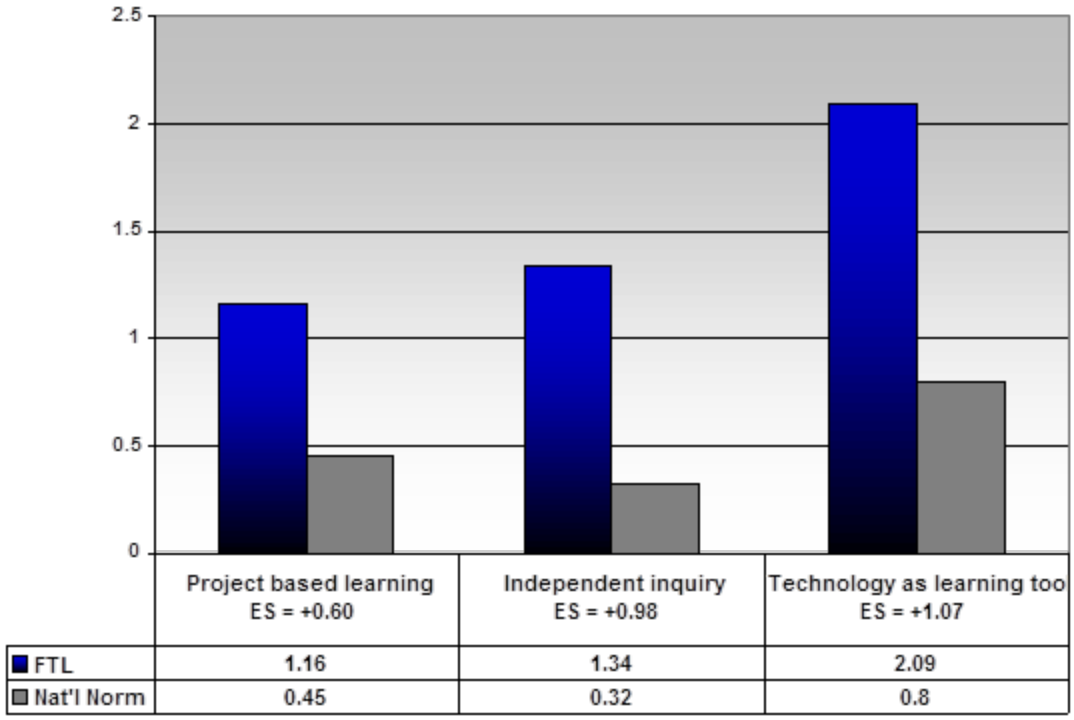
**Multi-Class SOM Inferential Results: FTL vs. National Norms.**

A series of *t*-tests comparing the FTL and national norm means on the 26 SOM items showed significantly higher frequency for FTL on three items and for the SOM national norms on seven items (see Table 3 and Figure 1). The most striking difference favoring FTL was student use of the laptops as a learning tool (FTL *M* = 2.09, SOM norm *M* = 0.80; *ES* = +1.07) as this strategy directly reflects FTL program goals. Also noteworthy were the significant differences in FTL teacher use of independent inquiry and/or research (FTL *M* = 1.34, SOM norm *M* = 0.32; *ES* = +0.98) and project-based learning (FTL *M* = 1.16, SOM norm *M* = 0.45; *ES* = +0.60). The analyses revealed that the greatest significant difference that favored the national norms were the use of work centers, which is understandable since work centers are less necessary when each student has an Internet-connected laptop.

**Table 3. Multi-Class SOM: Significant Differences Between FTL and National Norms**

| | FTL (*n* = 86) | | National Norms (*N* = 552) | | | | |
|---|---|---|---|---|---|---|---|
| **SOM Items** | ***M*** | ***SD*** | ***M*** | ***SD*** | ***t (85)*** | ***p**** | ***ES*** |
| Technology as a learning tool or resource | 2.09 | 1.20 | .80 | .98 | 9.958 | .001 | +1.07 |
| Independent inquiry/research on the part of students | 1.34 | 1.04 | .32 | .65 | 9.106 | .001 | +0.98 |
| Project-based learning | 1.16 | 1.18 | .45 | .76 | 5.567 | .001 | +0.60 |
| Use of higher-level questioning strategies | 1.28 | .99 | 1.63 | 1.12 | -3.287 | .001 | -0.35 |
| Experiential, hands-on learning | .86 | .94 | 1.20 | 1.00 | -3.367 | .001 | -0.36 |
| Performance assessment strategies | .28 | .57 | .50 | .83 | -3.615 | .001 | -0.39 |
| Sustained reading | .62 | .86 | 1.08 | .98 | -5.022 | .001 | -0.54 |
| Parent/community involvement in learning activities | .08 | .38 | .31 | .60 | -5.544 | .001 | -0.60 |
| Ability groups | .34 | .71 | 1.16 | 1.33 | -10.700 | .001 | -1.15 |
| Work centers (for individuals or groups) | .27 | .62 | 1.35 | 1.14 | -16.149 | .001 | -1.74 |

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively
**Bonferroni adjustment was used. Alpha is considered as .002 (.05/26)*
Red Text = Norm significantly higher than FTL




Scale: 0 = Not Observed; 4 = Extensively Observed

**Figure 1. Multi-Class SOM: Selected Significant Differences Between FTL and National Norms**

**Multi-Class SCU**

As seen in Table 4, when technology use was observed in FTL classrooms, the students were equipped with and using a laptop computer. The computer literacy skills of those students ranged from moderate (36.0%) to very good (52.3%). The FTL teachers integrated a wide variety of computer activities into their instruction as 18 of the 20 (90.0%) computer applications listed on the SCU were observed during unannounced visits to 599 FTL classrooms (see Table 5). Not surprisingly, the Internet was the most commonly used tool, as it was occasionally to extensively observed during 65.1% of the visits. Other computer uses included word processing (45.4%), other research tools (1.2%), presentation software (15.1%), and drill and practice educational software (10.5%). The subject areas of the computer activities that used production tools were primarily focused on language arts (53.5%), social studies (40.7%) and science (37.2%). The Internet/research activities were fairly equally distributed across language arts (53.5%), science (52.3%), and social studies (50.0%). The uses of educational and testing software were mainly for practicing or testing mathematics knowledge and skills.

***Meaningfulness of Computer Activities.*** When examining the meaningfulness of student computer activities, the data revealed very positive trends (see Table 5). Specifically, of all the computer activities observed during random visits to 599 classes, only 10.5% were considered "Low-level" use of computers; whereas, over 70% were rated as being "Meaningful" (54.6%) or "Somewhat Meaningful" (43.0%) use of computers. And encouragingly, over one-fourth (28%) of the student computer activities were rated as being "Very Meaningful" use of the laptops. According to SCU (Lowther & Ross, 2000), meaningful activities are those that "were problem-based, required some critical thinking skills, and some use of computer applications to locate and/or process information or some manipulation of educational software variables to reach solutions." In contrast, low-level computer activities "in general required no critical thinking, e.g., used computer applications for copying text or free-time drawing, or used educational software for drill & practice, tutorials, or games."

**Table 4. Multi-Class SCU Data Summary**

| Computer Configuration | Year | % |
|---|---|---|
| Percentages of classrooms with the following numbers of computers or digital tools: | | |
| None; One, or 2 -4 | 04-05 | 0.0 |
| | 05-06 | 3.5 |
| 5 – 10 | 04-05 | 16.7 |
| | 05-06 | 7.0 |
| 11 or more | 04-05 | 83.3 |
| | 05-06 | 89.5 |
| *Percentages of classrooms in which the majority of computers were:* | | |
| Up-to-date | 04-05 | 100.0 |
| | 05-06 | 96.5 |
| Aging, but adequate | 04-05 | 0.0 |
| | 05-06 | 1.2 |
| Outdated/limited capacity | 04-05 | 0.0 |
| | 05-06 | 0.0 |
| *Percentages of classrooms in which the majority of computers were:* | | |
| Connected to the Internet | 04-05 | 100.0 |
| | 05-06 | 94.2 |
| **Student Computer Use** | | |
| *Percentage of classrooms in which computers or digital tools were used by:* | | |
| Few (less than 10%) to Some (about 10-50%) students | 04-05 | 33.4 |
| | 05-06 | 8.2 |
| Most (about 51-90%) students | 04-05 | 0.0 |
| | 05-06 | 15.1 |
| Nearly all (91-100%) students | 04-05 | 66.7 |
| | 05-06 | 70.9 |
| *Percentage of classrooms in which students worked with computers or digital tools:* | | |
| Alone | 04-05 | 100.0 |
| | 05-06 | 87.2 |
| In pairs or small groups | 04-05 | 0.0 |
| | 05-06 | 7.0 |
| *Percentage of classrooms in which student computer literacy skills were:* | | |
| Poor | 04-05 | 0.0 |
| | 05-06 | 0.0 |
| Moderate | 04-05 | 50.0 |
| | 05-06 | 36.0 |
| Very good | 04-05 | 50.0 |
| | 05-06 | 52.3 |
| Not observed | 04-05 | 0.0 |
| | 05-06 | 11.6 |
| *Percentage of classrooms in which student keyboarding skills were:* | | |
| Poor | 04-05 | 0.0 |
| | 05-06 | 0.0 |
| Moderate | 04-05 | 50.0 |
| | 05-06 | 32.6 |
| Very good | 04-05 | 16.7 |
| | 05-06 | 38.4 |
| Not observed | 04-05 | 33.3 |
| | 05-06 | 29.1 |

| Digital Devices available for student use | | Not or Rarely Observed | Occasionally | Frequently or Extensively |
|---|---|---|---|---|
| Desktop Computers | 04-05 | 100.0 | 0.0 | 0.0 |
| | 05-06 | 98.8 | 1.2 | 0.0 |
| Laptop Computers | 04-05 | 33.3 | 33.3 | 33.3 |
| | 05-06 | 17.5 | 3.5 | 79.0 |
| Personal Data Assistants (PDA) | 04-05 | 100.0 | 0.0 | 0.0 |
| | 05-06 | 100.0 | 0.0 | 0.0 |
| Graphing Calculator | 04-05 | 100.0 | 0.0 | 0.0 |
| | 05-06 | 100.0 | 0.0 | 0.0 |
| Information Processor (e.g., Alphaboard) | 04-05 | 100.0 | 0.0 | 0.0 |
| | 05-06 | 100.0 | 0.0 | 0.0 |
| Digital Accessories (e.g., camera, scanner, probes) | 04-05 | 100.0 | 0.0 | 0.0 |
| | 05-06 | 97.7 | 1.2 | 0.0 |

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively
*Note*. Item percentages may not total 100% because of missing data.

### Table 5. Multi-Class SCU: Frequency of Observed Computer Activities

FTL 2004-2005 n = 6 (60 6th grade classrooms); National Norm N = 563
FTL 2005-2006 n= 86 (599 FTL classrooms)

| The extent to which each of the following was observed in the classroom. | | Percent Observed | | | FTL | | National Norm | |
|---|---|---|---|---|---|---|---|---|
| | | None or Rarely | Occasionally | Frequently or Extensively | Mean | Standard Deviation | Mean | Standard Deviation |
| **Production Tools** | | | | | | | | |
| Word Processing | 04-05 | 100.0 | 0.0 | 0.0 | 0.67 | 0.52 | 0.42 | 0.81 |
| | 05-06 | 54.7 | 25.6 | 19.8 | 1.41 | 1.19 | 0.50 | 0.90 |
| Database | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.01 | 0.15 |
| | 05-06 | 98.8 | 0.0 | 1.2 | 0.06 | 0.35 | 0.02 | 0.19 |
| Spreadsheet | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.06 | 0.28 |
| | 05-06 | 98.9 | 1.2 | 0.0 | 0.07 | 0.30 | 0.07 | 0.35 |
| Draw/Paint/Graphics | 04-05 | 100.0 | 0.0 | 0.0 | 0.17 | 0.4 | 0.16 | 0.49 |
| | 05-06 | 97.7 | 2.3 | 0.0 | 0.21 | 0.46 | 0.19 | 0.57 |
| Presentation (e.g., MS *PowerPoint*) | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.25 | 0.67 |
| | 05-06 | 84.9 | 9.3 | 5.8 | 0.56 | 0.89 | 0.26 | 0.68 |
| Authoring (e.g., HyperStudio) | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.60 |
| | 05-06 | 97.7 | 2.3 | 0.0 | 0.10 | 0.38 | 0.02 | 0.20 |
| Concept Mapping (e.g., Inspiration) | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.07 | 0.38 |
| | 05-06 | 98.9 | 1.2 | 0.0 | 0.03 | 0.24 | 0.08 | 0.40 |
| Planning (e.g., MS Project) | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.60 |
| | 05-06 | 100.0 | 0.0 | 0.0 | 0.03 | 0.18 | 0.01 | 0.11 |
| Other | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.11 | 0.46 |
| | 05-06 | 96.5 | 2.3 | 0.0 | 0.11 | 0.38 | 0.10 | 0.46 |
| **Internet/Research Tools** | | | | | | | | |
| Internet Browser (e.g., Netscape) | 04-05 | 66.7 | 0.0 | 33.3 | 1.33 | 1.75 | 0.70 | 1.09 |
| | 05-06 | 34.9 | 20.9 | 44.2 | 2.13 | 1.37 | 0.73 | 1.12 |
| CD Reference (encyclopedias, etc.) | 04-05 | 100.0 | 0.0 | 0.0 | 0.17 | 0.41 | 0.04 | 0.27 |
| | 05-06 | 93.0 | 3.5 | 2.3 | 0.21 | 0.62 | 0.05 | 0.29 |
| Communications | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.02 | 0.21 |
| | 05-06 | 97.7 | 0.0 | 0.0 | 0.05 | 0.21 | 0.02 | 0.25 |
| Other | 04-05 | 83.3 | 16.7 | 0.0 | 0.67 | 0.82 | 0.06 | 0.33 |
| | 05-06 | 98.9 | 1.2 | 0.0 | 0.09 | 0.33 | 0.09 | 0.45 |

| The extent to which each of the following was observed in the classroom. | | Percent Observed | | | FTL | | National Norm | |
|---|---|---|---|---|---|---|---|---|
| | | None or Rarely | Occasionally | Frequently or Extensively | Mean | Standard Deviation | Mean | Standard Deviation |
| **Educational Software** | | | | | | | | |
| Drill/Practice/Tutorial | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.71 | 1.01 |
| | 05-06 | 89.5 | 5.8 | 4.7 | 0.55 | 0.85 | 0.73 | 1.06 |
| Problem Solving (e.g., SimCity) | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.06 | 0.27 |
| | 05-06 | 100.0 | 0.0 | 0.0 | 0.03 | 0.18 | 0.07 | 0.31 |
| Process Tools (e.g., Geometer's Sketchpad) | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.01 | 0.85 |
| | 05-06 | 97.7 | 2.3 | 0.0 | 0.06 | 0.32 | 0.03 | 0.27 |
| Other | 04-05 | 83.4 | 16.7 | 0.0 | 0.50 | 0.84 | 0.17 | 0.58 |
| | 05-06 | 97.6 | 1.2 | 0.0 | 0.14 | 0.38 | 0.21 | 0.66 |
| **Testing Software** | | | | | | | | |
| Individualized/Tracked (e.g., Accelerated Reader) | 04-05 | 100.0 | 0.0 | 0.0 | 0.17 | 0.41 | 0.53 | 0.87 |
| | 05-06 | 97.6 | 2.3 | 0.0 | 0.13 | 0.40 | 0.52 | 0.91 |
| Generic | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.01 | 0.97 |
| | 05-06 | 98.8 | 1.2 | 0.0 | 0.06 | 0.28 | 0.02 | 0.20 |
| Other | 04-05 | 83.3 | 16.7 | 0.0 | 0.33 | 0.82 | 0.07 | 0.36 |
| | 05-06 | 96.5 | 0.0 | 2.4 | 0.16 | 0.59 | 0.08 | 0.41 |
| **Meaningfulness of Computer Activities** | | | | | | | | |
| Low level use of computers | 04-05 | 66.7 | 16.7 | 16.7 | 1.17 | 1.17 | 0.85 | 1.12 |
| | 05-06 | 87.2 | 9.3 | 1.2 | 0.49 | 0.72 | 0.84 | 1.16 |
| Somewhat meaningful use of computers | 04-05 | 66.7 | 33.3 | 0.0 | 1.00 | 0.90 | 0.73 | 0.97 |
| | 05-06 | 53.5 | 20.9 | 22.1 | 1.51 | 1.19 | 0.75 | 1.00 |
| Meaningful use of computers | 04-05 | 50.0 | 33.3 | 16.7 | 1.67 | 1.34 | 0.80 | 1.16 |
| | 05-06 | 45.3 | 26.7 | 27.9 | 1.62 | 1.26 | 0.86 | 1.21 |
| Very meaningful use of computers | 04-05 | 100.0 | 0.0 | 0.0 | 0.17 | 0.41 | 0.32 | 0.77 |
| | 05-06 | 68.6 | 14.0 | 14.0 | 0.98 | 1.22 | 0.39 | 0.88 |

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively
Note. Item percentages may not total 100% because of missing data.

| Subject Areas of Computer Activities | | Language | Mathematics | Science | S. Studies | Other | Percent Not Observed |
|---|---|---|---|---|---|---|---|
| Production Tools | 04-05 | 33.3 | 0.0 | 16.7 | 16.7 | 16.7 | 50.0 |
| | 05-06 | 53.5 | 19.8 | 37.2 | 40.7 | 22.1 | 19.8 |
| Internet/Research Tools | 04-05 | 33.3 | 33.3 | 16.7 | 16.7 | 16.7 | 16.7 |
| | 05-06 | 53.5 | 23.3 | 52.3 | 50.0 | 18.6 | 14.0 |
| Educational Software | 04-05 | 16.7 | 0.0 | 16.7 | 0.0 | 0.0 | 66.7 |
| | 05-06 | 14.0 | 27.9 | 17.4 | 7.0 | 7.0 | 52.3 |
| Testing Software | 04-05 | 16.7 | 16.7 | 0.0 | 16.7 | 0.0 | 66.7 |
| | 05-06 | 8.1 | 11.6 | 4.7 | 3.5 | 2.3 | 74.4 |

*Note*. Item percentages may not total 100% because of missing data and use of activities involving more than one subject area.

**Multi-Class SCU Inferential Results: FTL vs. National Norms**

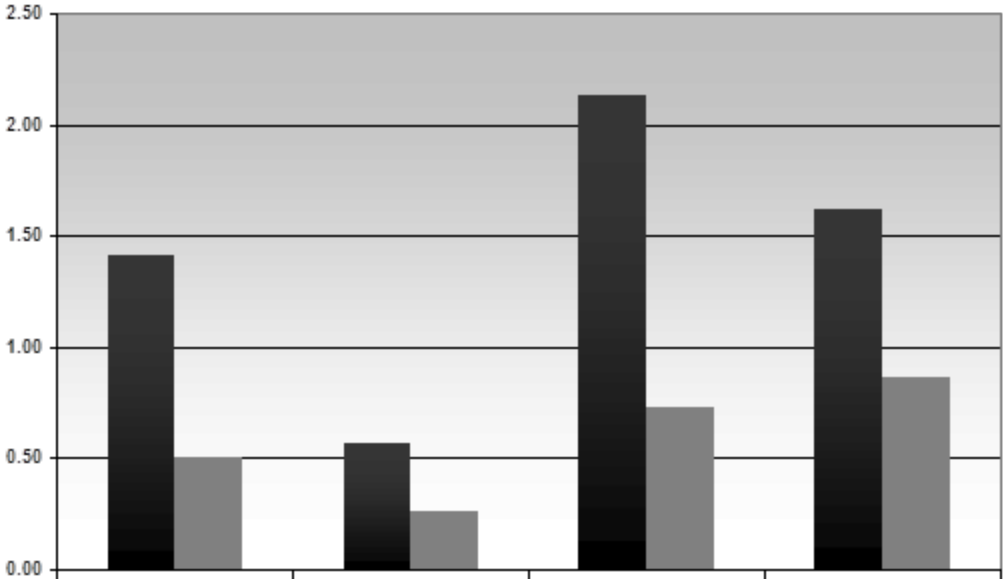
Comparison of multi-class SCU means with the SCU national norms revealed four significant differences (see Table 6 and Figure 2). The most prominent difference favoring FTL was student use of the Internet. Specifically, the FTL students used the Internet significantly more than students represented by the national norm (FTL *M* = 2.13, SCU norm *M* = 0.73; *ES* = +1.02). Significant FTL vs. national norm differences were also revealed with regard to use of word processing (FTL *M* = 1.41, SOM norm *M* = 0.50; *ES* = +0.76) and presentation software (FTL *M* = 0.56, SOM norm *M* = 0.26; *ES* = +0.34). Interestingly, the analyses revealed that the greatest significant difference that favored the national norms was student use of tracked, individualized testing software (FTL *M* = 0.13, SOM norm *M* = 0.52; *ES* = -0.98), which is typically associated with structured core content intervention programs such as Accelerated Reading or Accelerated Math. Since the FTL program focuses on using laptops as learning rather than assessment tools, this difference is not unexpected.

***Overall Meaningful Use of Computers.*** The analysis revealed significant FTL vs. national norm differences on the four levels of the "Meaningful" use of computers rubric (see Table 6). The greatest differences were seen in FTL teacher use of "Meaningful" (*ES* = +0.60) and "Somewhat meaningful" (*ES* = +0.62) computer activities. Also promising is the significantly greater (*ES* = +0.47) use of "Very meaningful" computer activities coupled with the significantly lower (*ES* = -0.48) use of "Low-level" activities.

**Table 6. Multi-Class SCU: Significant Differences Between FTL and National Norms**

| | Program (*n* = 86) | | National Norms (*N* = 563) | | | | |
|---|---|---|---|---|---|---|---|
| **SCU ITEMS** | ***M*** | ***SD*** | ***M*** | ***SD*** | ***t (85)*** | ***p*** | ***ES*** |
| **COMPUTER ACTIVITIES** | | | | | | | |
| ***Production Tools*** | | | | | | | |
| Word Processor | 1.41 | 1.19 | .50 | .90 | 7.057 | .001 | +0.76 |
| Presentation | .56 | .89 | .26 | .68 | 3.109 | .003 | +0.34 |
| ***Internet/Research Tools*** | | | | | | | |
| Internet Browser | 2.13 | 1.37 | .73 | 1.12 | 9.461 | .001 | +1.02 |
| ***Testing Software*** | | | | | | | |
| Individualized/Tracked | .13 | .40 | .52 | .87 | -9.093 | .001 | -0.98 |
| **MEANINGFULNESS** | | | | | | | |
| Low level use of computers | .49 | .72 | .84 | 1.16 | -4.482 | .001 | -0.48 |
| Somewhat meaningful use of computers | 1.51 | 1.19 | .75 | 1.00 | 5.772 | .001 | +0.62 |
| Meaningful use of computers | 1.62 | 1.26 | .86 | 1.21 | 5.579 | .001 | +0.60 |
| Very meaningful use of computers | .98 | 1.22 | .39 | .88 | 4.377 | .001 | +0.47 |

**p < .003
Rating scale: 0 = Not observed; 4 = Extensively
Red Text = Norm significantly higher than FTL
Scale: 0 = Non Observed; 4 = Extensively Observed




| | Word Processor ES = +0.76 | Presentation ES = +0.34 | Internet Browser ES = +1.02 | Meaningful computer use ES = +0.60 |
|---|---|---|---|---|
| FTL | 1.41 | 0.56 | 2.13 | 1.62 |
| Nat'l Norms | 0.50 | 0.26 | 0.73 | 0.86 |

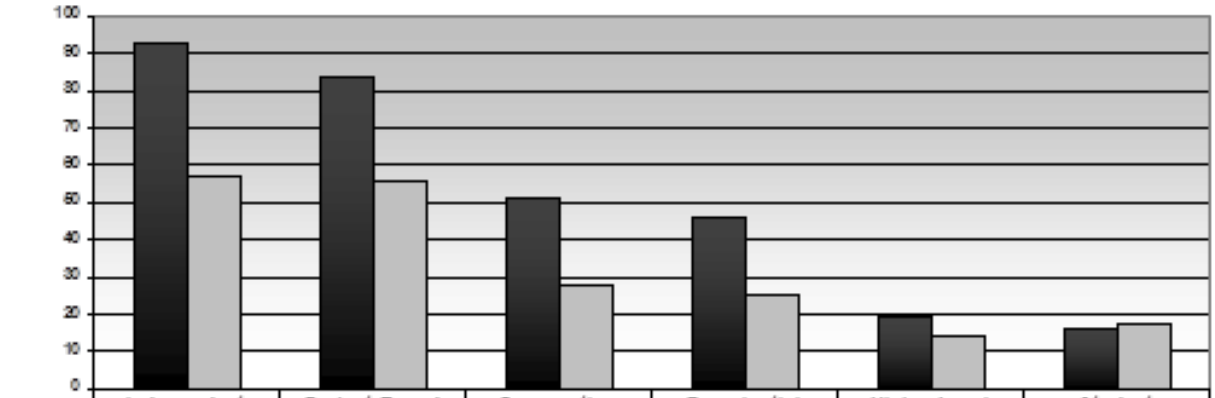
**Figure 2: Multi-Class SCU: Selected Significant Differences Between FTL and National Norms**

**Rubric for Student-Centered Activities (RSCA)**

Results address the percentage of multi-class sessions in which each RSCA strategy was observed at least once, the quality/depth of observed strategy applications, and the percentage of sessions in which technology was used with the observed strategy. When an RSCA strategy was observed, the implementation was rated with the following scale (1 = limited application to 4 = strong application). Therefore, when reviewing the RSCA mean scores, it is important to note the frequency with which the strategy was observed when examining the overall ratings.

A descriptive summary of the 2005-2006 FTL and national norm data are presented in Table 7. The RSCA was not used during classroom observations during 2004-2005. The results suggest that FTL teachers implemented somewhat strong applications of "Experiential Hands-On Learning" (*M* = 2.79), "Project-Based Learning" (*M* = 2.74), and use of "Higher-Level Questioning" (*M* = 2.07). FTL teachers were also able to implement somewhat strong applications of "Students as Producers of Knowledge" (*M* = 2.12), which involves student use of technology as a tool.

***RSCA Technology Use.*** As might be expected, technology was used to support all RSCA strategies to a greater extent in FTL classes as compared to the national norm, except for Student Discussion (FTL = 15.7%, Norm = 16.5%) (Figure 3). Understandably, technology was most frequently used to support student independent inquiry, such as searching for information on the Internet (93.3%) and to support project-based learning (83.6%).




| | Independent Inquiry | Project-Based Learning | Cooperative Learning | Experiential Hands-On | Higher Level Questioning | Student Discussion |
|---|---|---|---|---|---|---|
| FTL | 93 | 84 | 51 | 46 | 19 | 16 |
| Norm | 57 | 56 | 28 | 25 | 14 | 17 |

*Note*. "Students as producers of knowledge" is not included because use of technology is a required component.

**Figure 3. Percent of FTL vs. National Norm Multi-Class RSCA with Technology Use**

**Table 7. Multi-Class RSCA: Percent of Observed Strategies by Application Strength and Technology Use**

2004-2005 = NA (RSCA was not used)
2005-2006 n = 599; RSCA National Norm N = 1,788

| | % Observed | | Limited Application1 | | Somewhat Limited Application2 | | Somewhat Strong Application 3 | | Strong Application 4 | | Mean | | Technology Used FTL | | Natl Norm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | *n* | % | *n* | % | *n* | % | n | % | *n* | % | FTL | Nat. Norm | n | % | % |
| Experiential Hands-On | 84 | 14.0 | 10 | 11.9 | 21 | 25.0 | 30 | 35.7 | 23 | 27.4 | 2.79 | 2.46 | 39 | 46.4 | 25.1 |
| Project-Based Learning | 110 | 18.4 | 21 | 19.1 | 23 | 20.9 | 30 | 27.3 | 36 | 32.7 | 2.74 | 2.58 | 92 | 83.6 | 55.8 |
| Higher level Questioning | 133 | 22.2 | 51 | 38.3 | 34 | 25.6 | 36 | 27.1 | 12 | 9.0 | 2.07 | 2.21 | 25 | 18.8 | 14.4 |
| Cooperative Learning | 109 | 18.2 | 45 | 41.3 | 33 | 30.3 | 21 | 19.3 | 10 | 9.2 | 1.96 | 2.16 | 55 | 50.5 | 27.8 |
| Student Discussion | 134 | 22.4 | 69 | 51.5 | 35 | 26.1 | 21 | 15.7 | 9 | 6.7 | 1.78 | 2.07 | 21 | 15.7 | 16.5 |
| Independent Inquiry | 194 | 32.4 | 102 | 52.6 | 51 | 26.3 | 26 | 13.4 | 15 | 7.7 | 1.76 | 2.05 | 181 | 93.3 | 57.0 |
| Students as Producers | 244 | 40.8 | 87 | 35.7 | 75 | 30.7 | 48 | 19.7 | 34 | 13.9 | 2.12 | 2.08 | N/A | N/A | N/A |

**RSCA Inferential results: FTL vs. National Norms**

Inferential analyses (*t*-test for independent samples) were conducted to compare FTL vs. national norm RSCA rubric ratings. As seen in Table 8, the quality with which FTL teachers implemented experiential, hands-on learning experiences for FTL students was significantly higher than that of teachers represented in the national norms ($p$ = .003; *ES* = +0.33). The results, on the other hand, favored the national norms on two strategies: independent inquiry ($p$ = .001; *ES* = -0.30) and student discussion ($p$ = .001; *ES* = -0.31).

**Table 8. Multi-class RSCA: Significant Differences Between FTL and National Norms**

| | Program (*n* =599) | | National Norms | | | | |
|---|---|---|---|---|---|---|---|
| RSCA Items | *M** | *SD* | *M* | *t* | *df* | *p* | *ES* |
| Experiential hands-on learning | 2.79 | .98 | 2.46 | 3.03 | 83 | .003 | 0.33 |
| Independent inquiry/research | 1.76 | .95 | 2.05 | -4.17 | 193 | .001 | -0.30 |
| Student discussion | 1.78 | .94 | 2.07 | -3.59 | 133 | .001 | -0.31 |

**p < .007
Rating scale: 1 = Limited Application; 4 = Strong Application
Red Text = Norm significantly higher than FTL

## Targeted Classroom Observation Results

Targeted observations were conducted in 227 FTL classrooms. The data were collected with SOMs and SCUs during prearranged one-hour sessions in which FTL teachers were asked to implement a prepared lesson using the FTL laptops.

### Targeted SOM

Data from targeted visits to FTL classrooms revealed that the teachers primarily implemented student-centered activities during the observations (see Table 9). Specifically, the following activities were observed frequently or extensively during the indicated percentages of visits: teachers acting as facilitators and coaches (62.5%), project-based learning (37.9%), integration of subject areas (23.4%), higher-level questioning (20.7%) and higher-level instructional feedback (23.4%). Of key interest to this study, the students were frequently to extensively using their laptops as a tool to support and enhance their learning activities (72.2%), which included independent research (45.0%), and experiential hands-on learning (22.9%). Teachers and students were also frequently to extensively observed using the laptops for instructional delivery purposes in 26.5% of the classrooms. The majority of the targeted classrooms frequently to extensively had a high academic focus (85.5%) and high student engagement and interest (86.3%).

### Table 9. Targeted SOM Data Summary

2004-2005 FTL n = 16 6th grade classrooms; National Norm N = 552
2005-2006 FTL n = 227; National Norm N = 552

| The extent to which each of the following was observed in the classroom. | | Percent Observed | | | FTL | | National Norm | |
|---|---|---|---|---|---|---|---|---|
| | | None or Rarely | Occasionally | Frequently or Extensively | Mean | Standard Deviation | Mean | Standard Deviation |
| ***Instructional Orientation*** | | | | | | | | |
| Direct instruction (lecture) | 04-05 | 6.3 | 50.0 | 37.5 | 2.40 | 0.99 | 2.85 | 0.98 |
| | 05-06 | 38.3 | 32.2 | 29.1 | 1.82 | 1.25 | 2.77 | 1.01 |
| Team teaching | 04-05 | 87.5 | 0.0 | 12.6 | 0.44 | 1.21 | 0.58 | 0.79 |
| | 05-06 | 88.9 | 3.1 | 5.3 | 0.31 | 0.91 | 0.81 | 0.94 |
| Cooperative/collaborative learning | 04-05 | 62.5 | 6.3 | 31s.3 | 1.13 | 1.54 | 0.90 | 0.87 |
| | 05-06 | 66.5 | 10.6 | 19.9 | 0.97 | 1.42 | 1.08 | 0.98 |
| Individual tutoring (teacher, peer, aide, adult volunteer) | 04-05 | 68.8 | 18.8 | 12.5 | 0.75 | 1.18 | 0.68 | 0.97 |
| | 05-06 | 70.1 | 13.7 | 13.6 | 0.81 | 1.33 | 0.77 | 0.94 |
| ***Classroom Organization*** | | | | | | | | |
| Ability groups | 04-05 | 68.8 | 12.5 | 12.5 | 0.80 | 1.47 | 0.84 | 1.25 |
| | 05-06 | 78.0 | 4.4 | 16.3 | 0.68 | 1.35 | 1.16 | 1.33 |
| Multi-age grouping | 04-05 | 75.0 | 12.5 | 6.3 | 0.53 | 1.19 | 0.56 | 1.08 |
| | 05-06 | 86.7 | 4.4 | 7.5 | 0.42 | 1.06 | 0.58 | 1.03 |
| Work centers (for individuals or groups) | 04-05 | 81.3 | 6.3 | 6.3 | 0.40 | 0.91 | 1.16 | 1.16 |
| | 05-06 | 85.9 | 4.8 | 7.9 | 0.41 | 1.05 | 1.35 | 1.14 |
| ***Instructional Strategies*** | | | | | | | | |
| Higher level instructional feedback (written or verbal) to enhance student learning | 04-05 | 75.0 | 12.5 | 12.5 | 0.75 | 1.13 | 1.34 | 1.56 |
| | 05-06 | 51.6 | 22.5 | 23.4 | 1.38 | 1.4 | 1.44 | 1.15 |
| Integration of subject areas (interdisciplinary/thematic units) | 04-05 | 81.3 | 0.0 | 18.8 | 0.56 | 1.21 | 0.52 | 0.82 |
| | 05-06 | 62.9 | 11.5 | 23.4 | 1.13 | 1.52 | 0.54 | 0.80 |
| Project-based learning | 04-05 | 68.8 | 6.3 | 25.1 | 1.06 | 1.69 | 0.42 | 0.68 |
| | 05-06 | 53.7 | 7.0 | 37.9 | 1.60 | 1.78 | 0.45 | 0.76 |
| Use of higher-level questioning strategies | 04-05 | 75.0 | 12.5 | 12.5 | 0.81 | 1.28 | 1.54 | 1.15 |
| | 05-06 | 52.0 | 23.3 | 20.7 | 1.32 | 1.36 | 1.63 | 1.12 |
| Teacher acting as a coach/facilitator | 04-05 | 18.8 | 12.5 | 68.8 | 2.69 | 1.20 | 2.19 | 1.20 |
| | 05-06 | 20.7 | 15.9 | 62.5 | 2.65 | 1.42 | 2.29 | 1.18 |

| The extent to which each of the following was observed in the classroom. | | Percent Observed | | | FTL | | National Norm | |
|---|---|---|---|---|---|---|---|---|
| | | None or Rarely | Occasionally | Frequently or Extensively | Mean | Standard Deviation | Mean | Standard Deviation |
| Parent/community involvement in learning activities | 04-05 | 93.8 | 6.3 | 0.0 | 0.19 | 0.54 | 0.27 | 0.58 |
| | 05-06 | 95.2 | 0.0 | 1.8 | 0.07 | 0.48 | 0.31 | 0.60 |
| ***Student Activities*** | | | | | | | | |
| Independent seatwork (self-paced worksheets, individual assignments) | 04-05 | 37.6 | 12.5 | 50.0 | 2.06 | 1.65 | 2.50 | 0.98 |
| | 05-06 | 45.8 | 8.8 | 43.6 | 1.88 | 1.73 | 2.41 | 0.98 |
| Experiential, hands-on learning | 04-05 | 62.5 | 6.3 | 31.3 | 1.06 | 1.44 | 1.09 | 0.97 |
| | 05-06 | 68.7 | 6.6 | 22.9 | 0.98 | 1.48 | 1.20 | 1.00 |
| Systematic individual instruction (differential assignments geared to individual needs) | 04-05 | 75.0 | 6.3 | 18.8 | 0.75 | 1.39 | 0.32 | 0.69 |
| | 05-06 | 88.1 | 5.3 | 4.8 | 0.37 | 0.90 | 0.44 | 0.76 |
| Sustained writing/composition (self-selected or teacher-generated topics) | 04-05 | 93.8 | 0.0 | 6.3 | 0.19 | 0.75 | 0.67 | 0.87 |
| | 05-06 | 77.1 | 7.9 | 13.2 | 0.67 | 1.28 | 0.75 | 0.86 |
| Sustained reading | 04-05 | 81.3 | 12.5 | 6.3 | 0.50 | 0.97 | 1.01 | 0.97 |
| | 05-06 | 86.4 | 6.2 | 5.7 | 0.41 | 0.94 | 1.08 | 0.98 |
| Independent inquiry/research on the part of students | 04-05 | 25.1 | 18.8 | 56.3 | 2.44 | 1.50 | 0.40 | 0.70 |
| | 05-06 | 44.0 | 10.1 | 45.0 | 1.83 | 1.67 | 0.32 | 0.65 |
| Student discussion | 04-05 | 50.0 | 25.0 | 25.0 | 1.50 | 1.32 | 0.98 | 1.08 |
| | 05-06 | 69.6 | 16.7 | 12.3 | 0.86 | 1.20 | 0.89 | 1.11 |
| ***Technology Use*** | | | | | | | | |
| Computer for instructional delivery (e.g. CAI, drill & practice) | 04-05 | 56.3 | 12.5 | 31.3 | 1.38 | 1.59 | 0.89 | 1.00 |
| | 05-06 | 58.5 | 14.1 | 26.5 | 1.32 | 1.56 | 0.96 | 0.97 |
| Technology as a learning tool or resource (e.g. Internet research, spreadsheet or database creation) | 04-05 | 18.0 | 12.5 | 68.8 | 2.75 | 1.53 | 0.99 | 1.06 |
| | 05-06 | 18.5 | 8.8 | 72.2 | 2.93 | 1.50 | 0.80 | 0.98 |
| ***Assessment*** | | | | | | | | |
| Performance assessment strategies | 04-05 | 81.3 | 18.8 | 0.0 | 0.38 | 0.80 | 0.37 | 0.72 |
| | 05-06 | 73.5 | 8.4 | 17.6 | 0.81 | 1.37 | 0.50 | 0.83 |
| Student self-assessment (portfolios) | 04-05 | 81.3 | 0.0 | 18.8 | 0.63 | 1.36 | 0.26 | 0.60 |
| | 05-06 | 81.9 | 6.2 | 8.8 | 0.46 | 1.06 | 0.32 | 0.65 |
| ***Summary Items*** | | | | | | | | |
| High academically focused class time | 04-05 | 0.0 | 25.0 | 75.0 | 3.06 | 0.77 | 3.14 | 0.95 |
| | 05-06 | 4.4 | 10.1 | 85.5 | 3.27 | 0.95 | 3.33 | 0.80 |
| High level of student attention, interest, engagement | 04-05 | 0.0 | 31.3 | 68.8 | 2.88 | 0.72 | 2.93 | 0.93 |
| | 05-06 | 6.6 | 7.0 | 86.3 | 3.28 | 0.96 | 3.12 | 0.83 |

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively

**Targeted SOM Inferential Results: FTL vs. National Norms.**

A series of *t*-tests comparing the FTL and national norm means on the 26 SOM items showed significantly higher frequency for FTL on seven items and for the SOM national norms on five items (Table 10). As was seen in the multi-class SOM results, the most striking difference favoring FTL was student use of the laptops as a learning tool (*ES* = +1.42) and for instructional delivery (*ES* = +0.23). Also noteworthy were the significant differences in FTL students engaging in independent research (*ES* = +0.90) and project-based learning (*ES* = +0.64). Also encouraging were differences in teachers acting as a facilitator, with FTL teachers engaging in this practice significantly more than those represented in the norm (*ES* = +0.25). In addition, the FTL teachers implemented lessons that integrated subject areas (*ES* = +0.38) and used performance assessments (*ES* = +0.22) significantly more than the norm. On the other hand, the analyses revealed significant differences that favored the national norms were for teacher use of higher-level questioning, independent seatwork, sustained reading, direct instruction, and the use of work centers. These strategies primarily reflect teacher-centered environments.

**Table 10. Targeted SOM: Significant Differences Between FTL and National Norms**

| | FTL (*n* = 227) | | National Norms (*N* = 552) | | | | |
|---|---|---|---|---|---|---|---|
| **SOM Items** | ***M*** | ***SD*** | ***M*** | ***SD*** | ***t (85)*** | ***p**** | ***ES*** |
| Technology as a learning tool | 2.93 | 1.50 | .80 | .98 | 21.411 | .001 | 1.42 |
| Independent inquiry/research | 1.83 | 1.67 | .32 | .65 | 13.538 | .001 | 0.90 |
| Project-based learning | 1.60 | 1.78 | .45 | .76 | 9.659 | .001 | 0.64 |
| Integration of subject areas | 1.13 | 1.52 | .54 | .80 | 5.786 | .001 | 0.38 |
| Teacher acting as a coach/facilitator | 2.65 | 1.42 | 2.29 | 1.18 | 3.793 | .001 | 0.25 |
| Computer for instructional delivery | 1.32 | 1.56 | .96 | .97 | 3.414 | .001 | 0.23 |
| Performance assessment strategies | .81 | 1.37 | .50 | .83 | 3.354 | .001 | 0.22 |
| Use of higher-level questioning | 1.32 | 1.36 | 1.63 | 1.12 | -3.413 | .001 | -0.23 |
| Independent seatwork | 1.88 | 1.73 | 2.41 | .98 | -4.573 | .001 | -0.30 |
| Sustained reading | .41 | .94 | 1.08 | .98 | -10.606 | .001 | -0.70 |
| Direct instruction | 1.82 | 1.25 | 2.77 | 1.01 | -11.475 | .001 | -0.76 |
| Work centers | .41 | 1.05 | 1.35 | 1.14 | -13.502 | .001 | -0.90 |

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively
*Bonferroni adjustment was used. Alpha is considered as .002 (.05/26)
Red Text = Norm significantly higher than FTL
Scale: 0 = Not Observed; 4 = Extensively Observed

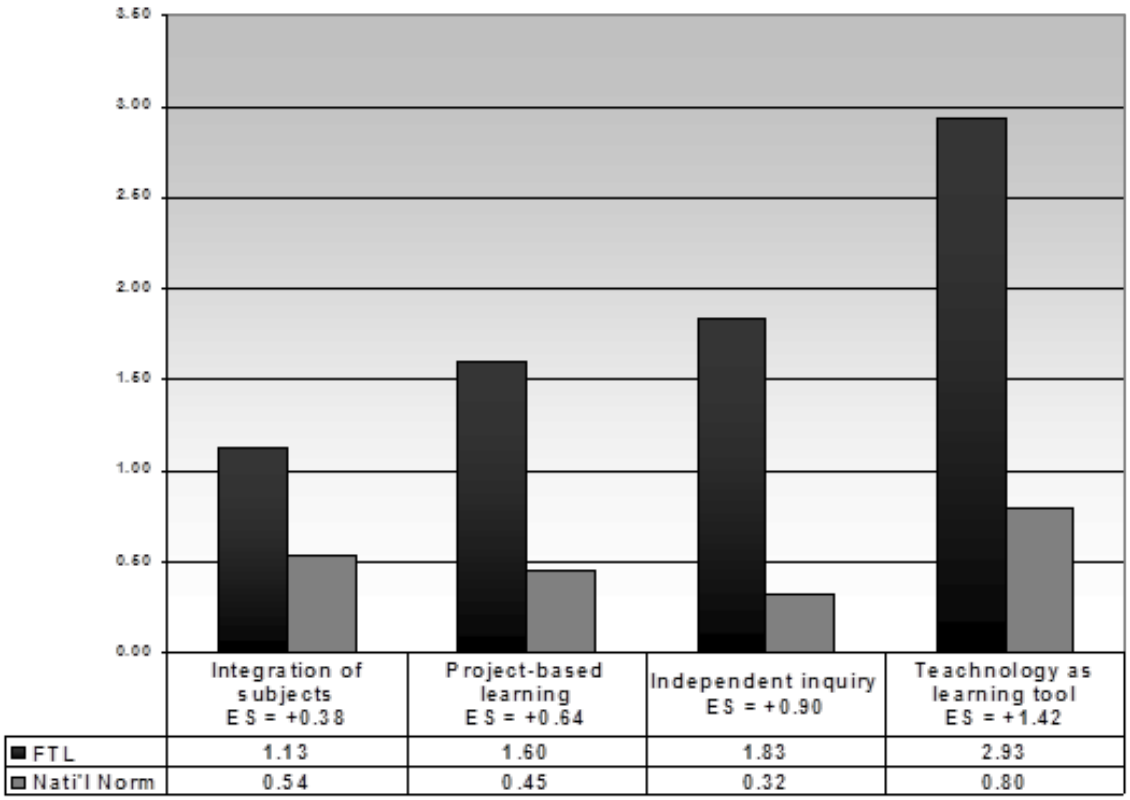



**Figure 4. Targeted SOM: Selected Significant Differences Between FTL and National Norms**

**Targeted SCU**

Not surprisingly, student use of laptops was observed during all targeted visits. One-to-one use of the laptops was observed during 84% of the visits, whereas, during 15% of the visits the laptops were used by pairs or small groups of students (see Table 11). Over half (56.5%) of the students exhibited very good computer literacy skills, whereas approximately a third (28.7%) showed very good keyboarding skills. Teachers used a wide variety of software activities during targeted visits to FTL classrooms as students were observed frequently to extensively using 18 of the 20 SCU computer applications (Table 12). During 60% (59.7%) of the visits, students frequently to extensively used Internet browsers, and in over 30% (31.0%) of the visits students were observed using word processing. Frequent use of the following types of software was seen less often: presentation (17.1%), CD-reference materials (16.1%), and drill and practice (10.3%). The subject area of Internet activities were fairly equally distributed across language arts (35.0%), social studies (29.6%) and science (28.3%). The largest percentage (43.9%) of computer activities involving production tools were focused on language arts, while smaller percentages involved mathematics, science and social studies.

***Meaningfulness of Computer Activities.*** The targeted SCU revealed very positive results with regard to FTL teachers implementing lessons that engaged students in meaningful and very meaningful activities. Specifically, the majority (82.0%) of computer activities observed in 227 FTL classes were considered to be meaningful (50.2%) or very meaningful (31.8%). In contrast, low-level use of computers was observed frequently to extensively in only 8.0% of visits.

## Table 11. Targeted SCU Data Summary

2004-2005 n = 16 6th grade FTL classrooms
2005-2006 n = 227 FTL classrooms

| Item | Year | % |
|---|---|---|
| **Computer Configuration** | | |
| Percentages of classrooms with the following numbers of computers or digital tools: | | |
| None; One, or 2 –4 | 04-05 | 0.0 |
| | 05-06 | 1.7 |
| 5 – 10 | 04-05 | 0.0 |
| | 05-06 | 3.1 |
| 11 or more | 04-05 | 100.0 |
| | 05-06 | 95.1 |
| *Percentages of classrooms in which the majority of computers were:* | | |
| Up-to-date | 04-05 | 100.0 |
| | 05-06 | 96.4 |
| Aging, but adequate | 04-05 | 0.0 |
| | 05-06 | 2.7 |
| Outdated/limited capacity | 04-05 | 0.0 |
| | 05-06 | 0.4 |
| *Percentages of classrooms in which the majority of computers were:* | | |
| Connected to the Internet | 04-05 | 100.0 |
| | 05-06 | 96.9 |
| **Student Computer Use** | | |
| *Percentage of classrooms in which computers or digital tools were used by:* | | |
| Few (less than 10%) to Some (about 10-50%) | 04-05 | 0.0 |
| students | 05-06 | 6.2 |
| Most (about 51-90%) students | 04-05 | 12.5 |
| | 05-06 | 7.6 |
| Nearly all (91-100%) students | 04-05 | 87.5 |
| | 05-06 | 83.4 |
| *Percentage of classrooms in which students worked with computers or digital tools:* | | |
| Alone | 04-05 | 75.0 |
| | 05-06 | 83.4 |
| In pairs or small groups | 04-05 | 25.0 |
| | 05-06 | 14.8 |
| Percentage of classrooms in which student computer literacy skills were: | | |
| Poor | 04-05 | 0.0 |
| | 05-06 | 0.4 |
| Moderate | 04-05 | 87.5 |
| | 05-06 | 39.0 |
| Very good | 04-05 | 12.5 |
| | 05-06 | 56.5 |
| Not observed | 04-05 | 0.0 |
| | 05-06 | 3.6 |
| *Percentage of classrooms in which student keyboarding skills were:* | | |
| Poor | 04-05 | 6.3 |
| | 05-06 | 5.4 |
| Moderate | 04-05 | 68.6 |
| | 05-06 | 42.6 |
| Very good | 04-05 | 6.3 |
| | 05-06 | 28.7 |

| Item | Year | % |
|---|---|---|
| Not observed | 04-05 | 18.8 |
| | 05-06 | 23.3 |

| Digital devices available for student use | | Not or Rarely Observed | Occasionally | Frequently or Extensively |
|---|---|---|---|---|
| Desktop Computers | 04-05 | 100.0 | 0.0 | 0.0 |
| | 05-06 | 92.4 | 2.7 | 4.0 |
| Laptop Computers | 04-05 | 0.0 | 6.3 | 93.7 |
| | 05-06 | 4.4 | 3.1 | 92.4 |
| Personal Data Assistants (PDA) | 04-05 | 100.0 | 0.0 | 0.0 |
| | 05-06 | 98.2 | 0.4 | 0.9 |
| Graphing Calculator | 04-05 | 100.0 | 0.0 | 0.0 |
| | 05-06 | 97.3 | 1.3 | 0.8 |
| Information Processor (e.g., Alphaboard) | 04-05 | 100.0 | 0.0 | 0.0 |
| | 05-06 | 99.1 | 0.4 | 0.0 |
| Digital Accessories (e.g., camera, scanner, probes) | 04-05 | 93.8 | 0.0 | 6.3 |
| | 05-06 | 96.0 | 1.3 | 2.2 |

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively
*Note*. Item percentages may not total 100% because of missing data.

### Table 12. Targeted SCU: Frequency of Observed Computer Activities

2004-2005 n = 16 6th grade FTL classrooms
2005-2006 n = 227 FTL classrooms

| The extent to which each of the following was observed in the classroom. | | Percent Observed | | | FTL | | National Norm | |
|---|---|---|---|---|---|---|---|---|
| | | None or Rarely | Occasionally | Frequently or Extensively | Mean | Standard Deviation | Mean | Standard Deviation |
| **Production Tools** | | | | | | | | |
| Word Processing | 04-05 | 43.8 | 12.5 | 33.3 | 1.81 | 1.76 | 0.42 | 0.81 |
| | 05-06 | 57.0 | 12.1 | 31.0 | 1.41 | 1.64 | 0.50 | 0.90 |
| Database | 04-05 | 100.0 | 0.0 | 0.0 | 0.06 | 0.25 | 0.01 | 0.15 |
| | 05-06 | 97.3 | 0.9 | 1.3 | 0.08 | 0.44 | 0.02 | 0.19 |
| Spreadsheet | 04-05 | 93.8 | 6.3 | 0.0 | 0.13 | 0.50 | 0.06 | 0.28 |
| | 05-06 | 88.7 | 4.0 | 6.7 | 0.34 | 1.02 | 0.07 | 0.35 |
| Draw/Paint/Graphics | 04-05 | 81.3 | 18.8 | 0.0 | 0.44 | 0.81 | 0.16 | 0.49 |
| | 05-06 | 94.6 | 3.6 | 1.3 | 0.14 | 0.52 | 0.19 | 0.57 |
| Presentation (e.g., MS *PowerPoint*) | 04-05 | 81.3 | 6.3 | 12.6 | 0.56 | 1.26 | 0.25 | 0.67 |
| | 05-06 | 80.2 | 2.2 | 17.1 | 0.69 | 1.41 | 0.26 | 0.68 |
| Authoring (e.g., HyperStudio) | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.60 |
| | 05-06 | 99.1 | 0.4 | 0.0 | 0.02 | 0.16 | 0.02 | 0.20 |
| Concept Mapping (e.g., Inspiration) | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.07 | 0.38 |
| | 05-06 | 95.0 | 1.8 | 2.7 | 0.14 | 0.65 | 0.08 | 0.40 |
| Planning (e.g., MS Project) | 04-05 | 100.0 | 0.0 | 0.0 | 0.06 | 0.25 | 0.0 | 0.60 |
| | 05-06 | 99.5 | 0.0 | 0.0 | 0.0 | 0.07 | 0.01 | 0.11 |
| Other | 04-05 | 81.3 | 6.3 | 12.5 | 0.63 | 1.40 | 0.11 | 0.46 |
| | 05-06 | 83.8 | 2.7 | 4.4 | 0.25 | 0.87 | 0.10 | 0.46 |
| **Internet/Research Tools** | | | | | | | | |
| Internet Browser (e.g., Netscape) | 04-05 | 37.5 | 12.5 | 5.0 | 2.19 | 1.75 | 0.70 | 1.09 |
| | 05-06 | 31.8 | 8.1 | 59.7 | 2.40 | 1.70 | 0.73 | 1.12 |
| CD Reference (encyclopedias, etc.) | 04-05 | 81.3 | 12.5 | 6.3 | 0.50 | 1.16 | 0.04 | 0.27 |
| | 05-06 | 71.3 | 9.0 | 16.1 | 0.80 | 1.36 | 0.05 | 0.29 |
| Communications | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.02 | 0.21 |
| | 05-06 | 92.3 | 2.2 | 1.3 | 0.11 | 0.54 | 0.02 | 0.25 |

| The extent to which each of the following was observed in the classroom. | | Percent Observed | | | FTL | | National Norm | |
|---|---|---|---|---|---|---|---|---|
| | | None or Rarely | Occasionally | Frequently or Extensively | Mean | Standard Deviation | Mean | Standard Deviation |
| Other | 04-05 | 93.8 | 6.3 | 0.0 | 0.13 | 0.50 | 0.06 | 0.33 |
| | 05-06 | 82.0 | 0.9 | 5.8 | 0.27 | 0.96 | 0.09 | 0.45 |
| **Educational Software** | | | | | | | | |
| Drill/Practice/Tutorial | 04-05 | 87.5 | 0.0 | 12.5 | 0.50 | 1.37 | 0.71 | 1.01 |
| | 05-06 | 84.7 | 4.0 | 10.3 | 0.47 | 1.16 | 0.73 | 1.06 |
| Problem Solving (e.g., SimCity) | 04-05 | 93.8 | 0.0 | 6.3 | 0.19 | 0.75 | 0.06 | 0.27 |
| | 05-06 | 95.9 | 1.3 | 1.3 | 0.10 | 0.50 | 0.07 | 0.31 |
| Process Tools (e.g., Geometer's Sketchpad) | 04-05 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.01 | 0.85 |
| | 05-06 | 96.4 | 0.9 | 0.8 | 0.05 | 0.39 | 0.03 | 0.27 |
| Other | 04-05 | 87.5 | 6.3 | 6.3 | 0.38 | 1.09 | 0.17 | 0.58 |
| | 05-06 | 87.4 | 0.9 | 6.2 | 0.27 | 0.93 | 0.21 | 0.66 |
| **Testing Software** | | | | | | | | |
| Individualized/Tracked (e.g., Accelerated Reader) | 04-05 | 93.8 | 0.0 | 6.3 | 0.25 | 1.00 | 0.53 | 0.87 |
| | 05-06 | 91.0 | 0.9 | 7.1 | 0.29 | 1.01 | 0.52 | 0.91 |
| Generic | 04-05 | 93.8 | 0.0 | 6.3 | 0.25 | 1.00 | 0.01 | 0.97 |
| | 05-06 | 96.9 | 0.0 | 0.4 | 0.03 | 0.29 | 0.02 | 0.20 |
| Other | 04-05 | 75.0 | 0.0 | 25.0 | 0.94 | 1.69 | 0.07 | 0.36 |
| | 05-06 | 86.1 | 1.3 | 5.3 | 0.26 | 0.91 | 0.08 | 0.41 |

| Subject Areas of Computer Activities | | Language | Mathematics | Science | S. Studies | Other | Percent Not Observed |
|---|---|---|---|---|---|---|---|
| Production Tools | 04-05 | 31.3 | 25.0 | 25.0 | 18.8 | 0.0 | 25.0 |
| | 05-06 | 43.9 | 16.6 | 23.8 | 22.9 | 8.5 | 26.5 |
| Internet/Research Tools | 04-05 | 31.3 | 12.5 | 25.0 | 25.0 | 0.0 | 25.0 |
| | 05-06 | 35.0 | 15.7 | 28.3 | 29.6 | 8.1 | 22.9 |
| Educational Software | 04-05 | 6.3 | 12.5 | 12.5 | 0.0 | 0.0 | 68.8 |
| | 05-06 | 9.0 | 12.1 | 7.6 | 9.0 | 2.2 | 67.3 |
| Testing Software | 04-05 | 0.0 | 0.0 | 6.3 | 6.3 | 0.0 | 87.5 |
| | 05-06 | 8.5 | 6.3 | 3.1 | 3.1 | 1.3 | 74.4 |

| Meaningfulness of Computer Activities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Low level use of computers | 04-05 | 93.8 | 0.0 | 6.3 | 0.19 | 0.75 | 0.85 | 1.12 |
| | 05-06 | 80.3 | 8.5 | 8.0 | 0.57 | 1.06 | 0.84 | 1.16 |
| Somewhat meaningful use of computers | 04-05 | 62.6 | 12.5 | 25.1 | 1.25 | 1.65 | 0.73 | 0.97 |
| | 05-06 | 61.0 | 17.0 | 18.8 | 1.13 | 1.42 | 0.75 | 1.00 |
| Meaningful use of computers | 04-05 | 37.5 | 6.3 | 56.3 | 2.13 | 1.78 | 0.80 | 1.16 |
| | 05-06 | 36.3 | 10.3 | 50.2 | 2.05 | 1.58 | 0.86 | 1.21 |
| Very meaningful use of computers | 04-05 | 62.6 | 6.3 | 31.3 | 1.19 | 1.51 | 0.32 | 0.77 |
| | 05-06 | 56.9 | 9.4 | 31.8 | 1.44 | 1.68 | 0.39 | 0.88 |

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively
*Note*. Item percentages may not total 100% because of missing data.

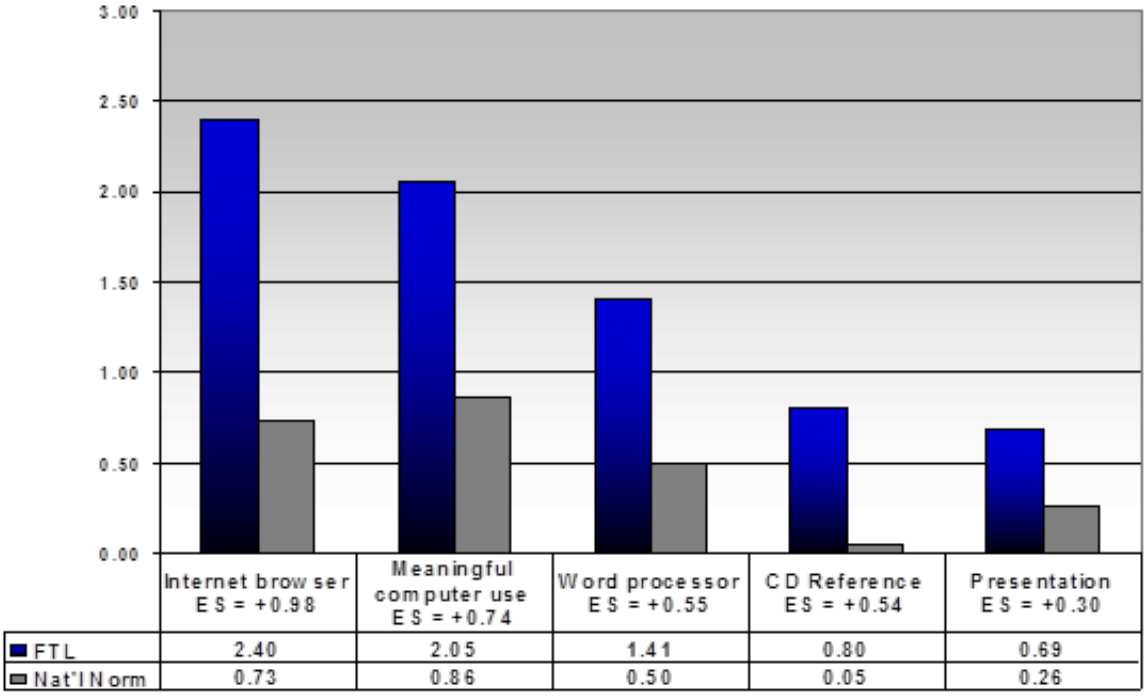
### Targeted SCU Inferential Results: FTL vs. National Norms

Table 13 lists significant results from *t*-tests comparing the SCU means for FTL with national norms. When examining student computer activities, the analyses revealed that FTL students used the following five software applications significantly more than students in classes represented by the national norms: Internet browsers (*ES* = +0.98); word processing (*ES* = +0.55); CD references (*ES* = +0.54); presentation software (*ES* = +0.30); and spreadsheets (*ES* = +0.27). But even more importantly, as compared to national norms, FTL students were more frequently engaged in meaningful (FTL *M* = 2.05, National norm *M* = 0.86; *ES* = +0.74) and very meaningful (FTL *M* = 1.44, National norm *M* = 0.39; *ES* = +0.62) computer activities. In contrast, students represented by the national norms were more frequently engaged in low-level uses of computers than were FTL students (FTL *M* = 0.57, National norm *M* = 0.84; *ES* = -0.25).

**Table 13. Targeted SCU: Significant Differences Between FTL and National Norms**

| | Program (*n* = 227) | | National Norms (*N* = 563) | | | |
|---|---|---|---|---|---|---|
| **COMPUTER ACTIVITIES** | ***M*** | ***SD*** | ***M*** | ***SD*** | ***t (85)*** | ***ES*** |
| ***Production Tools*** | | | | | | |
| Word Processor | 1.41 | 1.64 | .50 | 8.263 | .001 | 0.55 |
| Spreadsheet | .34 | 1.02 | .07 | 3.978 | .001 | 0.27 |
| Presentation | .69 | 1.41 | .26 | 4.524 | .001 | 0.30 |
| ***Internet/Research Tools*** | | | | | | |
| Internet Browser | 2.40 | 1.70 | .73 | 14.637 | .001 | 0.98 |
| CD Reference | .80 | 1.36 | .05 | 8.065 | .001 | 0.54 |
| ***Educational Software*** | | | | | | |
| Drill/Practice/Tutorial | .47 | 1.16 | .73 | -3.330 | .001 | -0.22 |
| ***Testing Software*** | | | | | | |
| Individualized/Tracked | .29 | 1.01 | .52 | -3.329 | .001 | -0.22 |
| **MEANINGFULNESS** | | | | | | |
| Low level use of computers | .57 | 1.06 | .84 | -3.756 | .001 | -0.25 |
| Somewhat meaningful use of computers | 1.13 | 1.42 | .75 | 3.979 | .001 | 0.27 |
| Meaningful use of computers | 2.05 | 1.58 | .86 | 11.101 | .001 | 0.74 |
| Very meaningful use of computers | 1.44 | 1.681 | .39 | 9.269 | .001 | 0.62 |

**p < .003
Rating scale: 0 = Not observed; 4 = Extensively
Red Text = Norm significantly higher than FTL




Scale: 0 = Not Observed; 4 = Extensively Observed

**Figure 5. Targeted SCU: Selected Significant Differences Between FTL and National Norms**

## Survey Results

Survey results for the FTL program evaluation are reported by FTL students, teachers, Lead Teachers, and parents.

### FTL Student Survey

The FTL Student Survey was completed by 5,770 students, primarily in the 6th grade, in classrooms equipped with FTL laptops. The results are shown in Table 14 and Figure 6. Overall, the students were very positive with regard to the benefits of having laptop computers to use at school. In particular, 90% (89.9%) of the students wanted to use them again next year. This response is supported in 87.8% of the students indicating that they were "very glad" that they got to use laptops. There was also strong agreement that use of the laptops had improved their Internet research skills (68.8%), made it easier to do school work (62.3%), made them more interested in learning (59.6%), would help them get better jobs in the future (58.9%). Fewer students agreed that laptops made them want to get better grades (40.7%), helped them to remember more and do better on tests (37.3%), or improved their writing (30.9%).

When asked how they used the FTL laptops, the majority of students indicated that they most frequently worked alone (80.2%), however, over one-fourth (28.9%) reported that they also frequently worked with one other student during laptop activities. Students indicated that they most frequently used the laptops for language arts (57.7%), social studies (52.5%), and science (46.6%), whereas the least frequent use was reported for mathematics (34.1%). Nearly 90% (87.6%) of the students indicated that they frequently used the Internet for class activities, while almost 73% (72.3%) reported frequent use of word processing. Other software use ranged from 55.0% for presentation and 38.0% for games to a low of 7.8% for *Squeak* and 7.4% for *Ready, Set, Go!.*

**Table 14. FTL Student Survey Results**

2004-2005 n = 4,245
2005-2006 n = 5,770

| | | Percent of Student Responses | | |
|---|---|---|---|---|
| **Items sorted by highest level of response to "Yes"** | | **Yes** | **Some** | **No** |
| I would like to use laptop computers again next year. | 04-05 | 87.9 | 6.9 | 3.9 |
| | 05-06 | 89.9 | 6.3 | 3.1 |
| I am very glad that I get to use laptops. | 04-05 | 85.3 | 10.2 | 3.2 |
| | 05-06 | 87.8 | 9.3 | 2.2 |
| My Internet research skills have improved since using the laptops. | 04-05 | 61.3 | 26.7 | 10.7 |
| | 05-06 | 68.8 | 22.2 | 8.3 |
| Using a laptop in class has made me more interested in learning. | 04-05 | 61.1 | 27.0 | 10.7 |
| | 05-06 | 59.6 | 29.0 | 10.8 |
| It is easier to do my schoolwork when I use a laptop. | 04-05 | 59.9 | 28.5 | 10.1 |
| | 05-06 | 62.3 | 28.2 | 8.8 |
| I will be able to get a better job because I have good computer skills. | 04-05 | 58.1 | 31.4 | 8.8 |
| | 05-06 | 58.9 | 31.2 | 9.1 |
| My computer skills have improved because I use a laptop at school. | 04-05 | 55.0 | 35.2 | 8.7 |
| | 05-06 | 63.5 | 30.2 | 5.7 |
| I learn more when I use a laptop computer | 04-05 | 53.6 | 35.4 | 9.8 |
| | 05-06 | 54.3 | 36.7 | 8.2 |
| My schoolwork is better when I use the laptop. | 04-05 | 49.7 | 36.1 | 12.3 |
| | 05-06 | 50.1 | 37.9 | 11.0 |
| Using the laptop makes me think more about the subject we are learning | 04-05 | 49.2 | 33.2 | 15.6 |
| | 05-06 | 48.1 | 33.0 | 17.8 |

| Items sorted by highest level of response to "Yes" | | Percent of Student Responses | | |
|---|---|---|---|---|
| | | **Yes** | **Some** | **No** |
| The laptop makes it easier to work with other students. | 04-05 | 48.1 | 32.2 | 18.5 |
| | 05-06 | 49.3 | 32.5 | 17.6 |
| Using laptops will make me a better high school student. | 04-05 | 46.9 | 37.5 | 13.8 |
| | 05-06 | 49.1 | 37.0 | 13.0 |
| I look forward to schoolwork because I get to use a laptop. | 04-05 | 45.0 | 33.5 | 19.8 |
| | 05-06 | 43.6 | 33.3 | 22.1 |
| Using a laptop has made me want to get better grades. | 04-05 | 41.5 | 33.0 | 24.3 |
| | 05-06 | 40.7 | 34.7 | 23.9 |
| Using a laptop helps me to remember more and do better on tests. | 04-05 | 36.9 | 38.8 | 22.5 |
| | 05-06 | 37.3 | 40.2 | 21.6 |
| My writing has improved because I use a laptop. | 04-05 | 27.1 | 31.2 | 40.4 |
| | 05-06 | 30.9 | 32.9 | 35.4 |
| | | **Frequently and A Lot** | **Occasionally** | **Never and Rarely** |
| How often do you use the laptop in the following ways in the classroom? | | | | |
| By Yourself | 04-05 | 68.3 | 15.0 | 13.7 |
| | 05-06 | 80.2 | 11.1 | 6.9 |
| With one other student | 04-05 | 26.3 | 30.4 | 39.2 |
| | 05-06 | 28.9 | 33.0 | 34.9 |
| In groups of 3 or more students | 04-05 | 15.3 | 14.5 | 65.8 |
| | 05-06 | 13.0 | 16.0 | 67.4 |
| How often do you use the laptop for the following subjects? | | | | |
| Social Studies | 04-05 | 51.9 | 18.8 | 25.4 |
| | 05-06 | 52.5 | 18.0 | 26.8 |
| Sciences | 04-05 | 43.5 | 22.0 | 30.7 |
| | 05-06 | 46.6 | 25.2 | 25.6 |
| Language Arts | 04-05 | 42.0 | 21.6 | 32.9 |
| | 05-06 | 57.7 | 18.4 | 21.4 |
| Mathematics | 04-05 | 24.2 | 19.7 | 52.2 |
| | 05-06 | 34.1 | 22.5 | 40.9 |
| How often do you use the following software when doing activities with your laptop? | | | | |
| Internet (Explorer/Netscape) | 04-05 | 79.6 | 7.6 | 10.0 |
| | 05-06 | 87.6 | 4.6 | 6.1 |
| Word Processing (MS Word) | 04-05 | 58.7 | 16.2 | 22.6 |
| | 05-06 | 72.8 | 11.4 | 14.1 |
| Presentation (*PowerPoint*) | 04-05 | 41.7 | 20.7 | 34.6 |
| | 05-06 | 55.0 | 20.1 | 22.9 |
| Games | 04-05 | 37.0 | 21.7 | 38.0 |
| | 05-06 | 38.0 | 21.4 | 38.3 |
| CD Reference (e.g., Encarta) | 04-05 | 27.4 | 18.6 | 49.9 |
| | 05-06 | 32.7 | 18.5 | 45.9 |
| Educational Software (e.g., math practice) | 04-05 | 19.0 | 17.4 | 60.0 |
| | 05-06 | 28.1 | 17.5 | 51.5 |
| Discourse | 04-05 | 17.9 | 16.0 | 62.7 |
| | 05-06 | 21.4 | 14.5 | 60.9 |
| Spreadsheets (*Excel*) | 04-05 | 16.5 | 17.5 | 62.9 |
| | 05-06 | 24.9 | 19.5 | 53.2 |
| Authoring (e.g., html) | 04-05 | 11.4 | 9.5 | 75.3 |
| | 05-06 | 15.9 | 11.0 | 70.1 |
| MS One Note | 04-05 | 7.2 | 6.1 | 83.4 |
| | 05-06 | 9.8 | 6.3 | 80.9 |

| Items sorted by highest level of response to "Yes" | | Percent of Student Responses | | |
|---|---|---|---|---|
| | | Yes | Some | No |
| *Squeak* | 04-05 | 7.1 | 4.4 | 85.1 |
| | 05-06 | 7.8 | 5.7 | 83.6 |
| *Ready, Set, Go*! | 04-05 | 5.3 | 4.3 | 87.2 |
| | 05-06 | 7.4 | 4.7 | 85.2 |

*Note*. Item percentages may not total 100% because of missing data.

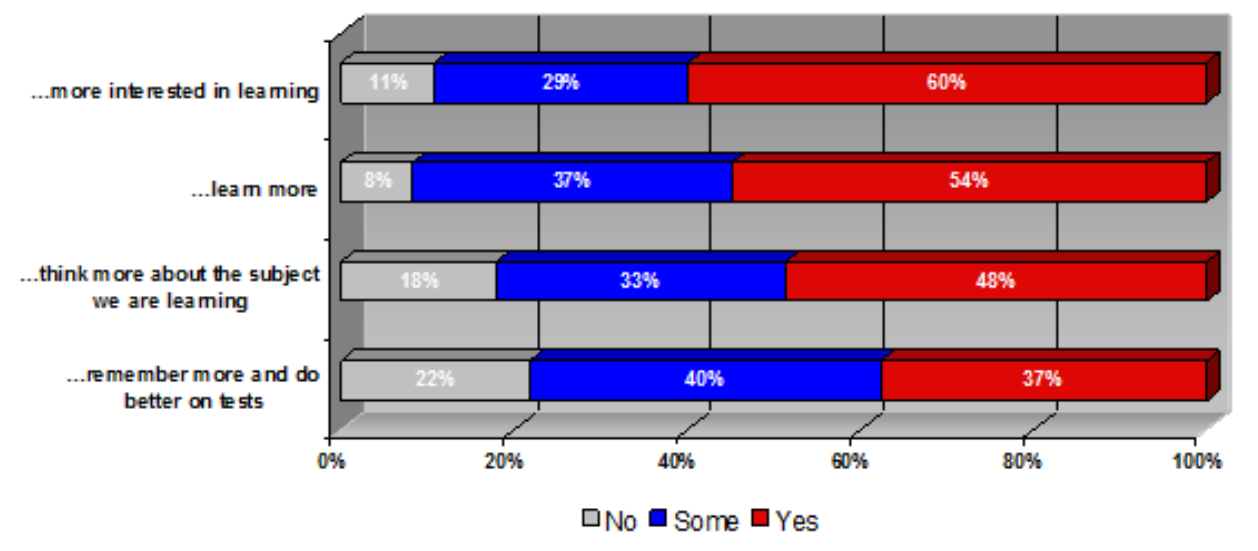



**Figure 6. Student Survey: Impact of Using Laptops on Learning**

**FTL Teacher Technology Questionnaire (FTL-TTQ)**

The FTL-TTQ was completed by total of 380 FTL teachers from 77 schools. The FTL results and national norms (N = 5,542) for the TTQ are presented in Table 15. Overall, the FTL teacher responses were significantly more positive on four of the five TTQ categories: Impact on Classroom Instruction (*ES* = +0.42); Impact on Students (*ES* = +0.35); Teacher Readiness to Integrate Technology (*ES* = +0.36); and Technical Support (*ES* = +0.29). Specifically, the FTL teachers indicated that laptop use had a positive impact student learning and achievement (FTL *M* = 4.17) and had increased the level of student interactions and/or collaborations (FTL *M* = 4.15). The teachers had the highest overall level of agreement that most of their students could capably use the FTL laptops at an age-appropriate level (FTL *M* = 4.24). FTL teachers were also in strong agreement that they routinely integrated use of the laptops into their instruction (FTL *M* = 3.87) and that their teaching was more student-centered (FTL *M* = 3.85) and more interactive (FTL *M* = 3.88) when laptops were used.

Strikingly, in comparison to national norms, the FTL teachers showed significantly greater confidence that they knew how to meaningfully integrate laptop use into lessons (FTL *M* = 4.11; Norm *M* = 3.74, *ES* = +0.45) and align use of the laptops with curriculum standards (FTL *M* = 4.04; Norm *M* = 3.65, *ES* = +0.48). In addition, the FTL teachers were in greater agreement that their computer skills were adequate to conduct lessons that had students using laptop computers (FTL *M* = 4.13; Norm *M* = 3.82, *ES* = +0.37).

When FTL teachers were asked to respond to items regarding the effectiveness of FTL Lead Teachers, results revealed general agreement (*M* = 4.05) that Lead Teachers had been a valuable asset to their school's FTL program. There was moderate teacher agreement that they frequently participated in professional development (PD) provided by their Lead Teacher or Super Coach (*M* = 3.53) or that the PD had helped teachers to improve integration lessons (*M* = 3.60) or to more frequently integrate use of laptops (*M* = 3.54).

**Table 15. FTL TTQ: FTL vs. National Norm Significant Differences**

2004-2005 FTL Teachers n = 279; National Norms N = 5,542
2005-2006 FTL Teachers n = 380; National Norms N = 5,542

| Category and Related TTQ Items | | FTL Mean | FTL SD | National Norms | *t(274)* | *p* | *ES* |
|---|---|---|---|---|---|---|---|
| **Impact on Classroom Instruction** | | | | | | | |
| My teaching is more student-centered when FTL laptops are integrated into the lessons. | 04-05 | 3.96 | 0.95 | 3.57 | 6.76 | .001** | 0.41 |
| | 05-06 | 3.85 | 0.94 | 3.54 | 6.41 | .001** | 0.33 |
| I routinely integrate the use of FTL laptops into my instruction. | 04-05 | 3.81 | 1.05 | 3.50 | 4.96 | .001** | 0.30 |
| | 05-06 | 3.87 | 1.05 | 3.43 | 8.24 | .001** | 0.42 |
| The FTL laptop program has changed classroom learning activities in a very positive way. | 04-05 | 4.20 | 0.88 | 3.90 | 5.74 | .001** | 0.34 |
| | 05-06 | 4.13 | 0.89 | 3.86 | 5.83 | .001** | 0.30 |
| My teaching is more interactive when the FTL laptops are integrated into the lessons. | 04-05 | 3.93 | 0.90 | 3.61 | 5.81 | .001** | 0.36 |
| | 05-06 | 3.88 | 0.94 | 3.59 | 5.88 | .001** | 0.30 |
| ***Overall*** | 04-05 | 3.98 | 0.80 | 3.65 | 6.81 | .001** | 0.41 |
| | 05-06 | 3.94 | 0.79 | 3.60 | 8.18 | .001** | 0.42 |
| **Impact on Students** | | | | | | | |
| The use of FTL laptops has increased the level of student interaction and/or collaboration. | 04-05 | 4.26 | 0.85 | 3.93 | 6.39 | .001** | 0.39 |
| | 05-06 | 4.15 | 0.94 | 3.88 | 5.46 | .001** | 0.28 |
| The integration of the FTL laptops has positively impacted student learning and achievement. | 04-05 | 4.30 | 0.85 | 3.97 | 6.34 | .001** | 0.39 |
| | 05-06 | 4.17 | 0.90 | 3.92 | 5.47 | .001** | 0.28 |
| Most of my students can capably use the FTL laptops at an age-appropriate level. | 04-05 | 4.21 | 0.83 | 4.00 | 4.14 | .001** | 0.25 |
| | 05-06 | 4.24 | 0.80 | 3.95 | 7.03 | .001** | 0.36 |
| The use of the FTL laptops has improved the quality of student work. | 04-05 | 3.96 | 0.87 | 3.59 | 7.07 | .001** | 0.43 |
| | 05-06 | 3.87 | 0.99 | 3.56 | 6.06 | .001** | 0.31 |

| Category and Related TTQ Items | | FTL Mean | FTL SD | National Norms | *t(274)* | *p* | *ES* |
|---|---|---|---|---|---|---|---|
| ***Overall*** | 04-05 | 4.18 | 0.72 | 3.88 | 6.97 | .001** | 0.42 |
| | 05-06 | 4.11 | 0.78 | 3.83 | 6.89 | .001** | 0.35 |
| **Teacher Readiness to Integrate Technology** | | | | | | | |
| I know how to meaningfully integrate the laptops into lessons. | 04-05 | 4.01 | 0.89 | 3.78 | 4.21 | .001** | 0.26 |
| | 05-06 | 4.11 | 0.82 | 3.74 | 8.83 | .001** | 0.45 |
| I am able to align use of the FTL laptops with my district's standards-based curriculum. | 04-05 | 3.99 | 0.89 | 3.72 | 4.96 | .001** | 0.30 |
| | 05-06 | 4.04 | 0.82 | 3.65 | 9.29 | .001** | 0.48 |
| I have received adequate training to incorporate the FTL laptops into my instruction. | 04-05 | 3.50 | 1.09 | 3.78 | -4.26 | .001** | -0.26 |
| | 05-06 | 3.67 | 1.05 | 3.72 | -0.97 | .33 NS | n/a |
| My computer skills are adequate to conduct classes that have students using the FTL laptops. | 04-05 | 4.07 | 0.91 | 3.85 | 4.08 | .001** | 0.24 |
| | 05-06 | 4.13 | 0.84 | 3.82 | 7.23 | .001** | 0.37 |
| ***Overall*** | 04-05 | 3.89 | 0.77 | 3.79 | 2.17 | .031* | 0.13 |
| | 05-06 | 3.99 | 0.72 | 3.73 | 7.01 | .001** | 0.36 |
| **Overall Support for Technology in the School** | | | | | | | |
| Parents/Caregivers and community members support our school's FTL program | 04-05 | 3.93 | 0.88 | 3.84 | 1.71 | .089 NS | n/a |
| | 05-06 | 3.88 | 0.87 | 3.80 | 1.70 | .08 NS | n/a |
| Teachers receive adequate administrative support to integrate the FTL laptops into classroom practices. | 04-05 | 3.77 | 1.12 | 3.94 | -2.56 | .011* | -0.15 |
| | 05-06 | 3.81 | 0.97 | 3.90 | -1.75 | .08 NS | n/a |
| Our school has a well-developed technology plan that guides all technology integration efforts. | 04-05 | 3.31 | 1.06 | 3.76 | -7.03 | .001** | -0.42 |
| | 05-06 | 3.41 | 0.97 | 3.67 | -5.17 | .001** | -0.27 |
| The FTL teachers in this school are generally supportive of the FTL laptop program. | 04-05 | 4.25 | 0.80 | 3.90 | 7.20 | .001** | 0.44 |
| | 05-06 | 4.19 | 0.77 | 3.85 | 8.66 | .001** | 0.44 |
| ***Overall*** | 04-05 | 3.81 | 0.74 | 3.86 | -1.03 | .306 NS | n/a |
| | 05-06 | 3.82 | 0.70 | 3.80 | 0.63 | .52 NS | n/a |
| **Technical Support** | | | | | | | |
| Most of our FTL laptops are kept in good working condition. | 04-05 | 4.41 | 0.77 | 3.95 | 10.06 | .001** | 0.60 |
| | 05-06 | 4.24 | 0.72 | 3.91 | 9.05 | .001** | 0.46 |
| I can readily obtain answers to technology-related questions. | 04-05 | 3.76 | 1.04 | 4.03 | -4.29 | .001** | -0.26 |
| | 05-06 | 4.02 | 0.86 | 4.00 | 0.41 | .67 NS | n/a |
| My students have adequate access to up-to-date technology resources. | 04-05 | 4.08 | 0.91 | 3.78 | 5.48 | .001** | 0.33 |
| | 05-06 | 4.1 | 0.89 | 3.70 | 8.66 | .001** | 0.44 |
| Materials (e.g., software, printer supplies) for classroom use of the FTL laptops are readily available. | 04-05 | 3.51 | 1.22 | 3.70 | -2.59 | .010** | -0.16 |
| | 05-06 | 3.68 | 1.08 | 3.63 | 0.91 | .36 NS | n/a |
| ***Overall*** | 04-05 | 3.94 | 0.77 | 3.86 | 1.74 | .083 NS | n/a |
| | 05-06 | 4.01 | 0.67 | 3.81 | 5.72 | .001** | 0.29 |
| *Lead Teacher Effectiveness* | | | | | | | |
| I have frequently participated in professional development that was planned by or provided by my Lead Teacher and/or Super Coach. | 04-05 | 3.57 | 1.12 | NA | NA | NA | NA |
| | 05-06 | 3.53 | 1.10 | | | | |
| I more frequently integrate technology into my instruction as a result of participating in professional development planned or provided by my Lead Teacher and/or Super Coach. | 04-05 | 3.66 | 1.07 | NA | NA | NA | NA |
| | 05-06 | 3.54 | 1.10 | | | | |
| The quality of my technology integration lessons has improved as a result of participating in professional development planned or provided by my Lead Teacher and/or Super Coach. | 04-05 | 3.66 | 1.07 | NA | NA | NA | NA |
| | 05-06 | 3.60 | 1.03 | | | | |
| Overall, my Lead Teacher has been a valuable asset to our school's FTL laptop program. | 04-05 | 4.09 | 0.95 | NA | NA | NA | NA |
| | 05-06 | 4.05 | 0.99 | | | | |
| ***Overall*** | 04-05 | 3.74 | 0.90 | NA | NA | NA | NA |
| | 05-06 | 3.68 | 0.93 | | | | |

Scale: 1 = Strongly Disagree; 5 = Strongly Agree
* p <.05
**p < .01, NS = No significant differences, Red Text = Norm significantly higher than FTL

### FTL Lead Teacher Questionnaire (FTL-LT)

A total of 75 FTL Lead Teachers from 63 schools completed the on-line FTL Lead Teacher Questionnaire. The results are presented in Table 16. Not surprisingly, nearly all (96.0%) of the Lead Teachers agreed that the FTL program had a positive impact on students' ability and comfort level with technology. However, even more importantly, there was strong agreement that use of the laptops had increased student motivation to learn (90.7%), increased teacher use of student-centered learning in the classroom (89.3%), and increased the student-to-teacher interactions (82.7%). Nearly 75% (74.7%) indicated that FTL professional development had been effective, while 57.3% of the Lead Teachers agreed that they provided teacher training to the FTL teachers in their school. Fewer agreed that administrators participated in FTL training for teachers (34.7%), or that the community (28.0%) or parents (10.7%) were involved in the FTL program.

### Table 16. FTL Lead Teacher Survey

2004-2005 n = 63
2005-2006 n = 75

| Items sorted by highest level of agreement | | Percentage of Responses | | |
|---|---|---|---|---|
| | | Strongly Agree & Agree | Neutral | Strongly Disagree and Disagree |
| FTL has had a positive impact on students' ability and comfort levels with technology. | 04-05 | 90.5 | 1.6 | 1.6 |
| | 05-06 | 96.0 | 2.7 | 1.3 |
| Use of the FTL laptops has increased student motivation to learn. | 04-05 | 85.7 | 6.3 | 1.6 |
| | 05-06 | 90.7 | 8.0 | 1.3 |
| Use of laptops in FTL classes has increased teacher use of student-centered learning. | 04-05 | 84.1 | 7.9 | 1.6 |
| | 05-06 | 89.3 | 10.7 | 0.0 |
| Our principal is very supportive of the FTL program. | 04-05 | 84.1 | 6.3 | 3.2 |
| | 05-06 | 89.3 | 9.3 | 1.3 |
| Use of the FTL laptops has increased student-to-teacher interactions. | 04-05 | 84.1 | 4.8 | 4.8 |
| | 05-06 | 82.7 | 12.0 | 5.3 |
| I provided ongoing support to FTL teachers. | 04-05 | 82.5 | 7.9 | 3.2 |
| | 05-06 | 78.7 | 17.3 | 2.7 |
| FTL teachers are very supportive of the FTL program. | 04-05 | 81.0 | 7.9 | 4.8 |
| | 05-06 | 77.3 | 18.7 | 1.3 |
| FTL teachers' ability and comfort levels with technology have increased due to FTL. | 04-05 | 77.8 | 12.7 | 3.2 |
| | 05-06 | 89.3 | 9.3 | 1.3 |
| Our district is very supportive of the FTL program. | 04-05 | 77.8 | 7.9 | 7.9 |
| | 05-06 | 85.3 | 9.3 | 4.0 |
| Use of the FTL laptops has increased student-to-student interactions. | 04-05 | 73.0 | 14.3 | 6.3 |
| | 05-06 | 76.0 | 18.7 | 5.3 |
| Student learning and achievement has increased as a result of using FTL laptops. | 04-05 | 71.4 | 20.6 | 1.6 |
| | 05-06 | 80.0 | 18.7 | 1.3 |
| FTL sponsored professional development has been effective. | 04-05 | 71.4 | 14.3 | 6.3 |
| | 05-06 | 74.7 | 17.3 | 8.0 |
| Our parents are very supportive of the FTL program. | 04-05 | 68.3 | 20.6 | 4.8 |
| | 05-06 | 72.0 | 26.7 | 1.3 |
| I participated in professional development provided by our Super Coach. | 04-05 | 63.5 | 11.1 | 19.0 |
| | 05-06 | 50.7 | 16.0 | 32.0 |
| Collaborations among FTL teachers have increased due to the FTL program. | 04-05 | 55.6 | 33.3 | 4.8 |
| | 05-06 | 74.7 | 18.7 | 5.3 |
| Use of the FTL laptops has decreased classroom discipline problems. | 04-05 | 55.6 | 27.0 | 11.1 |
| | 05-06 | 65.3 | 26.7 | 8.0 |

| Items sorted by highest level of agreement | | Percentage of Responses | | |
|---|---|---|---|---|
| | | Strongly Agree & Agree | Neutral | Strongly Disagree and Disagree |
| Administrators in our school model the use of technology. | 04-05 | 54.0 | 17.5 | 22.2 |
| | 05-06 | 65.3 | 22.7 | 12.0 |
| Administrators in our school are very involved with FTL. | 04-05 | 49.2 | 23.8 | 19.0 |
| | 05-06 | 56.0 | 29.3 | 14.7 |
| Our administrators have participated in FTL professional development for administrators. | 04-05 | 47.6 | 20.6 | 23.8 |
| | 05-06 | 37.3 | 40.0 | 21.3 |
| I provided professional development workshops for our FTL teachers. | 04-05 | 46.0 | 25.4 | 22.2 |
| | 05-06 | 57.3 | 22.7 | 18.7 |
| Our teachers participated in professional development provided by our Super Coach. | 04-05 | 42.9 | 11.1 | 39.7 |
| | 05-06 | 33.3 | 17.3 | 45.3 |
| Our administrators have participated in FTL professional development for teachers. | 04-05 | 34.9 | 19.0 | 38.1 |
| | 05-06 | 34.7 | 32.0 | 33.3 |
| Our community members are involved and supportive of FTL. | 04-05 | 30.2 | 41.3 | 22.2 |
| | 05-06 | 28.0 | 37.3 | 33.3 |
| Our parents are very involved with FTL. | 04-05 | 20.6 | 36.5 | 36.5 |
| | 05-06 | 10.7 | 54.7 | 34.7 |

*Note*. Item percentages may not total 100% because of missing input from some respondents.

### FTL Parent Survey

A total of 1,241 parents/guardians of children in FTL classrooms completed the paper-based survey. The parents represented 90 of the 195 (46.2%) schools implementing FTL. Overall, parent responses were positive and supportive of the advantages of their children using laptops at school (Table 17). Almost all (90.9%) parents agreed that using laptop computers had improved their child's research skills "a lot" (61.8%) or "some" (29.1%). While approximately 80% indicated that laptop use had increased their child's interest ("a lot" = 36.5%; "some" = 43.3%) and achievement in school ("a lot" = 31.1%; "some" = 45.9%). There was slightly less overall agreement (69.3%) that using laptops had improved their child's writing skills ("a lot" = 26.8%; "some" = 42.5%).

Less than 20% of the parents (17.8%) had participated in FTL-sponsored activities. The most commonly attended activity was an open house (67.4%), whereas nearly 23% (22.6%) of the parents had participated in computer training. Of the parents who responded to the "helpfulness" of the activities, most indicated that they were "very helpful."

### Table 17. FTL Parent Survey

2004-2005 parent survey not administered
2005-2006 n = 1,241

| To what degree has using a laptop computer at school changed you child's: | Percent Not Sure | Percent Not at All | Percent Some | Percent A Lot |
|---|---|---|---|---|
| Research skills | 4.2 | 4.3 | 29.1 | 61.8 |
| Involvement in project-type school work | 6.6 | 7.0 | 34.6 | 50.4 |
| Interest in school? | 8.3 | 10.6 | 43.3 | 36.5 |
| Achievement in school? | 9.1 | 12.5 | 45.9 | 31.1 |
| Writing skills | 10.5 | 18.7 | 42.5 | 26.8 |
| Ability to work with other students | 14.4 | 17.5 | 40.0 | 26.7 |

| | | |
|---|---|---|
| **Have you participated in any parent activities supported by the laptop program?** | Yes | 17.8 |
| | No | 0.1 |
| | **Percentage of activity participation** | |
| If yes, please indicate the type of activity (mark all that apply) | Open house | 67.4 |
| | Computer training | 22.6 |
| | Technology fair | 4.5 |
| | Other | 36.7 |
| How helpful was the activity? | Very helpful | 12.5 |
| | Somewhat helpful | 7.3 |
| | Not helpful | 0.6 |
| | Did not attend any activities | 15.6 |

*Note*. Item percentages may not total 100% because of missing input from some respondents

## Student Performance-Based Assessment Results

The Problem-Solving and Technology Tasks were administered to examine the impact of the FTL program on 6th grade students' ability to solve problems and to generate computer products that reflect problem-solving solutions according to ISTE NETS for students. The performance-based assessments were administered to 6th grade FTL and Control students who were strategically matched on the basis of school size; school local (urban, suburban, rural); ethnicity (percent minority); SES indicator (percent free and reduced-price lunch); and availability of control school computer access (computer labs) for assessment administration. Results for each assessment are presented below.

### Student Problem-Solving Task

As described earlier, the Student Problem-Solving Task was assessed with a rubric comprised of seven components, each rated on a three-level scale with "3" representing the highest level of response. The participants consisted of 32 6th grade students, 11 in the FTL group and 21 in the Control group. Across all problem-solving areas, the FTL means scores were higher or equal to those of the control group (Table 18). The FTL students exhibited the highest ability in demonstrating understanding of the problem (*M* = 1.50), identifying what is known about the problem (*M* = 1.36) and what needs to be known about the problem (*M* = 1.23). In contrast, the control group's highest level of performance was with regard to understanding the problem (*M* = 1.14) and in describing the use of collaborative learning in the solution (*M* = 1.14). The lowest level of ability for both the FTL and Control groups was seen in three areas: how to present the findings (FTL *M* = 1.05, Control *M* = 1.02), determining how the data needs to be manipulated to solve the problem (FTL *M* = 1.05, Control *M* = 1.00), and interestingly, describing how technology would be used to solve the problem (FTL *M* = 1.00, Control *M* = 1.00).

**Table 18. Student* Problem-Solving Task: Frequencies and Means**

| Items by Group | 0 | | 1 | | 1.5 | | 2 | | 2.5 | | 3 | | Overall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | % | *N* | % | *N* | % | *N* | % | *N* | % | *N* | % | *n* | *M* | *SD* |
| **Understands Problem** | | | | | | | | | | | | | | | |
| Program | 0 | 0.0 | 4 | 36.4 | 3 | 27.3 | 4 | 36.4 | 0 | 0.0 | 0 | 0.0 | 11 | 1.50 | 0.45 |
| Control | 0 | 0.0 | 17 | 81.0 | 2 | 9.5 | 2 | 9.5 | 0 | 0.0 | 0 | 0.0 | 21 | 1.14 | 0.32 |
| **Identifies what is known about the problem** | | | | | | | | | | | | | | | |
| Program | 0 | 0.0 | 6 | 54.5 | 2 | 18.2 | 3 | 27.3 | 0 | 0.0 | 0 | 0.0 | 11 | 1.36 | 0.45 |
| Control | 0 | 0.0 | 19 | 90.5 | 0 | 0.0 | 2 | 9.5 | 0 | 0.0 | 0 | 0.0 | 21 | 1.10 | 0.30 |
| **Identifies what needs to be know to solve the problem** | | | | | | | | | | | | | | | |
| Program | 0 | 0.0 | 7 | 63.6 | 3 | 27.3 | 1 | 9.1 | 0 | 0.0 | 0 | 0.0 | 11 | 1.23 | 0.34 |
| Control | 0 | 0.0 | 19 | 90.5 | 2 | 9.5 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 21 | 1.05 | 0.15 |
| **Determine how the data needs to be manipulated to solve the problem** | | | | | | | | | | | | | | | |
| Program | 0 | 0.0 | 10 | 90.9 | 1 | 9.1 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 11 | 1.05 | 0.15 |
| Control | 0 | 0.0 | 21 | 100.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 21 | 1.00 | 0.00 |
| **Describes the use of technology** | | | | | | | | | | | | | | | |
| Program | 0 | 0.0 | 11 | 100.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 11 | 1.00 | 0.00 |
| Control | 0 | 0.0 | 21 | 100.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 21 | 1.00 | 0.00 |
| **Describes how to present findings** | | | | | | | | | | | | | | | |
| Program | 0 | 0.0 | 10 | 90.9 | 1 | 9.1 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 11 | 1.05 | 0.15 |
| Control | 0 | 0.0 | 20 | 95.2 | 1 | 4.8 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 21 | 1.02 | 0.11 |
| **Collaborative Learning** | | | | | | | | | | | | | | | |
| Program | 0 | 0.0 | 9 | 81.8 | 1 | 9.1 | 1 | 9.1 | 0 | 0.0 | 0 | 0.0 | 11 | 1.14 | 0.32 |
| Control | 0 | 0.0 | 18 | 85.7 | 0 | 0.0 | 3 | 14.3 | 0 | 0.0 | 0 | 0.0 | 21 | 1.14 | 0.36 |

*6th Grade students

***Student Problem-Solving Task Inferential Results: FTL vs. Control.*** Preliminary analysis did not justify using MANOVA due to properties of the student problem solving task score distributions. Therefore, separate ANOVA were conducted to compare FTL Program vs. Control students' problem solving scores across seven components of the problem-solving rubric. Results of the analyses are seen in Table 19 and Figure 7. FTL program students exhibited significantly higher (*ES* = +0.97) ability in demonstrating understanding of the problem and in identifying what needs to be known to solve the problem (*ES* = +0.77). These effect sizes can be considered as representing a strong and meaningful educational effect.

**Table 19. Student Problem-Solving Task: Significant Differences Between FTL and Control**

| | FTL (*n* = 11) | | Control (*n* = 21) | | | | |
|---|---|---|---|---|---|---|---|
| **Problem-Solving Rubric items** | ***M*** | ***SD*** | ***M*** | ***SD*** | ***F(1,30)*** | ***p*** | ***ES*** |
| Understands problem | 1.50 | 0.48 | 1.14 | 0.32 | 6.785 | 0.014* | 0.97 |
| Identifies what needs to be known to solve the problem | 1.23 | 0.34 | 1.05 | 0.15 | 4.277 | 0.047* | 0.77 |

**Problem-Solving: Significant FTL vs. Control Differences**

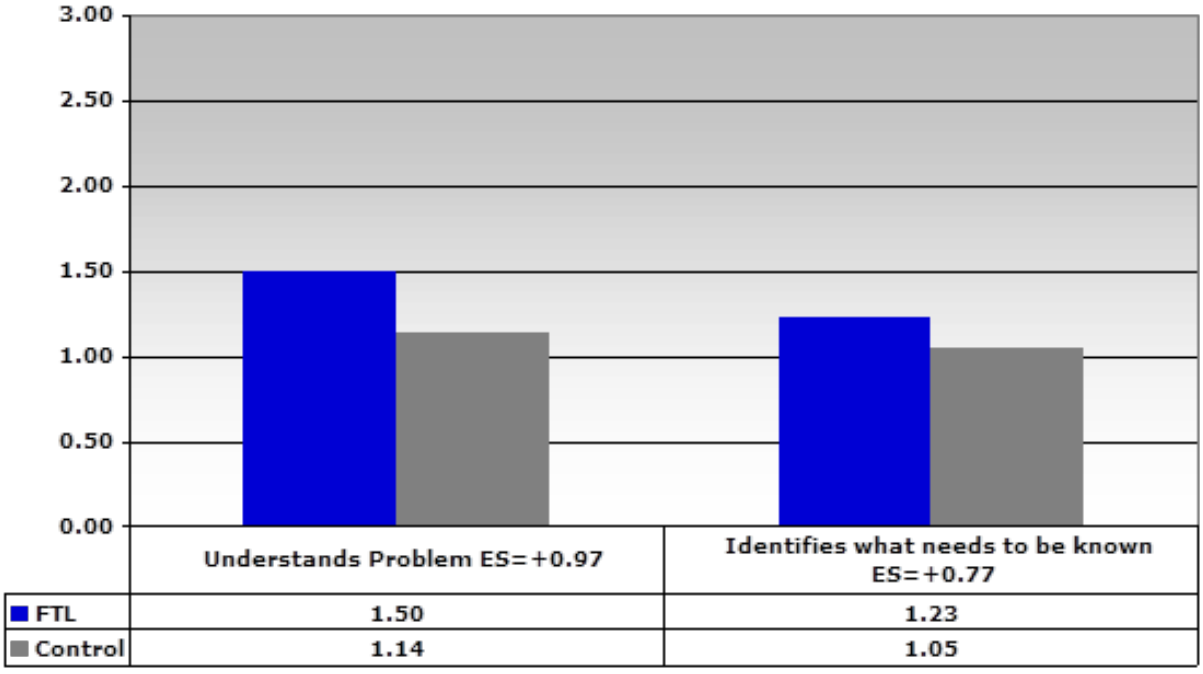



**Figure 7. Student Problem-Solving Assessment: Significant FTL vs. Control Differences**

**Student Technology Task**

As described earlier, each component in the Student Technology Task was assessed with a three-level rubric scale regarding the degree to which the element was completed as described ("2" = completed; "1" = partially completed; "0" = not completed). Results for the Student Technology Tasks are presented in the following tables: Spreadsheets (Table 20); Presentation (Table 21); and Internet (Table 22). As seen in Table 20, FTL program students exhibited a slightly higher degree of proficiency with spreadsheets than Control students. However the overall performance for both groups was below average (FTL *M* = 0.16; Control *M* = 0.09).

**Table 20. SPREADSHEETS: Student* Technology Task Frequencies and Means**

| Spreadsheets | 0 | | 1 | | 2 | | Overall | | |
|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *N* | % | *n* | *M* | *SD* |
| **Enter numerical data into spreadsheet cells?** | | | | | | | | | |
| FTL Program | 20 | 74.1 | 0 | 0.0 | 7 | 25.9 | 27 | 0.52 | 0.89 |
| Control | 21 | 87.5 | 1 | 4.2 | 2 | 8.3 | 24 | 0.21 | 0.59 |
| **Place column names into correct cells?** | | | | | | | | | |
| FTL Program | 20 | 74.1 | 2 | 7.4 | 5 | 18.5 | 27 | 0.44 | 0.80 |
| Control | 21 | 87.5 | 1 | 4.2 | 2 | 8.3 | 24 | 0.21 | 0.59 |
| **Place row names in correct cells?** | | | | | | | | | |
| FTL Program | 20 | 74.1 | 3 | 11.1 | 4 | 14.8 | 27 | 0.41 | 0.75 |
| Control | 21 | 87.5 | 1 | 4.2 | 2 | 8.3 | 24 | 0.21 | 0.59 |
| **Use a spreadsheet formula to calculate the average of a column of numbers?** | | | | | | | | | |
| FTL Program | 25 | 92.6 | 0 | 0.0 | 2 | 7.4 | 27 | 0.15 | 0.53 |
| Control | 24 | 100.0 | 0 | 0.0 | 0 | 0.0 | 24 | 0.00 | 0.00 |
| **Create a chart?** | | | | | | | | | |
| FTL Program | 26 | 96.3 | 1 | 3.7 | 0 | 0.0 | 27 | 0.04 | 0.19 |
| Control | 23 | 95.8 | 1 | 4.2 | 0 | 0.0 | 24 | 0.04 | 0.20 |
| **Change the color of columns in a column chart?** | | | | | | | | | |
| FTL Program | 27 | 100.0 | 0 | 0.0 | 0 | 0.0 | 27 | 0.00 | 0.00 |
| Control | 23 | 95.8 | 0 | 0.0 | 1 | 4.2 | 24 | 0.08 | 0.41 |
| **Add a title to a chart?** | | | | | | | | | |
| FTL Program | 27 | 100.0 | 0 | 0.0 | 0 | 0.0 | 27 | 0.00 | 0.00 |
| Control | 23 | 95.8 | 1 | 4.2 | 0 | 0.0 | 24 | 0.04 | 0.20 |
| **Add a title to a chart axis?** | | | | | | | | | |
| FTL Program | 27 | 100.0 | 0 | 0.0 | 0 | 0.0 | 27 | 0.00 | 0.00 |
| Control | 23 | 95.8 | 1 | 4.2 | 0 | 0.0 | 24 | 0.04 | 0.20 |
| **Change the range of the Y-axis scale?** | | | | | | | | | |
| FTL Program | 27 | 100.0 | 0 | 0.0 | 0 | 0.0 | 27 | 0.00 | 0.00 |
| Control | 24 | 100.0 | 0 | 0.0 | 0 | 0.0 | 24 | 0.00 | 0.00 |
| **Change location of the legend?** | | | | | | | | | |
| FTL Program | 27 | 100.0 | 0 | 0.0 | 0 | 0.0 | 27 | 0.00 | 0.00 |
| Control | 23 | 95.8 | 0 | 0.0 | 1 | 4.2 | 24 | 0.08 | 0.41 |

*6TH grade

| **OVERALL** | *n* | *M* | *SD* |
|---|---|---|---|
| **FTL Program** | 27 | 0.16 | 0.28 |
| **Control** | 24 | 0.09 | 0.26 |

The FTL students demonstrated a much greater degree of expertise with *PowerPoint* software (Table 21), as the overall mean scores for each presentation task were higher for FTL student performance products as compared to the presentation products created by the Control students. Specifically, the FTL mean scores ranged from *M* = 1.78 to *M* = 0.04, whereas the range for Control students was *M* = 1.00 to *M* = 0.00.

**Table 21. PRESENTATION: Student* Technology Task Frequencies and Means**

| Presentation | 0 | | 1 | | 2 | | Overall | | |
|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *N* | % | *n* | *M* | *SD* |
| **Add a title to a slide?** | | | | | | | | | |
| FTL Program | 4 | 14.8 | 0 | 0.0 | 23 | 85.2 | 27 | 1.70 | 0.72 |
| Control | 12 | 50.0 | 0 | 0.0 | 12 | 50.0 | 24 | 1.00 | 1.02 |
| **Add a slide to a presentation?** | | | | | | | | | |
| FTL Program | 3 | 11.1 | 0 | 0.0 | 24 | 88.9 | 27 | 1.78 | 0.64 |
| Control | 12 | 50.0 | 0 | 0.0 | 12 | 50.0 | 24 | 1.00 | 1.02 |
| **Insert a clipart image or photograph to a slide?** | | | | | | | | | |
| FTL Program | 8 | 29.6 | 0 | 0.0 | 19 | 70.4 | 27 | 1.41 | 0.93 |
| Control | 18 | 75.0 | 0 | 0.0 | 6 | 25.0 | 24 | 0.50 | 0.88 |
| **Change the font of a text within a presentation?** | | | | | | | | | |
| FTL Program | 12 | 44.4 | 0 | 0.0 | 15 | 55.6 | 27 | 1.11 | 1.01 |
| Control | 15 | 62.5 | 0 | 0.0 | 9 | 37.5 | 24 | 0.75 | 0.99 |
| **Change the size of text within a presentation?** | | | | | | | | | |
| FTL Program | 19 | 70.4 | 0 | 0.0 | 8 | 29.6 | 27 | 0.59 | 0.93 |
| Control | 19 | 79.2 | 0 | 0.0 | 5 | 20.8 | 24 | 0.42 | 0.83 |
| **Bold text within a presentation?** | | | | | | | | | |
| FTL Program | 15 | 55.6 | 0 | 0.0 | 12 | 44.4 | 27 | 0.89 | 1.01 |
| Control | 19 | 79.2 | 0 | 0.0 | 5 | 20.8 | 24 | 0.42 | 0.83 |
| **Insert a Microsoft *Excel* spreadsheet chart onto a slide?** | | | | | | | | | |
| FTL Program | 26 | 96.3 | 1 | 3.7 | 0 | 0.0 | 27 | 0.04 | 0.19 |
| Control | 24 | 100.0 | 0 | 0.0 | 0 | 0.0 | 24 | 0.00 | 0.00 |
| **Arrange content on a slide as a bullet list?** | | | | | | | | | |
| FTL Program | 5 | 18.5 | 2 | 7.4 | 20 | 74.1 | 27 | 1.56 | 0.80 |
| Control | 14 | 58.3 | 1 | 4.2 | 9 | 37.5 | 24 | 0.79 | 0.98 |
| *Add a design template to a presentation?* | | | | | | | | | |
| FTL Program | 16 | 59.3 | 0 | 0.0 | 11 | 40.7 | 27 | 0.81 | 1.00 |
| Control | 19 | 79.2 | 1 | 4.2 | 4 | 16.7 | 24 | 0.37 | 0.77 |
| **Select and use relevant images?** | | | | | | | | | |
| FTL Program | 8 | 29.6 | 0 | 0.0 | 19 | 70.4 | 27 | 1.41 | 0.93 |
| Control | 19 | 79.2 | 0 | 0.0 | 5 | 20.8 | 24 | 0.42 | 0.83 |

*6th grade

| **OVERALL** | *n* | *M* | *SD* |
|---|---|---|---|
| **FTL Program** | 27 | 1.13 | 0.52 |
| **Control** | 24 | 0.57 | 0.50 |

The greatest level of expertise and skill demonstrated by the FTL students was in their use of the Internet (Table 22). The overall mean scores for FTL student performance as compared to the Control student performance is striking: FTL *M* = 1.58 vs. Control *M* = 0.42.

**Table 22. INTERNET: Student* Technology Task Frequencies and Means**

| Internet | 0 | | 1 | | 2 | | Overall | | |
|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *N* | % | *n* | *M* | *SD* |
| **Navigate to a web site given a specific web address (URL)?** | | | | | | | | | |
| FTL Program | 5 | 18.5 | 0 | 0.0 | 22 | 81.5 | 27 | 1.63 | 0.79 |
| Control | 18 | 75.0 | 0 | 0.0 | 6 | 25.0 | 24 | 0.50 | 0.88 |
| **Obtain an image from a website and use it in a document?** | | | | | | | | | |
| FTL Program | 7 | 25.9 | 0 | 0.0 | 20 | 74.1 | 27 | 1.48 | 0.89 |
| Control | 20 | 83.3 | 0 | 0.0 | 4 | 16.7 | 24 | 0.33 | 0.76 |

*6th grade

| **OVERALL** | *n* | *M* | *SD* |
|---|---|---|---|
| **FTL Program** | 27 | 1.56 | 0.80 |
| **Control** | 24 | 0.42 | 0.78 |

***Student Technology Task Inferential Results: FTL vs. Control.*** A MANOVA comparing the FTL Program and Control student technology task scores yielded a highly significant difference (Hotellings T = 0.54, F (3, 47) = 8.48, *p* = .001). Follow-up analyses (Table 23 and Figure 8) showed overall significant advantages for the FTL Program group with regard to completing Presentation and Internet tasks. The effect sizes ranged from +1.02 to +1.44, thus indicating that the significant differences were very strong and educationally meaningful.

**Table 23. Student Technology Task: Significant Differences Between FTL and Control**

| Overall | Hotellings T | *F* | Hypothesis *df* | Error *df* | Significance |
|---|---|---|---|---|---|
| | 0. 541 | 8.479 | 3 | 47 | 0.001 |

| | Program (*n* = 27) | | Control (*n* = 24) | | | | |
|---|---|---|---|---|---|---|---|
| **Technology Tasks** | ***M*** | ***SD*** | ***M*** | ***SD*** | ***F (1, 49)*** | ***p*** | ***ES(d)*** |
| Spreadsheets | 0.16 | 0.28 | 0.09 | 0.26 | 0.72 | 0.400 | N/A |
| Presentation | 1.13 | 0.52 | 0.57 | 0.59 | 13.11 | 0.001** | 1.02 |
| Internet | 1.56 | 0.80 | 0.42 | 0.78 | 26.48 | 0.001** | 1.44 |

** p < .01

**Technology Tasks: Significant FTL vs. Control Differences**

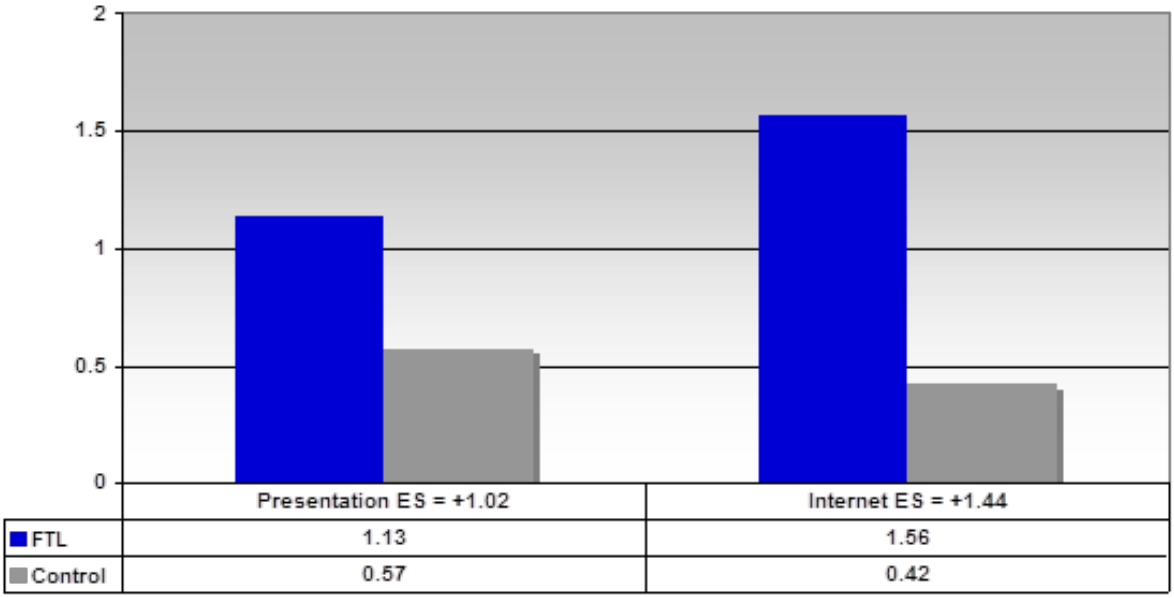



**Figure 8. Student Problem-Solving Assessment: Significant FTL vs. Control Differences**

## Student Achievement Analysis Results

A series of 2x2 chi-square frequency analyses were conducted comparing FTL and comparison schools, to investigate the association between the program and students' achievement in four subjects: English, Math, Reading and Writing. For these subject areas, there were four levels of achievement: Level 1 (exceeded MI standards), Level 2 (met MI standards), Level 3 (at basic level), and Level 4 (apprentice) according to the Michigan Educational Assessment of Program (MEAP). Based on the differences among the levels, the proficiency level classifications were collapsed into two categories: meet or exceed standard (Level 1 and 2) and at basic or below standard (Level 3 and 4). The number of students in these two classifications was calculated and inserted into a 2 by 2 frequency table. The chi-square outcomes indicated that the student outcomes for one pair of schools were not significantly different (Table 24). Among the remaining seven pairs, four FTL schools outperformed their matched comparison schools in math (2 pairs) and writing (2 pairs). For the remaining three school pairs, the comparison schools outperformed the FTL schools in math (2 pairs), and in both English and writing (1 pair).

**Table 24. FTL Student Achievement Analysis by School Pairs and Test Subjects**

| School Pairs | FTL | | Comparison | | | |
|---|---|---|---|---|---|---|
| | *Number Meeting or Exceeding Standard* | *Number At or Below Standard* | *Number Meeting or Exceeding Standard* | *Number At or Below Standard* | ***Chi Square*** | ***p*** |
| ***Pair 1*** | | | | | | |
| English | 123 | 105 | 90 | 68 | 0.41 | .52 |
| Math | 83 | 140 | 79 | 80 | 5.94 | .015** |
| Reading | 136 | 92 | 99 | 59 | 0.38 | .54 |
| Writing | 110 | 118 | 87 | 71 | 1.88 | .17 |
| ***Pair 2*** | | | | | | |
| English | 93 | 162 | 58 | 65 | 4.10 | .043** |
| Math | 75 | 183 | 26 | 96 | 2.58 | .11 |
| Reading | 110 | 145 | 64 | 59 | 2.65 | .10 |
| Writing | 85 | 170 | 54 | 69 | 4.15 | .042** |
| ***Pair 3*** | | | | | | |
| English | 16 | 7 | 12 | 6 | 0.04 | .84 |
| Math | 10 | 13 | 13 | 5 | 3.38 | .07 |
| Reading | 17 | 6 | 16 | 2 | 1.45 | .23 |
| Writing | 17 | 6 | 8 | 10 | 3.69 | .05* |
| ***Pair 4*** | | | | | | |
| English | 19 | 5 | 56 | 19 | 0.20 | .65 |
| Math | 21 | 4 | 47 | 28 | 3.91 | .048* |
| Reading | 20 | 4 | 61 | 14 | 0.05 | .83 |
| Writing | 16 | 8 | 53 | 22 | 0.14 | .71 |
| ***Pair 5*** | | | | | | |
| English | 37 | 21 | 30 | 21 | 0.29 | .59 |
| Math | 15 | 43 | 26 | 25 | 7.28 | .007** |
| Reading | 42 | 16 | 32 | 19 | 1.17 | .28 |
| Writing | 30 | 28 | 20 | 31 | 1.71 | .19 |
| ***Pair 6*** | | | | | | |
| English | 14 | 2 | 32 | 7 | 0.24 | .62 |
| Math | 14 | 2 | 22 | 16 | 4.44 | .035* |
| Reading | 14 | 2 | 32 | 7 | 0.24 | .62 |
| Writing | 14 | 2 | 29 | 10 | 1.14 | .29 |
| ***Pair 7*** | | | | | | |
| English | 26 | 8 | 120 | 67 | 2.00 | .16 |
| Math | 27 | 7 | 121 | 66 | 2.81 | .09 |
| Reading | 25 | 9 | 125 | 62 | 0.59 | .44 |
| Writing | 27 | 7 | 109 | 78 | 5.51 | .02* |
| ***Pair 8*** | | | | | | |
| English | 22 | 9 | 43 | 21 | 0.14 | .71 |
| Math | 21 | 10 | 35 | 29 | 1.46 | .23 |
| Reading | 21 | 10 | 41 | 23 | 0.12 | .73 |
| Writing | 21 | 10 | 37 | 27 | 0.86 | .35 |

*FTL significantly higher than Control; **Control significantly higher than FTL

# Conclusions

The conclusions of the present study are presented in association with each of the FTL program goals in the following section.

**GOAL 1 Enhance student learning and achievement in core academic subjects with an emphasis on developing the knowledge and skills requisite to the establishment of a 21st Century workforce in Michigan.**

The results of this evaluation suggest that FTL students have greater advantages than non-FTL students with regard to developing the knowledge and skills needed to achieve success in the 21st Century workforce and equal to or enhanced advantages for increased learning and achievement. FTL students as compared to control students exhibited greater ability to locate and utilize Internet resources and develop computer-based presentations. FTL students also demonstrated significantly higher problem-solving abilities than non-FTL students. Just at importantly, the majority of the FTL students agreed that use of the laptops had made them more interested in learning and would help them get better jobs in the future. Similarly, the FTL teachers agreed to a significantly higher degree than teachers represented by the national norms that laptop use had a positive impact on student learning and achievement. Additionally, observations showed that FTL students were engaged in meaningful computer learning activities significantly more than students represented in the national norms.

**GOAL 2 Provide greater access to equal educational opportunities statewide through ubiquitous access to technology.**

The Freedom to Learn program, as documented in this evaluation report, has made tremendous strides toward providing greater access to equal educational opportunities to students in FTL classrooms. This is evidenced by the program providing laptop computers to students in 195 schools and in data from over 5,700 FTL students who report that they are very glad that they get to use laptop computers and want to use them again next year. Nearly all students reported that using laptop computers increased their research skills, made schoolwork easier and made them learn more and do better on tests. Similarly, the FTL teachers reported that having laptops had increased their use of student-centered practices, increased student motivation and learning, and improved student computer skills as well as their own personal technology skills. Additional evidence was revealed when examining data from random visits to 599 FTL classrooms. For example, FTL vs. national norm classroom observation data show that computer activities in FTL lessons were significantly more meaningful and that FTL students more frequently used the laptops as learning tools. Collectively, these data present triangulated evidence that the 2005-2006 FTL program implementation did provide greater access to equal educational opportunities statewide through ubiquitous access to technology.

**GOAL 3 Foster effective use of the wireless technology through systematic professional development for teachers, administrators and staff.**

There was moderate agreement among the 380 FTL teachers that they had received adequate training to incorporate laptops into their instruction. There was also moderate agreement that, as a result of the FTL professional development (PD), the quality of laptop lessons was improved and the teachers more frequently integrated the laptops into their instruction. Evidence of PD effectiveness was seen during classroom observations in which FTL teachers implemented lessons that were significantly more meaningful, more student-centered, and more often used laptops as tools for learning than did teachers represented by CREP's national norms. The results suggest that the PD focus and approach for preparing teachers to integrate effective use of laptops into their instruction is successful. However, the data also suggest that the frequency and amount of professional development needs to be increased. According to Lead Teacher surveys from 63 schools, administrator participation in FTL professional development occurred less frequently during the second year of implementation, although many administrators modeled the use of technology and were involved in the FTL program.

**GOAL 4 Empower parents and caregivers with the tools to become more involved in their children's education.**

Direct information from over 1,200 parents/caregivers representing approximately half of the FTL schools revealed that parents were positive and supportive of their children using laptops at school. Almost all parents agreed that laptop use had improved their child's research skills and increased their interest and achievement in school. However, very few of the parents reported participation in FTL-sponsored computer training. Similar results are seen in survey responses from FTL teachers and Lead Teachers who generally agreed that parents supported the FTL program, while Lead Teacher data suggested that parental involvement with FTL was minimal.

**GOAL 5 Support innovative structural changes in participating schools and sharing of best practices through the creation of human networks among Program participants.**

Data from this evaluation reveal that the FTL program enabled and supported participating schools to achieve significantly more innovative structural changes during 2005-2006 than schools represented in the national norms. This was evidenced by observing significantly more student-centered activities that engaged students in independent research through the use of laptops as tools. It was also evidenced in FTL students demonstrating significantly higher problem solving, Internet and presentation software ability than matched-control students. Additional evidence is seen in FTL teachers being significantly more confident about meaningfully integrating technology than national norm teachers. Collectively, data from observations, surveys, performance-based assessments, and achievement analyses suggest that the two-year FTL program has been a catalyst for innovative technology interventions that have improved educational opportunities for Michigan's students, while the data also reveal room for continued growth and improvement.

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