The Impacts of Maine's Middle School One-to-One Laptop Program: A Status Report

Report to the

Maine Department of Education
and
Joint Standing Committee on Education and Cultural Affairs
and
Joint Standing Committee on Appropriations and Financial Affairs

Report by

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Executive Summary

Over eight years ago, Maine embarked on a bold new initiative. Entitled the Maine Learning Technology Initiative (MLTI), the State of Maine funded program provided all 7th and 8th grade students and their teachers with laptop computers, and provided schools and teachers with a wireless internet infrastructure technical assistance, and professional development for integrating laptop technology into their, curriculum and instruction.

The concept of the Maine Learning Technology Initiative began with a vision of former Governor Angus King. He believed that if Maine wanted to prepare Maine's students for a rapidly changing world, and wanted to gain a competitive edge over other states, it would require a sharp departure in action from what Maine had done in the past.

In the Fall of 2002-2003 academic year, the first full implementation of MLTI began. At the same time the then Maine commissioner of education, J. Duke Albanese, contracted with the Maine Education Policy Research Institute (MEPRI) to conduct the ongoing evaluation of MLTI. MEPRI is a non-partisan research institute funded jointly by the Maine State Legislature and the University of Maine System. Over the past eight years the MEPRI evaluation team has used a mixed method approach in the evaluation of the MLTI program; an approach that uses both quantitative and qualitative techniques in collecting and analyzing evaluation evidence.

The evaluation evidence contained in this report is organized into six sections. The first two sections of this report describe the most recent evidence on how the laptops are being used in Maine schools and classrooms, and some factors which appear to be related to use levels. The third section describes perceived benefits reported by teachers and students. These sections are followed by one reporting achievement impacts of the program, and one reporting program costs. The final section summarizes the impacts of the MLTI program, and presents a series of recommendations.

The evidence presented in this report, indicates that the MLTI program has had a significant impact on curriculum, instruction, and learning in Maine's middle schools. In the areas of curriculum and instruction, the evidence indicates many teachers have reached the tipping point in the adoption and integration of the laptop into their teaching. However, the adoption is uneven for some teachers, and in some areas. Relatively speaking, mathematics teachers use the laptops less frequently than their colleagues in other core disciplines. Most teachers are not using the laptops as frequently in assessment as one might expect, and too few teachers report using the laptop to frequently teach 21st Century Skills.

Middle school teachers report substantial benefits from the laptop program. Teachers indicated the laptops helped them teach more, in less time, and with greater depth, and they also reported that they could individualize their curriculum and instruction. Many teachers reported that their students learned more and with greater depth and understanding with the laptops.

There is some evidence of the direct impact of the laptops on student achievement. Results indicate that students' writing has improved. In mathematics there is evidence that a well-designed and executed professional development resulted in improved student performance in mathematics. A science study also found significant gains in student achievement when students used their laptop to learn science. In addition, two studies demonstrated the power of

students' laptops in learning an important 21st Century Skill; the skills of locating and evaluating information.

In light of these benefits of the laptop program, it is important to also consider the costs of the program. Although some of the evidence in this area must be used cautiously, it appears Maine's one-to-one laptop program costs are in line with the average costs found in other laptop programs. Maine's per unit costs were very similar to the average found in four other cost studies, and the incremental costs appear to be reasonable.

Thus, it appears the MLTI program has been successful in many ways. But this review has also surfaced some areas which need attention. A fundamental premise of the MLTI program is that technology integration is more about professional development than about hardware. The evaluators agree with this premise, and recommend that the project staff make some important changes and/or additions to the MLTI professional development program.

More specifically, the evaluation team recommends that for the near future the MLTI project staff focus professional development programs in the following areas:

1. increasing the use of technology in differentiating instruction
2. increasing the use of technology in teaching and learning mathematics
3. integrating technology with student assessment systems
4. integrating technology into the teaching of 21st Century skills
5. helping school level administrators become more effective in supporting the integration of technology into curriculum and instruction.

Second, the MLTI project staff should continue their efforts to deliver professional development program in the most effective and efficient ways possible, given limited resources. Third, the project staff should continue to document the impacts of the laptop program on student achievement.

The evaluation team believes that implementing these recommendations will enhance the effectiveness and impacts of the middle school laptop program. In addition, they will bring the program closer to achieving the original goal of the Maine Learning Technology Initiative.

The Impacts of Maine's Middle School One-to-One Laptop Program: A Status Report

Maine Education Policy Research Institute

University of Southern Maine

Introduction

Over eight years ago, Maine embarked on a bold new initiative, an initiative designed to:

> *...transform Maine into the premier state for utilizing technology in kindergarten to grade 12 education in order to prepare students for a future economy that will rely heavily on technology and innovation.* (Task Force on Maine's Learning Technology Endowment, 2001, p. vi)

Entitled the Maine Learning Technology Initiative (MLTI), the State of Maine funded program provided all 7th and 8th grade students and their teachers with laptop computers, and provided schools and teachers with a wireless internet infrastructure technical assistance, and professional development for integrating laptop technology into their, curriculum and instruction. This status report is designed to report on the impacts of the program. It presents evidence on both the use and impacts of the laptop technology on teachers and students, evidence of the impacts of the program on student achievement, and a cost analysis of the program.

Background

The concept of the Maine Learning Technology Initiative began with a vision of former Governor Angus King. He believed that if Maine wanted to prepare Maine's students for a rapidly changing world, and wanted to gain a competitive edge over other states, it would require a sharp departure in action from what Maine had done in the past.

In late 1999 a one-time state surplus provided Governor King the opportunity to act upon his beliefs. He proposed that all middle school students and teachers in Maine be provided laptop computers. In the summer of 2000 the Legislature and Governor King convened a Joint Task Force on the Maine Learning Technology Endowment and charged the task force with conducting an in-depth examination of the issues surrounding Governor King's proposal, and to recommend the best course for Maine to follow.

The task force concluded:

> *We live in a world that is increasingly complex and where change is increasingly rampant. Driving much of this complexity and change are new concepts and a new economy based on powerful, ubiquitous computer technology linked to the Internet.*

> *Our schools are challenged to prepare young people to navigate and prosper in this world, with technology as an ally rather than an obstacle. The challenge is familiar, but the imperative is new: we must prepare young people to thrive in a world that doesn't exist yet, to grapple with problems and construct new knowledge which is barely visible to us today. It is no longer adequate to prepare some of our young people to high levels of learning and technological literacy; we must prepare all for the demands of a world in which workers and citizens will be required to use and create knowledge, and embrace technology as a powerful tool to do so.*
>
> *If technology is a challenge for our educational system, it is also part of the solution. To move all students to high levels of learning and technological literacy, all students will need access to technology when and where it can be most effectively incorporated into learning.* (Task Force on Maine's Learning Technology Endowment, 2001, p. i).

In early 2001, the Task Force issued its report with the recommendation that Maine pursue a plan to deploy learning technology to all of Maine's students and teachers in the 7th and 8th grades, and then to examine expanding the program to other grade levels.

In September 2001, the Department of Education issued an RFP (Request for Proposal) for the MLTI, and a contract was awarded to Apple Computer, Inc. The initial phase of the program began in Spring 2002, when through funds provided by the Gates Foundation Grant, one so-called Exploration School was identified in each of the nine Superintendent Regions throughout the state of Maine. Seventh grade students and their teachers in these nine Exploration Schools were provided laptop computers. Also at this time, a program of professional development for teachers began that introduced teachers to the laptop and basic computer skills.

Teacher training through professional development was believed to be paramount for the successful implementation of the laptop program. The first step towards developing a statewide network of teacher training was the identification of Regional Integration Mentors (RIM). One teacher from each Exploration School was selected to serve as the RIM for that region. In addition to their regular teaching responsibilities, RIMs helped to develop practices and procedures for laptop use within their Exploration School, as well as assist MLTI staff in the development of a statewide network of professional development related to technology integration in middle schools and within each region.

In the Fall of the 2002-2003 academic year, the first full implementation phase of the MLTI began. In this phase, over 17,000 seventh graders and their teachers in over 240 schools

across the state of Maine received laptop computers. Concurrently, the Maine Department of Education initiated a professional development network consisting of several new roles and regional positions. In each of the State's middles schools, both a Teacher Leader and a Technology Coordinator were nominated and received training to help serve as leaders within their schools for the MLTI. These teacher leaders and technology coordinators now serve as contact and support personnel for the classroom teachers in the buildings where they teach. Subsequently new roles were created and added to the MLTI professional development network. These roles were Content Mentors and Content Leaders. These positions were created to facilitate greater integration of curriculum and technology and as support for the transformation of teaching and learning in Maine's classrooms.

With a mechanism for teacher training and professional development in place, the next phase of the initiative began in the Fall of the 2003-2004 academic year. Beginning with this academic year, and each subsequent year thereafter, all seventh and eighth graders and their teachers received laptop computers.

The initial program continues today. New contracts have been awarded to Apple Computers, Inc., and the Maine Department of Education, along with Apple personnel, continue to provide on-site and virtual professional development programs.

Evaluation Design

In June 2002, the then Maine commissioner of education, J. Duke Albanese, contracted with the Maine Education Policy Research Institute (MEPRI) to conduct the ongoing evaluation of MLTI. MEPRI is a non-partisan research institute funded jointly by the Maine State Legislature and the University of Maine System. The institute conducts education policy research for the Legislature, and under grants and contracts, conducts a variety of studies and evaluations for various state agencies such as the Maine Department of Education and the Maine State Board of Education.

Over the past eight years the MEPRI evaluation team has used a mixed method approach in the evaluation of the MLTI program; an approach that uses both quantitative and qualitative techniques in collecting and analyzing evaluation evidence. According to Frechtling and Sharp (1997):

> *There is a growing consensus among evaluation experts that both qualitative and quantitative methods have a place in the performance of effective evaluations.*

Both formative and summative evaluations are enriched by a mixed method approach.

By using different sources and methods at various points in the evaluation process, the evaluation team can build on the strength of each time of data collection and minimize the weaknesses of any single approach. A multi-method approach to evaluation can increase both the validity and reliability of evaluation data (p. 8-9)

Additionally, Johnson, Onwuegbuzie and Turner (2007) write:

Mixed methods research is becoming increasingly articulated, attached to research practice, and recognized as the third major research approach or research paradigm, along with qualitative research and quantitative research. Mixed methods research is, generally speaking, an approach to knowledge (theory and practice that attempts to consider multiple viewpoints, perspectives, positions, and standpoints (always including the standpoints of qualitative and quantitative research (p.112).

Evaluation evidence has been collected using a variety of tools. These included:

1. On-line and paper surveys. Survey data has been collected from teachers, students, principals, superintendents, technology coordinators, parents, RIMS, and teacher leaders. The surveys were designed primarily to collect information on the nature and breadth of uses and impacts. To date, over 95,000 surveys have been collected and analyzed.
2. Site visits. Over 50 site visits have been conducted over the past eight years in a variety of schools of differing size configuration, and geographic location. These site visits have included interviews with school personnel, students, parents, and observations.
3. Observation. Over 100 classroom observations of varying length and depth have been conducted during the site visits. Additionally, members of the evaluation team have regularly attended and conducted observations of a wide variety of professional development activities and programs.
4. Document analysis. Various types of documents have been analyzed by the evaluation team. These included school policies and procedures, school website documents, memos, lesson plans, student work, local school evaluation data, and professional development activity.
5. Achievement impact studies. The evaluation team has conducted five achievement studies using a variety of research designs. These include a random control trial (RCT), which is considered the gold star research design, as well as an ex post facto design, and three applied research designs.

Evaluation Evidence

The evaluation evidence contained in this report is organized into six sections. The first two sections of this report describe the most recent evidence on how the laptops are being used in Maine schools and classrooms, and some factors which appear to be related to use levels. The third section describes perceived benefits reported by teachers and students. These sections are followed by one reporting achievement impacts of the program, and one reporting program costs. The final section summarizes the impacts of the MLTI program, and presents a series of recommendations.

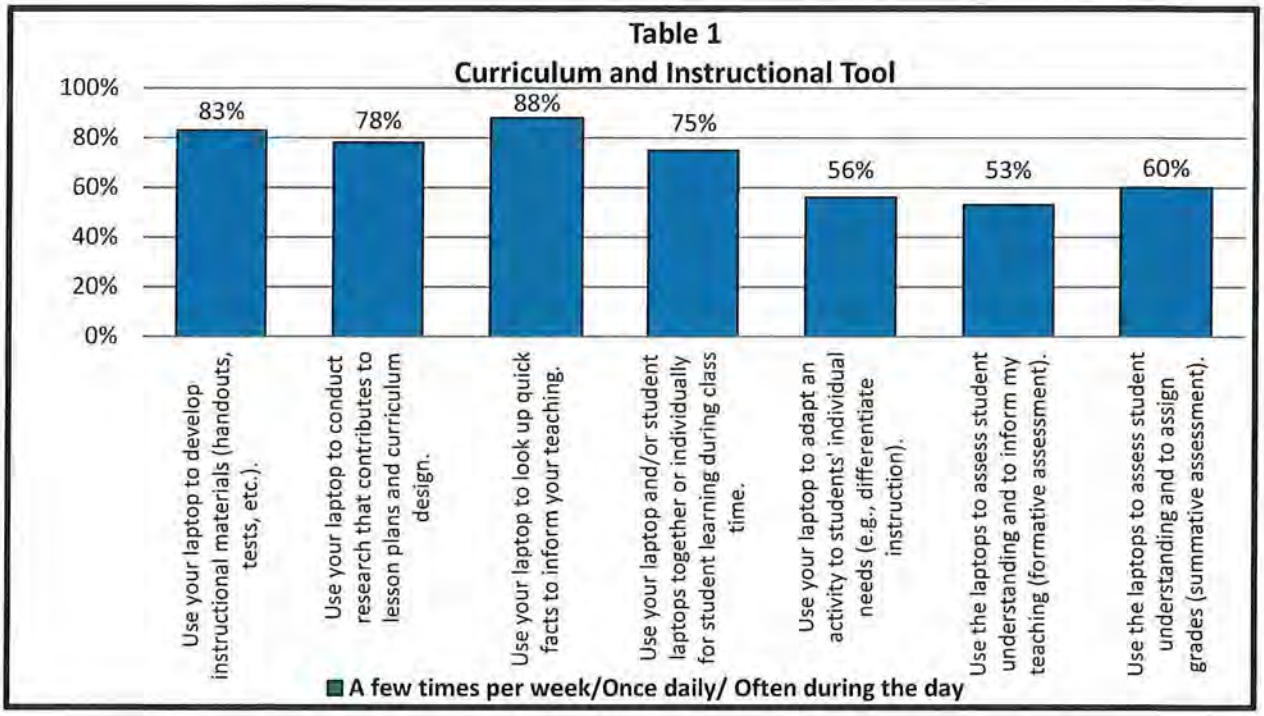
Section 1: Evidence on Laptop Uses

This section of the report describes information on laptop use by teachers and students in Maine's middle schools. How frequently are the laptops being used in classroom instruction, and how are they being used? Are use levels as high as one might expect? This section will attempt to answer these questions.

Teachers report using the laptops in a variety of ways, and with different levels of frequency. Tables 1 and 2 describe two broad categories of use, as reported by over 1690 middle school teachers in Spring 2010. These teachers represent approximately 38% of all middle school teachers, and an analysis of the demographic of the respondents indicated these teachers were fairly representative of all of Maine's middle school teachers. For example, respondents were similar to the population of middle school teachers in terms of subjects taught, age, degrees earned, and years of experience. A copy of the 2010 survey appears in Appendix A.

Table 1 on the next page presents frequency use for a series of activities which may be classified as related to curriculum development and instruction. The survey items asked teachers how frequently they used their laptops to perform certain activities. Teachers could respond by checking one of the following categories: (a) Never; (b) Less than once per week; (c) Once per week; (d) A few times per week; (e) Once daily; or (f) Often during the day. For purposes of characterizing these results in this section of the report, the top three most frequent use levels were combined and this is presented in the tables which follow. Thus, the tables included in this section only report frequencies levels for use of the laptops "A Few Times Each Week or More Often."

Several findings are noteworthy. For instance, approximately 80-90% of the teachers report using their laptops a few times a week or more frequently to develop instructional



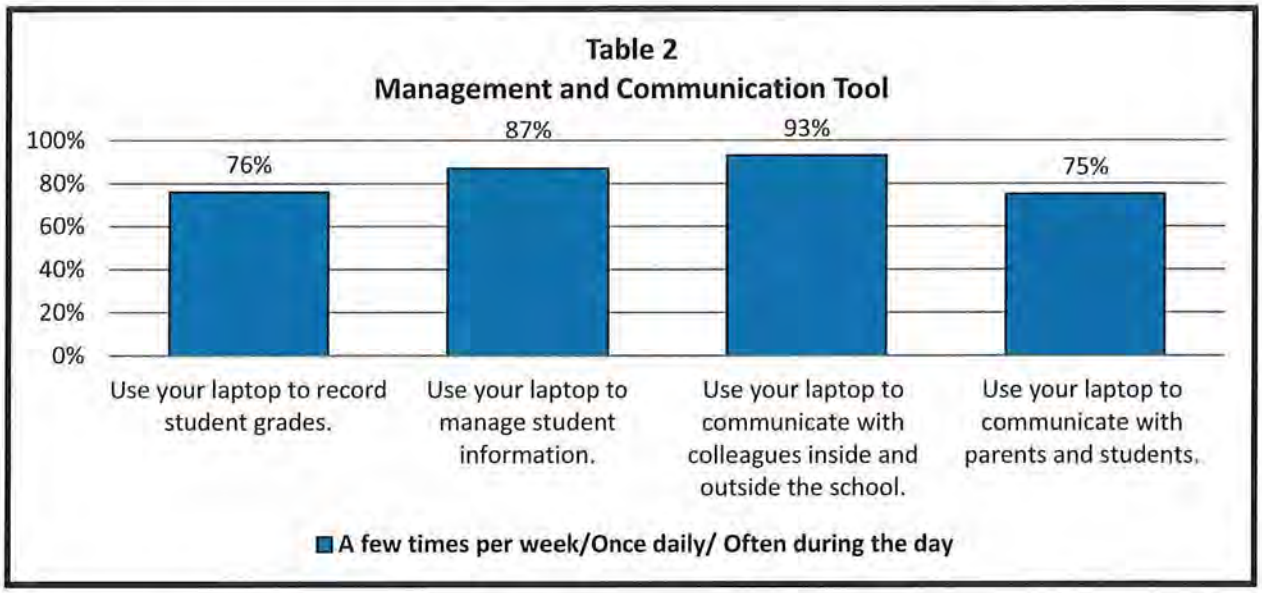
materials, and conduct research for lesson development. And three-quarters of the teachers (75%) report using the laptop just as frequently in providing instruction (i.e., Use your laptop and/or student laptops together or individually for student learning during class time).

Second, while a large majority of teachers report frequently using the laptop in developing lessons and in providing classroom instruction, only a little over half the teachers reported using the laptops to provide differentiated instruction. As will be noted in a later section of this report, teachers believe one of the benefits of the laptop is that it allows them to differentiate instruction more (see page 22). So at first blush, these findings are somewhat surprising. However, given the potential power of differentiating instruction in meeting individual learner needs, it is important to explore these findings in further detail. Why this is not higher is not discernable from the survey evidence. It might be that differentiating instruction is done, but just less often in any given span of a week. Or possibly teachers have not yet developed the skills for frequently differentiating instruction with the laptops. In either case, additional analyses are needed in this area.

The same may be true in the case of using the laptops for assessment. Three out of five teachers reported using the laptops for summative assessments, but only about one-half report using them for conducting formative assessments. Again, given the importance of these activities in understanding student learning, one might expect formative assessments using the

laptops to take place even more frequently than summative assessments. Why is this not the case? It could be that many teachers may lack the skills to use the laptops in conducting formative assessment or teachers may be unclear about what constitutes a "formative" assessment. In either case, this type of activity, and why it is not more integrated in the use of the laptops, needs further research and possibly the implementation of more targeted professional development on the part of the MLTI project team.

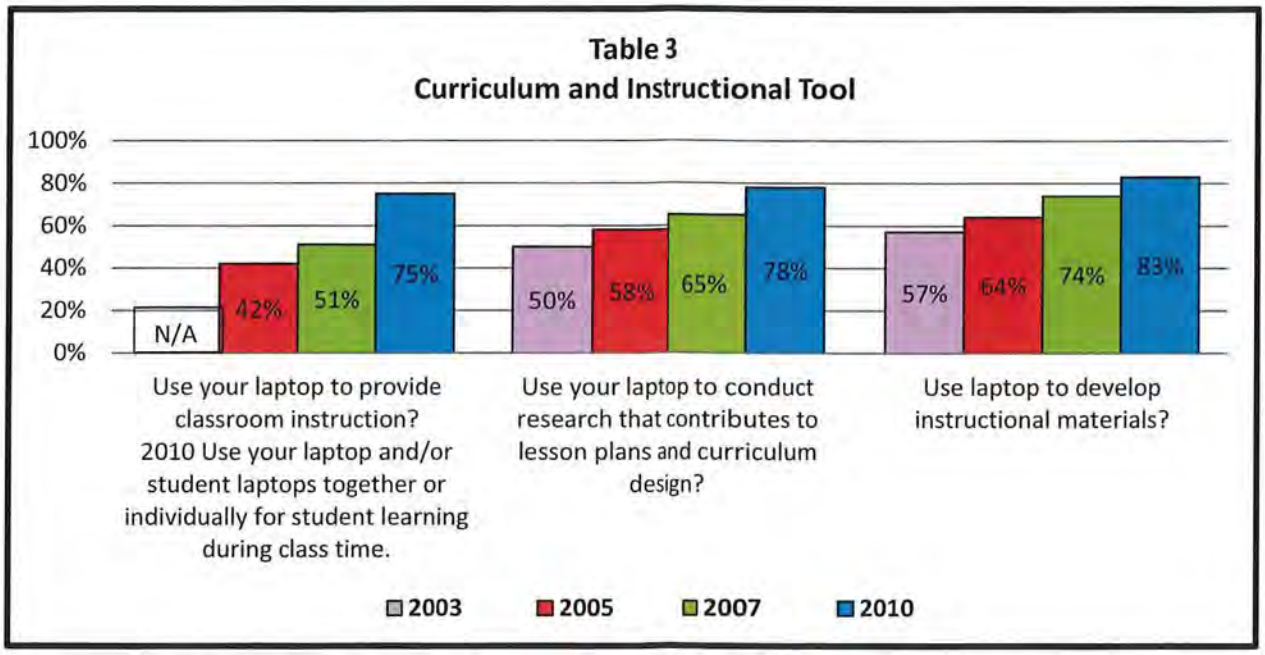
Table 2 reports activities that suggest the laptops are also being used as a management and communication tool. Approximately 75-90% of the teachers use the laptops a few times a



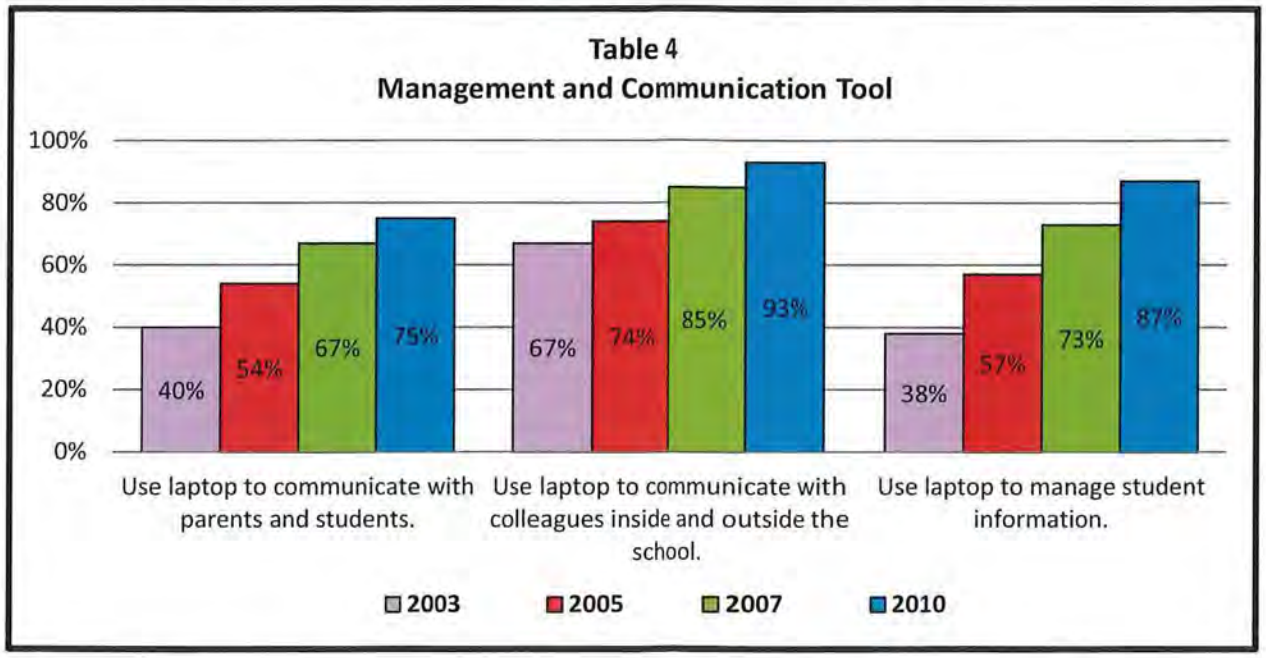
week or more frequently to record and manage student information. Over 90% of the teachers use their laptop for communicating with colleagues. However, the type of communication (i.e., school or non-school) is unknown. Three out of 4 teachers report using their laptops to communicate with parents and students.

Have use levels changed over time and have they reached desired levels? In the case of changes over time, Tables 3 and 4 on the next page report changes in use levels over the past eight years. In the case of using the laptops as a curriculum and instructional tool, Table 3 on the next page reports teacher use levels for four different time periods: (1) 2003, at the end of the first full year of implementation; (2) Year 3 of implementation; (3) Year 5 of implementation; and (4) for 2010, eight years after the initial deployment of the laptops to all middle schools. As the data shows, there has been a consistent increase in the use of the laptops in developing

curriculum and in providing instruction. The same is true in the case of using the laptops as management and communication tools (Table 4). The greatest increase has been the frequent use



of the laptop to manage student information, from 38% to 87%. And possibly particularly noteworthy is the increased use of the laptops for communicating with parents and students.



Whereas, by the end of the first year of deployment of the laptops, 4 out of 10 teachers reported using their laptops to communicate with parents and students a few times a week or more

frequently, eight years after the initial deployment, 75% of the teachers indicated they were communicating frequently with parents and students.

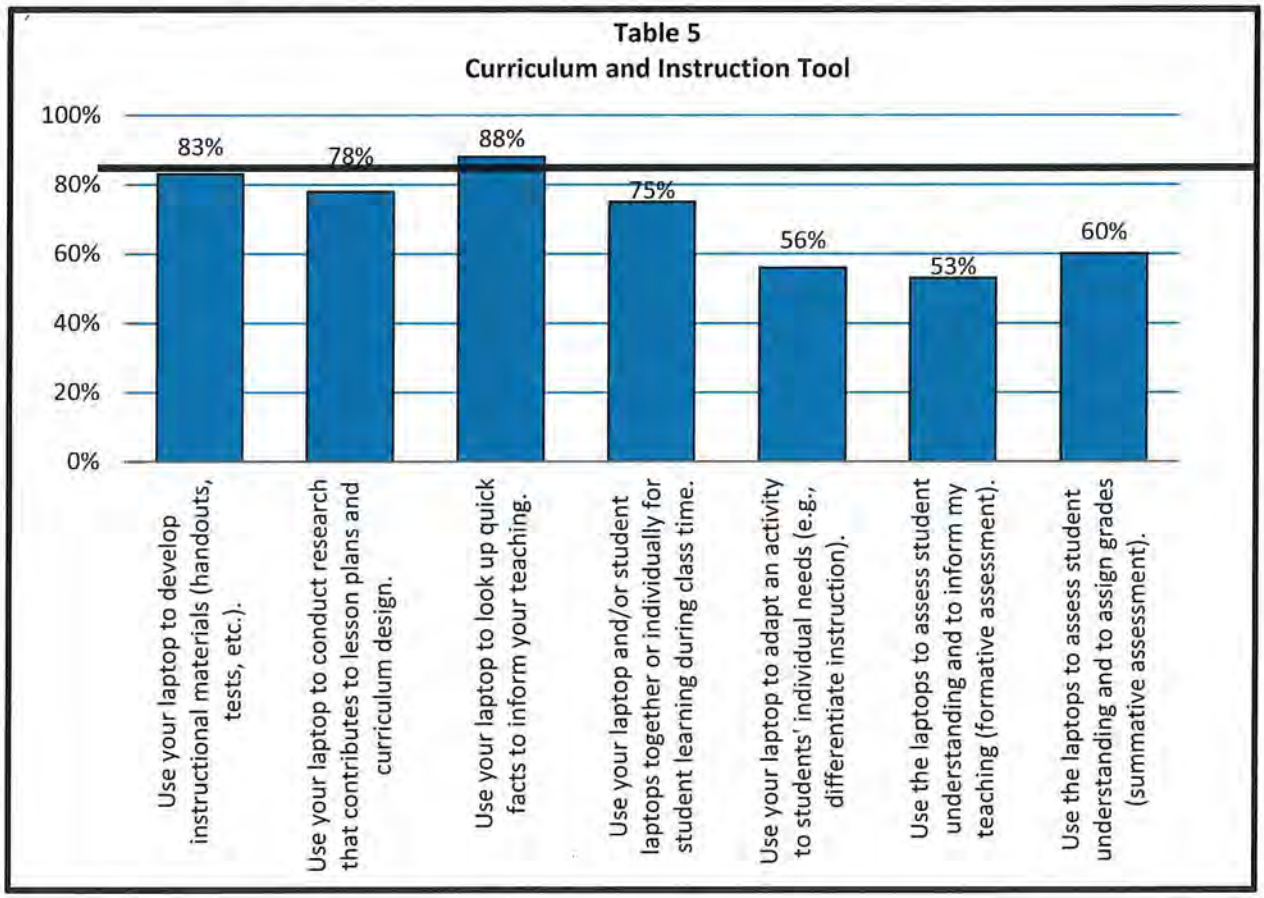
Are these use levels eight years into the project at the desired levels? Are they at a level one might expect to find after eight years? These questions are difficult to answer for several reasons. First, what constitutes the "desired level"? From the beginning, MLTI had a vision. But it did not have clearly articulated goals and objectives. That is to say, the initiative did not include a set of benchmarks by which to measure progress. Second, and as described earlier, for this report, the top three most frequent use levels have been combined to define "Frequent Use." But, one may ask, is use "A Few Times a Week or More Often" the appropriate standard? Should there be a different standard depending upon the type of activity (e.g., preparing lessons vs providing instruction)? Might frequency level depend upon the discipline, content, time of year, or class schedule (e.g., daily or block schedule)? Consequently, determining the appropriate standard is still an open question.

Setting aside for the moment this set of questions, one might consider using a comparative standard for judging those use levels. That is to say, are the use levels found here in Maine comparable to levels found in other one-to-one laptop programs. Unfortunately, a review of the extant literature provides very little guidance here. In fact, in general there is a dearth of information documenting laptop use by teachers in their curriculum and instruction, and what does exist uses a variety of different metrics for measuring use (e.g., hours per day, days per week, more or less than without laptops, etc.) Thus, a comparative standard for use levels is difficult at this time.

Another potential way of examining use levels is in terms of what is known about innovation and diffusion. Roger's seminal book (1995) describes how new ideas or innovations are adopted by individuals and become diffused throughout the organization, how they reach what Gladwell (2000) and others before him called the "tipping point," the point where something that began as unique became common.

Rogers identifies five types of adopters: (1) innovators; (2) early adopters, (3) early majority adopters; (4) late majority adopters; and (5) laggards. The first four groups account for approximately 84% of all adopters, with laggards accounting for the last 16%. Reaching Roger's 100% adoption level is theoretically possible, but empirical evidence suggests that achieving 100% may be unrealistic. Laggards may never become adopters.

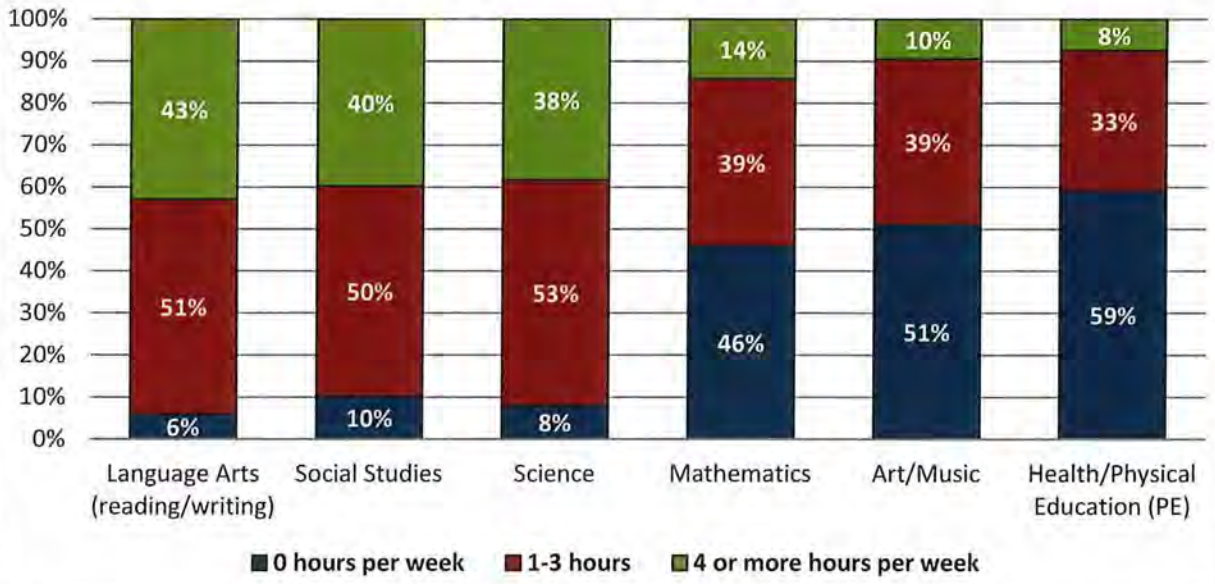
How might this research be applicable in Maine's case? Table 5 on the next page reports frequent use levels measured against the 84% bar (e.g., less laggards). Given that the teachers who did complete the 2010 survey are fairly representative of the population of Maine's middle school teachers, as was noted earlier, these findings suggest that use levels are approaching the



tipping point in several areas, but not in others. Eight years after the initial deployment of the laptops, most teachers who may become adopters have done so in the areas related to developing and providing curriculum and instruction. Using the laptops in differentiating instruction and assessment has not reached the tipping point. However, as mentioned earlier it is unclear if using laptops "a few times a week or more frequently" is the appropriate standard. Possibly it takes longer for adoption to reach critical levels in these areas. Or these are areas prime for additional professional development. But taking all the evidence into consideration in Table 5, it appears that for many Maine teachers the critical tipping point has been met for integrating the laptops into some core curriculum and instruction activities. Not all teachers report high use levels, but for many, frequent use appears to be commonplace.

Turning to student use levels, Table 6 reports how often students in 2008 reported using their laptops in different subject areas. Students reported using their laptops most frequently in Language Arts, Social Studies, and Science. In these three areas, approximately 40% of the students indicated they use their laptops four hours or more each week. The same may not be said for other subject areas. In the case of Art/Music and Health/Physical Education the less

Table 6
Student Reported Laptop Use in Classes

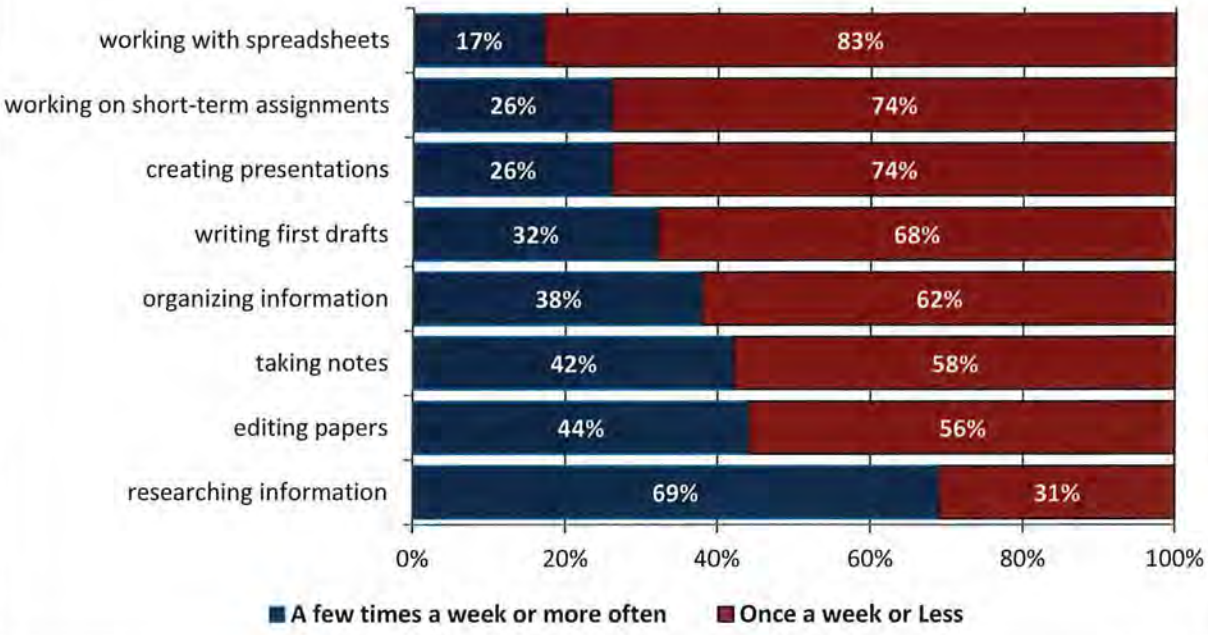


frequent use may, at least in part, be attributed to the fact that classes in these areas are often held less often during a school week. But this is not true for Mathematics where only 14% of students report using their laptops for four hours or more, and almost one-half report never using their laptops in mathematics classes. Given the importance of this subject area, further research is needed to determine why, in light of the availability of many interactive programs in mathematics, use levels are so low. And based on these findings, ways to increase use levels in this area need to be explored, developed, and implemented.

Tables 7 and 8 on the next two pages report survey results from 2008 about how students use their laptops in classes and in completing homework. As indicated in Table 7, approximately 7 out of 10 students report using their laptops to conduct research a few times or more during the school week. But similar use levels are not as high for other tasks. For example, one-half or more of the students report using their laptops once a week or less to prepare written papers, and take notes, and over 80% report less use to work with spreadsheets.

Use of the laptops in writing is particularly noteworthy. Only approximately one-third of the students report using their laptops frequently for writing first drafts of papers, but almost

Table 7
Percent of Student Indicating How Often They Use their Laptop

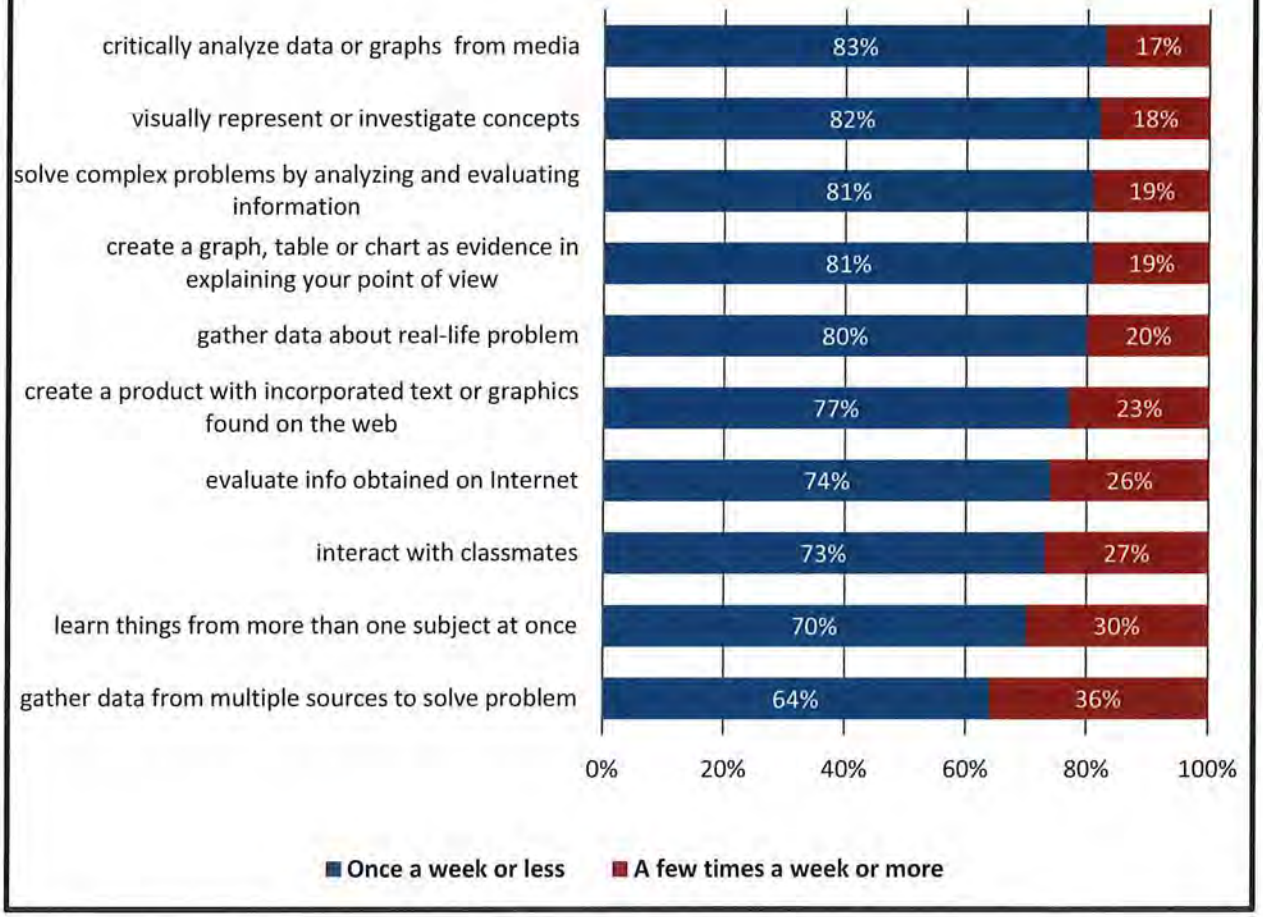


45% report editing, revising and preparing final written papers a few times or more each week. If one assumes the accuracy of these self-reported responses, it appears the laptops are being used more frequently to polish writing skills than to create and capture initial thoughts in writing. If this is the case, then additional research needs to be undertaken to explain this phenomena.

Table 8 on the next page reports student use of the laptops in other areas. In this case, the ten use areas represent what many experts believe to be skills needed in the 21st Century. Unfortunately, as may be seen from the student responses, it appears students are being asked very infrequently to use their laptops in developing and practicing their skills. For instance, in only four of the ten areas do a quarter or more of the students report using their laptop a few times a week or more. And less than one in five report frequent use in gathering information about a real-life problem, or creating a graph, table or chart, or using their laptops to analyze or evaluate information. Thus, it appears the laptops are not being used with a high degree of frequency in developing these 21st Century skills. What is unclear from the survey results is if this infrequent use, relatively speaking, is because teachers lack skills to develop activities that

use the laptops to teach these skills or if teachers are not teaching these skills regardless of the instructional mode. That is to say, many teachers may not be making the development of these

Table 8
Percent of students indicating how often they use their laptop to do the following:



21st Century skills part of their curriculum and instruction. Given the importance of these skills, and the potential power of using technology to acquire these skills, this area needs considerable further investigation and corrective action.

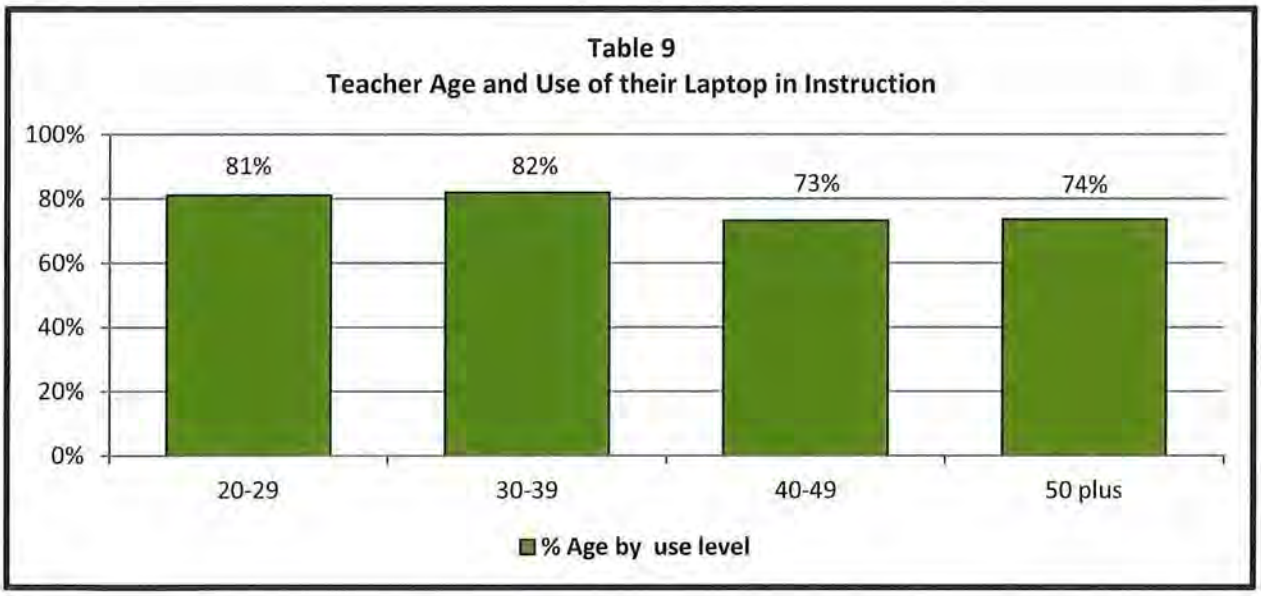
Section 2: Factors Relating to Use Levels

Turning to an examination of the factors which may influence teacher use of the laptops, the evidence above indicates that while most teachers report frequent use of their laptops, this is not true for all teachers. What accounts for these differences? One reason has already been discussed above; that is, differences in adoption levels. But are there other factors which may

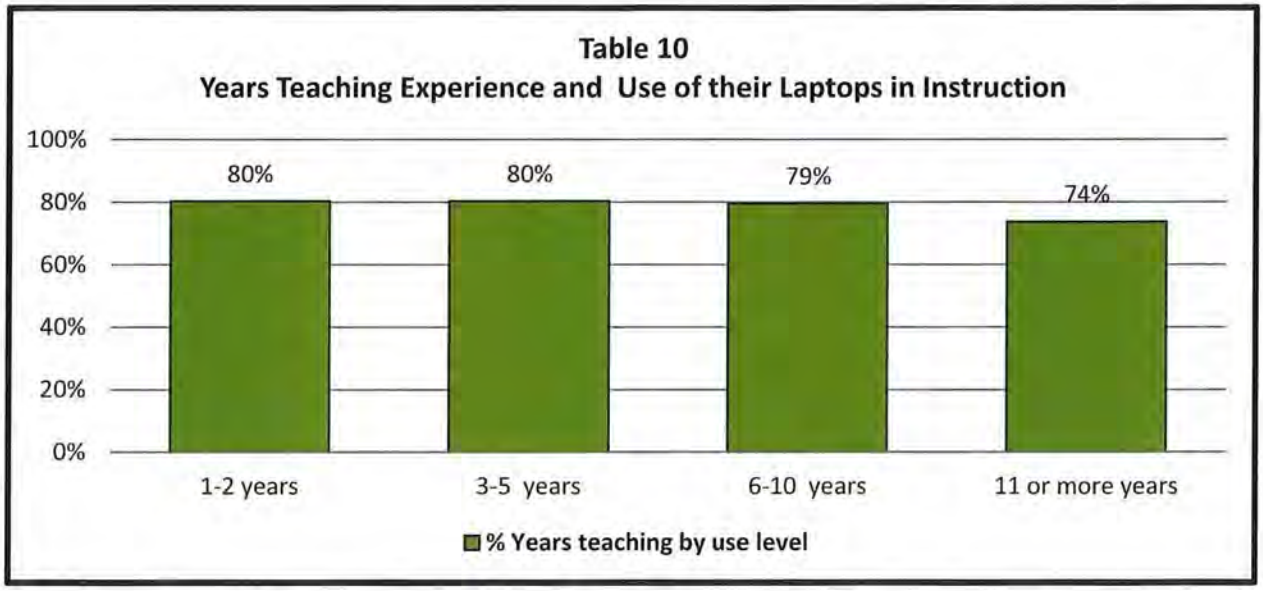
explain the differences? More specifically, are there teacher characteristics or school characteristics which may influence use levels?

Several possible characteristics are discussed next. But first a cautionary note must be made. The evidence will suggest a link between some characteristics and use levels. But causal relationships cannot be determined with descriptive data. Just because two variables are related does not reveal which is the cause and which is the effect, or even if there is not another variable which explains the causal relationship. This caveat must be kept in mind as one explores links between variables; in this case, the link between teacher and school characteristics and use levels.

Notwithstanding this caveat, over the course of several years attempts have been made by the evaluation team to begin to explore the possible relationships between use levels and teacher characteristics. For example, are use levels related to age or years of teaching experience? Tables 9 and 10 provide evidence related to these factors. As is the case for all the tables in this section of the report, use levels reported are in terms of the standard set in Section 1; that is, "A Few Times Each Week or More Often." In the case of teacher age, the evidence in Table 9 indicates frequent use levels are high and do not vary among teachers younger than 40 years of age. For those over 40 years old, overall frequency of use falls off some, but does not differ for older teachers.

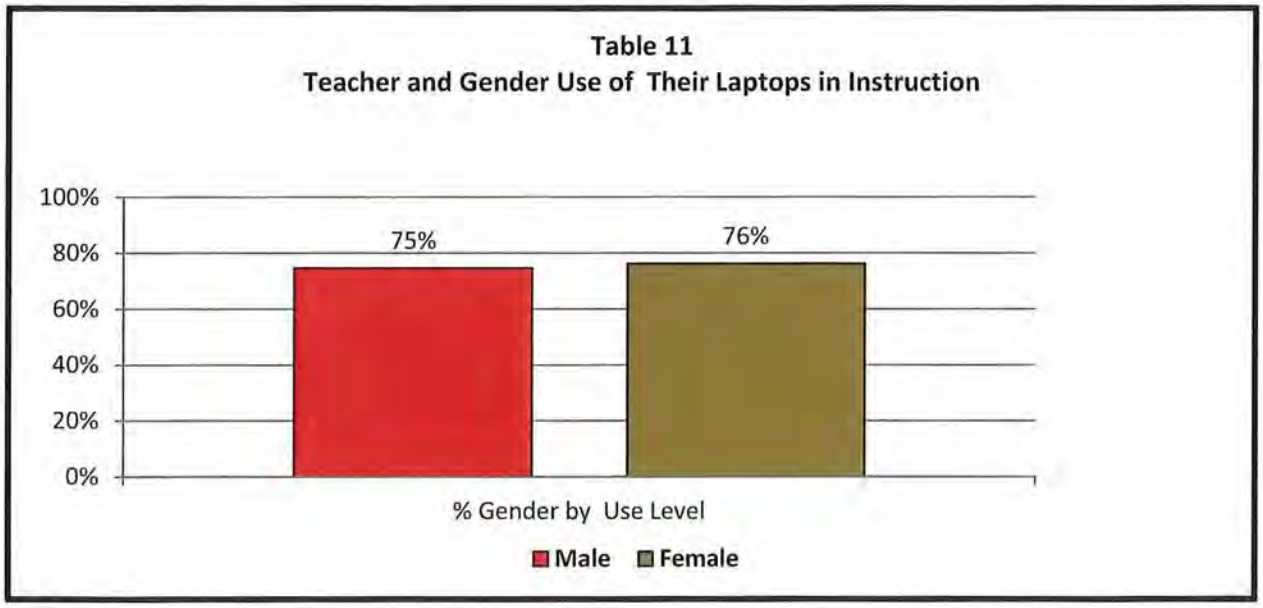


In the case of years of teaching experience, and as may be seen in Table 10, it appears that frequent use levels are generally also unrelated to years of experience. For teachers relatively new to the teaching profession (i.e., 1-2 years), approximately 8 out of 10 reported

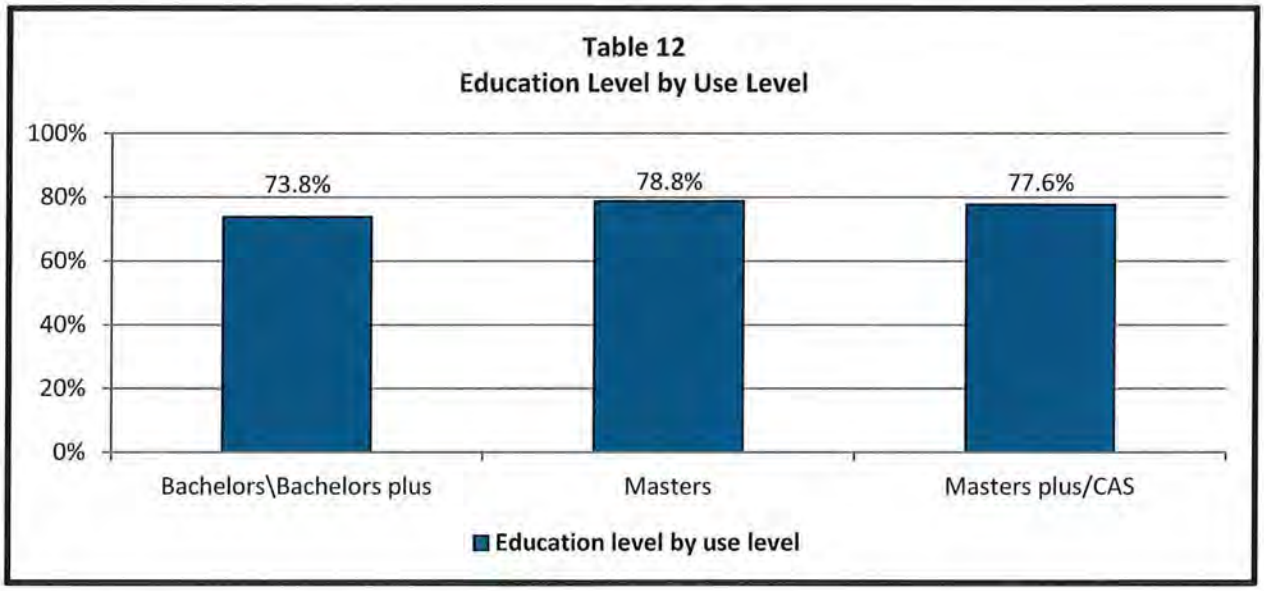


using their laptops frequently in providing classroom instruction. And this ratio of frequent users is the same for teachers with up to ten years of experience. It is somewhat less for teachers who have been teaching for more than ten years, but frequent use is still relatively high (e.g. 74%).

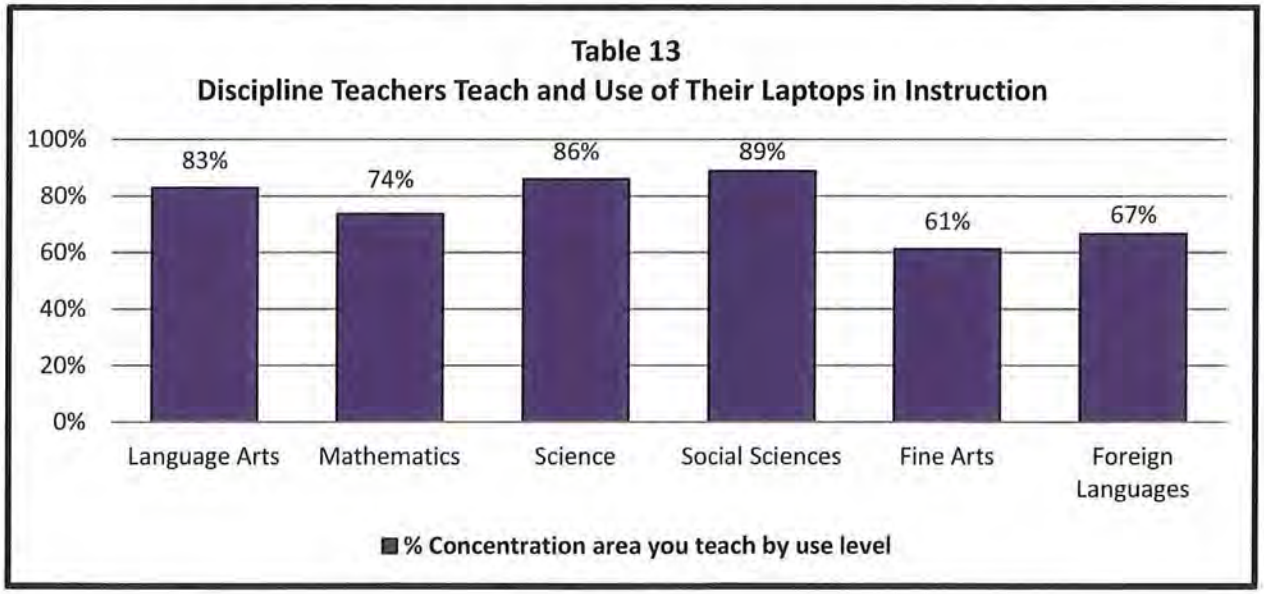
The findings are similar for other teacher characteristics. For instance, Table 11 reveals



no significant differences in frequent use levels by gender, and Table 12 reveals the same for the education level of teachers. However, in the area of disciplines, Table 13 does reveal some differences in frequent use levels depending upon what subject the teachers teach, results which



parallel those reported by students in Table 6. Between 80 – 90 percent of teachers who teach Language Arts, Science, and Social Sciences report using their laptops in classroom instruction a few times a week or more frequently. Relatively speaking, Mathematics teachers use the laptops less frequently, as do Foreign Language teachers. Fine Arts teachers report even less frequent

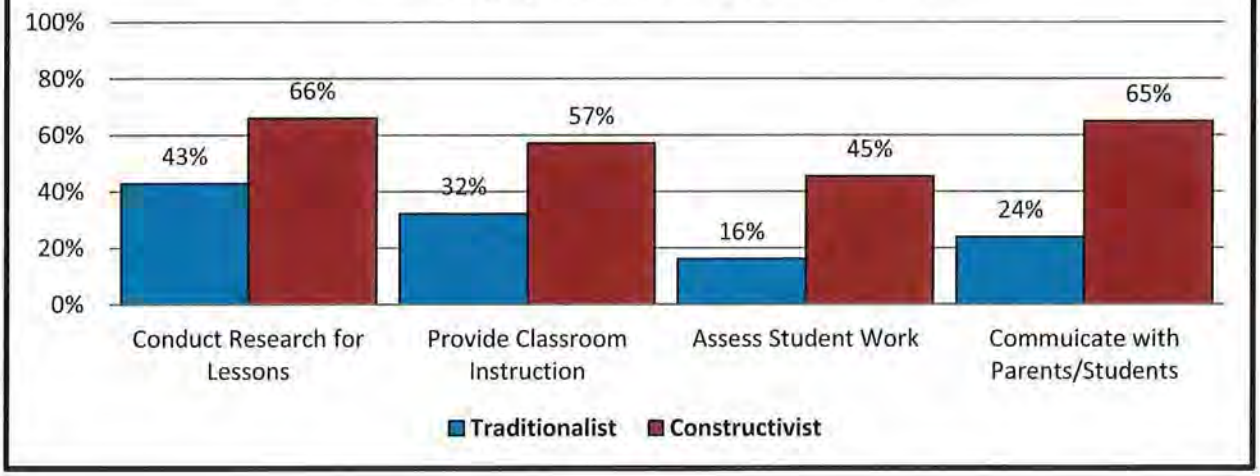


use; however, some of this phenomena may be due to the fact that fine arts classes, in many middle schools, do not meet as often as other disciplines (e.g., three times a week versus every day).

Turning to other factors which may be related to use levels, teaching philosophy appears to be related to teacher use levels. Teachers' philosophy on teaching and learning is often characterized as being somewhere on a continuum from Traditionalist to Constructivist. So-called Traditionalist teachers maintain teacher-directed classrooms. Teachers are very much in control of the teaching and learning environment. They decide what is taught, how it is taught, and at what speed students will learn. Constructivist teachers, on-the-other hand, are described as more facilitators and guides of learning than their counterparts, and believe students should play a larger role in directing more of their own learning. In reality, teaching philosophy is much more situational than absolute. Most teachers adopt different aspects of these two philosophies in different situations, while still maintaining an underlying teaching philosophy that is more reflective of one or the other philosophy.

Are these two teaching philosophies related to use levels? Table 14 presents some insight into this question. As may be seen from the table, teaching philosophy and frequency of use appear to be related when it comes to using the laptop in classroom instruction. Approximately 57% of the teachers classified as Constructivist, as defined by their responses to teaching philosophy survey items, report using their laptops frequently in providing instruction. In contrast, frequent use levels by more Traditionalist teachers is only approximately 32%. Similar

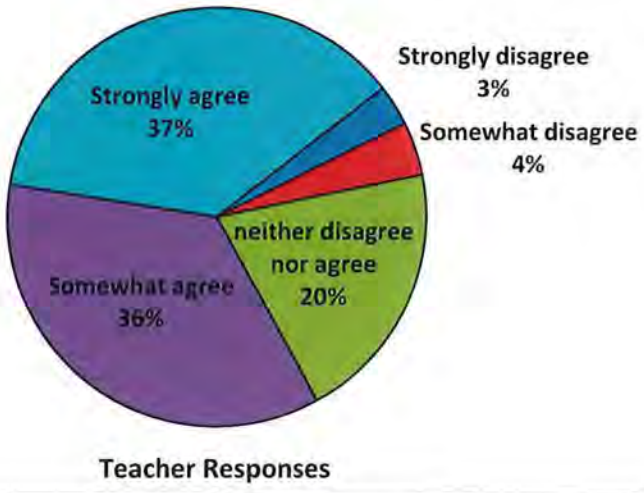
Table 14
Teacher Philosophy and Use of Laptops in Instruction



differences in frequent use levels also are apparent in other areas, as shown in the table.

An interesting finding is that use of the laptops appears to have helped some teachers shift their teaching philosophy. Figure 1 reports teachers' belief about becoming more student-centered (i.e., more Constructivist). Almost 75% of the teachers who completed the MLTI evaluation survey in 2010 reported that the availability of the laptops have helped them to be more student-centered. What is unclear is what and why this happened. How did using the

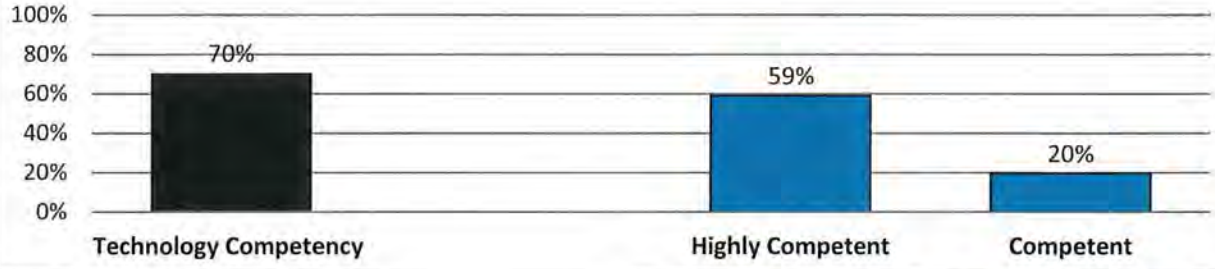
Figure 1: Availability of the laptops has helped me shift my teaching from being more teacher-centered to being more student-centered.



laptops help shift their teaching approach? And who shifted? Did more traditionalists shift their teaching, or was the shift primarily only for those teachers already using a student-centered approach in their teaching, albeit just not as often, or consistently? These questions need further research because the answers may suggest ways of influencing teaching philosophy, and ways to use professional development more effectively in shifting teaching practice.

In the case of technology competency, and as may be seen in Table 15, teachers who feel

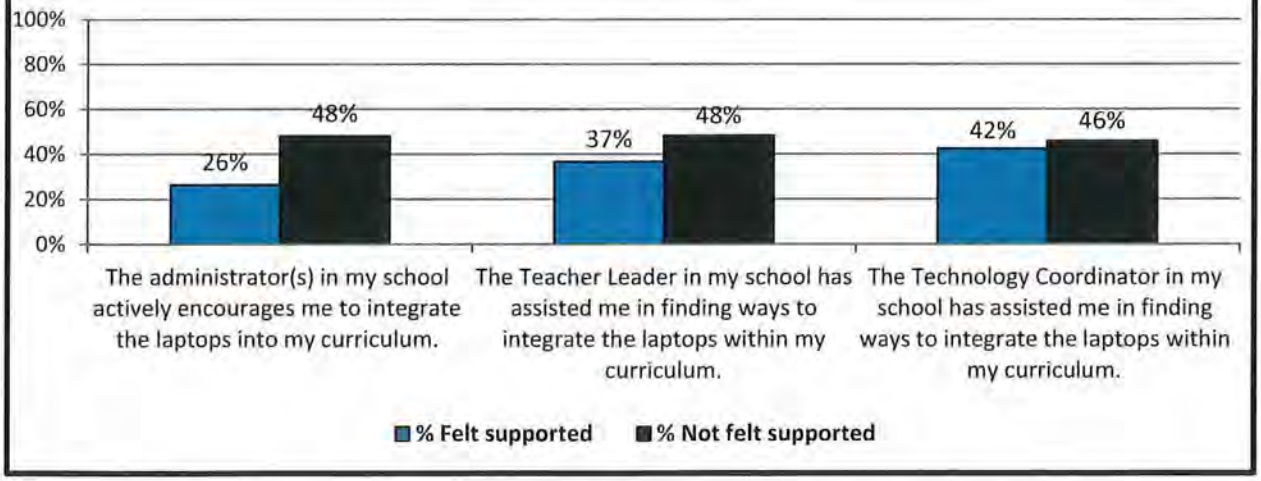
Table 15
Teacher Technology Competency and Use of Laptops in Instruction



they are competent in their ability to integrate the laptops in their instruction are three times more likely to frequently use the laptops in providing instruction than the teachers who felt less competent (60% vs 20%). This is not very surprising, but the difference appears to be quite dramatic. Also of interest is the data presented in the left column in the table. Combining this data with the competency and use data reveals that while 7 out of 10 teachers rate themselves as adequately prepared (competent) to integrate laptops in their classrooms on a frequent basis, not all of them do (only approximately 60%). Unfortunately it is not clear from the evidence why this is the case.

The last major factor that has been explored in an attempt to identify factors related to use levels is actually a three part factor. School level support of teachers is seen by teachers as important to integration of technology into curriculum and instruction. Teachers were asked if they felt supported by three different types of personnel in the integration of technology into their curriculum. As may be seen in Table 16, some teachers do feel more supported than others, and those support levels appear to be related to frequent use levels. Teachers who feel supported by their building administrators are almost twice as likely to be more frequent users than teachers

Table 16
Teacher Support by School Personnel



who do not feel supported. There is also a difference depending upon how helpful teachers feel their teacher leaders are of their work in integrating the laptops in their classrooms, but not much of a difference in the case of technology coordinator support. These findings suggest that while all school level supports are important, support by building level administrators is particularly

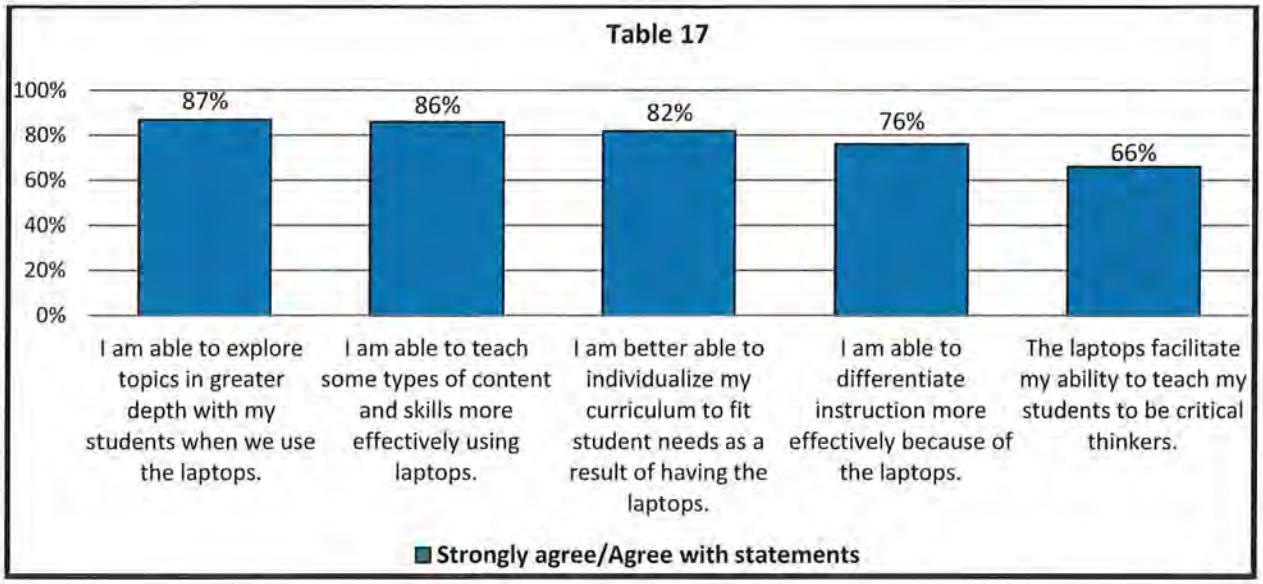
important. This has significant implications for the provision of professional development, both for pre-service and in-service school principals and assistant principals.

Thus, in summary the results suggest links between some teacher and school characteristics and use levels. Characteristics like age, gender, teaching experience, and education level appear not to be significantly linked, but teaching philosophy, technology competence, and school supports do appear to be linked to use levels. These findings are important for the MLTI project staff to consider when developing professional development programs.

Section 3: Benefits of the Laptop Program

Section 1 of this report described the types of uses, and the frequency of uses of the laptops by teachers and students. Given these use levels and types, and the evidence of increase of use levels over time, it is important to examine the benefits of the MLTI program. In the MLTI evaluation, benefits have been examined in terms of self-reports by teachers and students, and in impacts on achievement. This section will describe the self-reported benefits to teaching and learning. The fourth section of this report will summarize some of the evidence of the impacts of the laptop program on student achievement.

Table 17 reports teachers' perceived benefits of the laptops in helping them teach. On the MLTI evaluation surveys teachers were given a list of potential benefits and asked to indicate

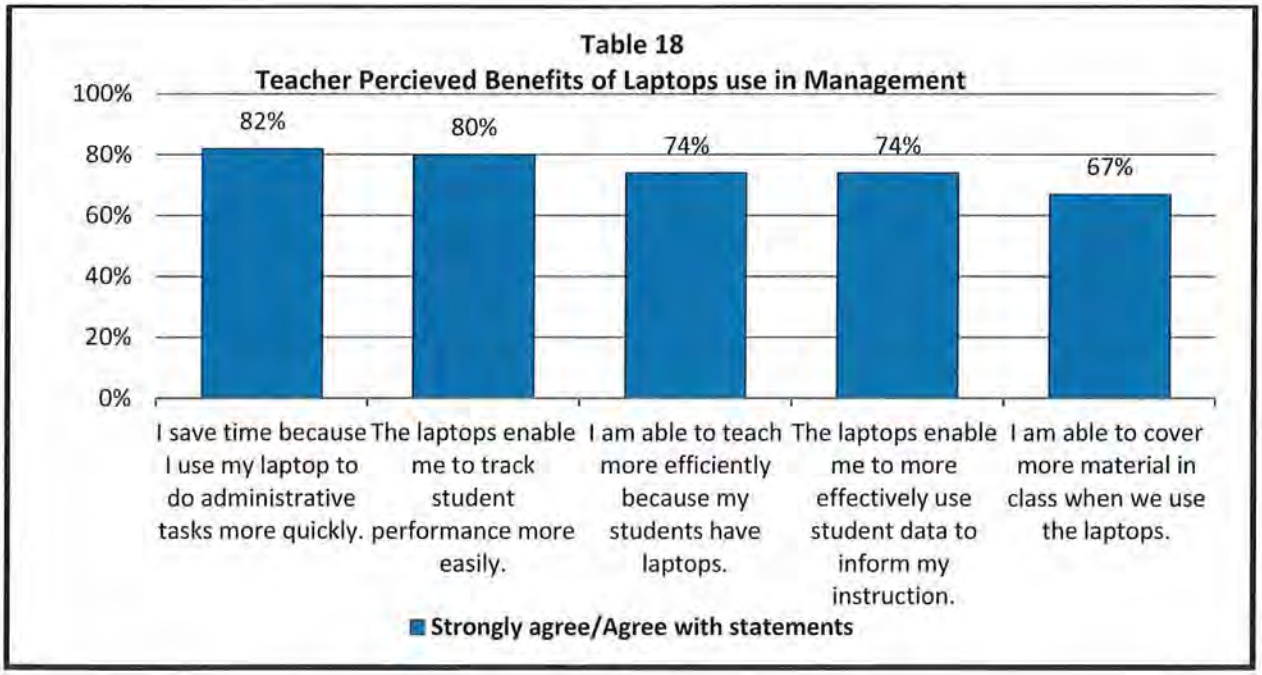


their level of agreement for each benefit. Responses could range from "Strongly Disagree" to "Strongly Agree", and only the two top categories (Strongly Agree and Agree) are reported in the subsequent tables in this section of the report.

It is clear many teachers perceive that the laptops help them in providing classroom instruction. Not all teachers, but over 80% report that the laptops help them explore and teach in greater depth and to teach a wider variety of content. Over 3 out of 4 teachers believe the laptops help them to differentiate instruction more (although the evidence reported earlier may call this into question) and do a better job of individualizing the curriculum to meet the different needs of different students. And two-thirds of the teachers believe the laptops help them to better teach their students critical thinking skills.

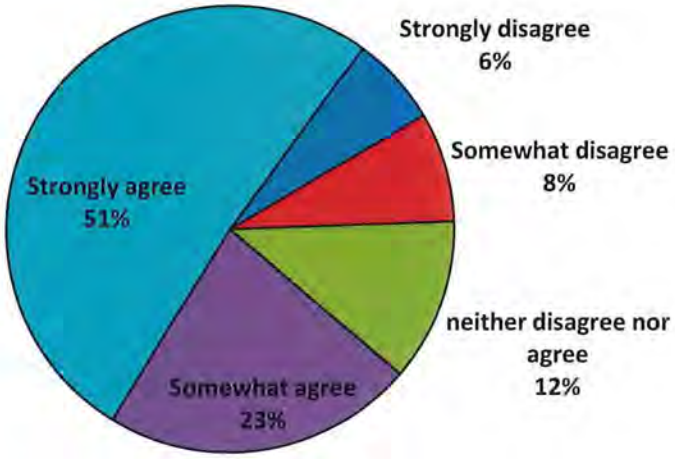
The teachers also report benefits from using the laptops to manage their curriculum, use student data, and track student performance (Table 18). A majority of the teachers report that because of the laptops they can cover more material (67%), teach more efficiently (74%), and use student data to guide their instruction (74%). And over 8 out of 10 teachers believe the laptops help them to track student progress and perform administrative duties.

Thus, it is apparent that many teachers believe that having the laptops benefits them both in teaching and managing curriculum. In fact, when asked how important the laptops were to



their teaching, a large majority reported they were of considerable importance. More specifically, many indicated they could not imagine teaching without their laptops. Figure 2 reports this evidence. Almost three-quarters of the teachers report that their laptops are an

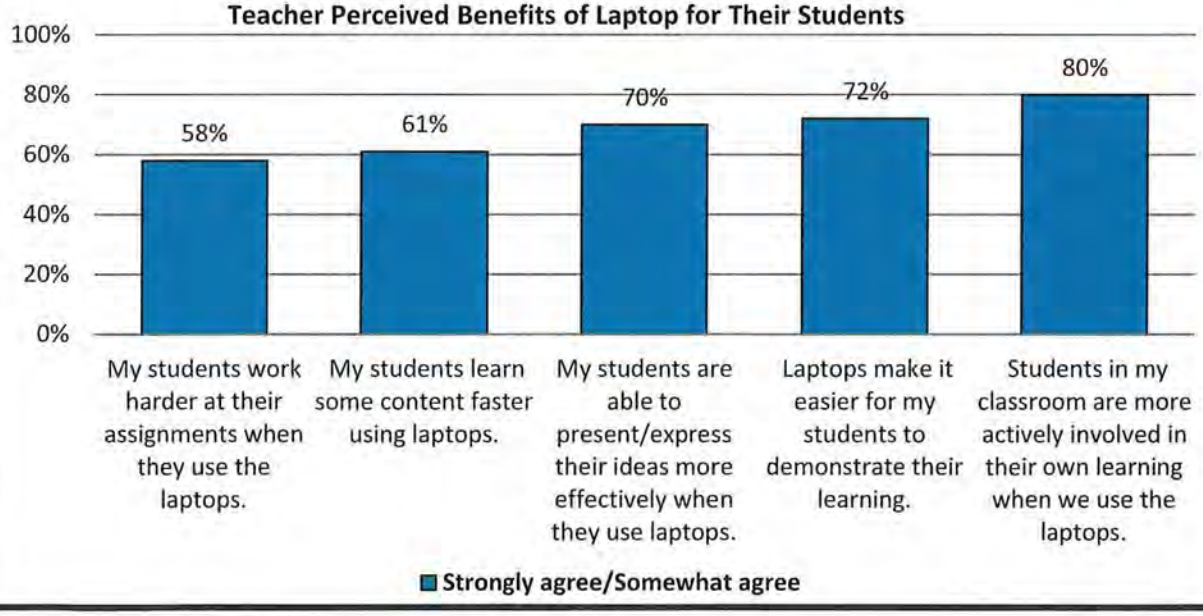
Figure 2: The laptops have become such an important tool in my teaching that I cannot imagine teaching without them.



important teaching tool.

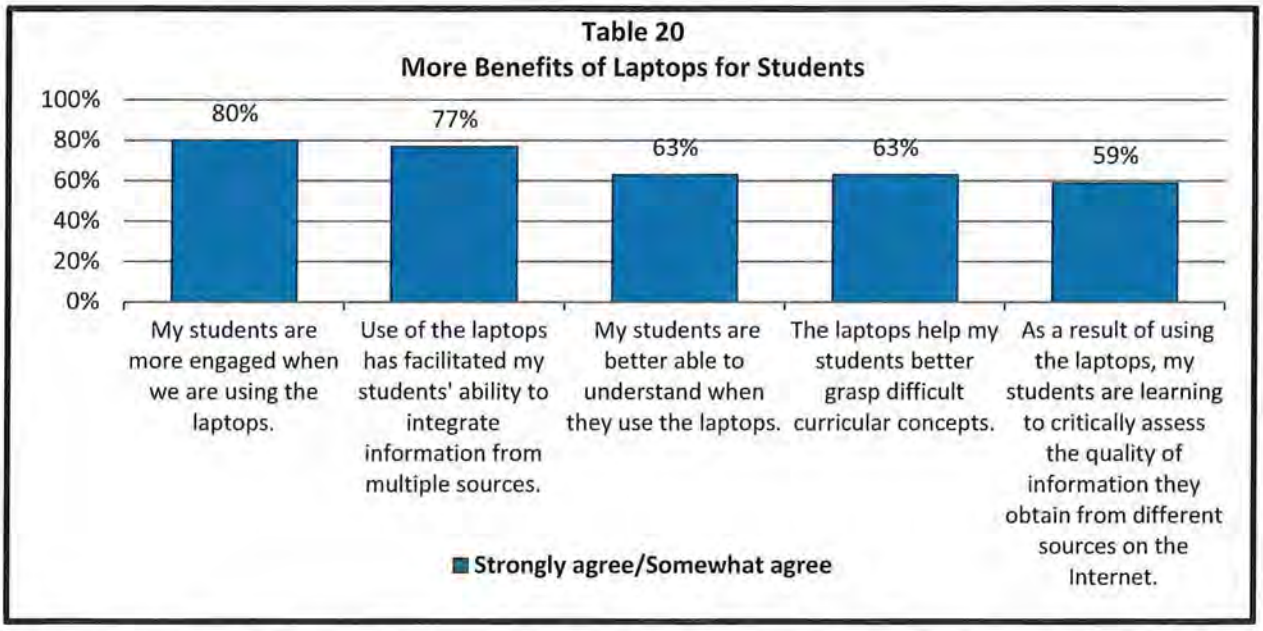
Teachers also believe the laptops are beneficial for their students. As shown in Table 19, 8 out of 10 teachers believe the laptops keep their students more engaged and more actively

Table 19
Teacher Perceived Benefits of Laptop for Their Students



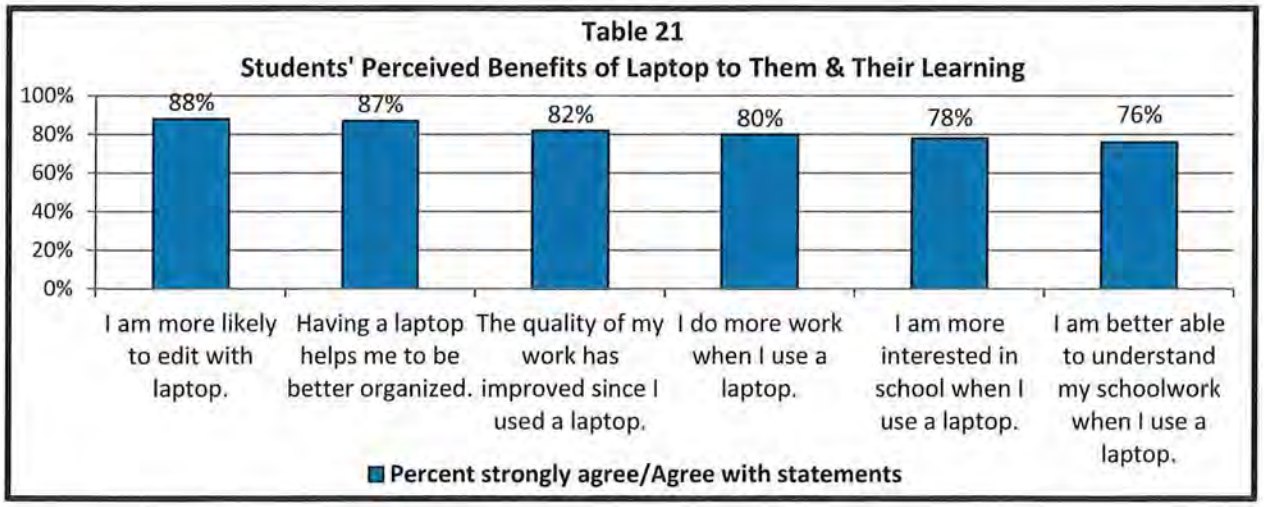
involved in their learning. Additionally, approximately 6 out of 10 teachers report that the laptops benefit their students by helping them learn content quicker, and that the students work harder on assignments when they use their laptops.

Table 20 reports other benefits many teachers believe their students receive from having



laptops. Seven out of 10 teachers report that the laptops help their students express their thinking better, and demonstrate their learning. Even more teachers think the laptops help students better access and integrate information from multiple sources, and approximately 60% believe laptops help students to learn how to critically evaluate information obtained from the Internet.

In many areas students agree with their teachers' assessments of the benefits of the laptops. As shown in Table 21, approximately 80% of the students report that the laptops help



them do more work, to improve the quality of work, and to be more interested in school. And almost 9 out of 10 students report that the laptops help them edit their work more, and to be better organized. Finally three-fourths of the students believe having and using their laptops help them to understand what they are learning in school.

Thus, in terms of self-perceptions, both teachers and students believe there are many benefits in having and using the laptops. Many teachers believe they can provide better instruction, and more individualized instruction with the laptops. They believe the laptops help their students become better learners, and their students agree.

Section 4: Impacts on Student Learning: A Summary of Findings

Is there achievement evidence which supports the self-reported benefits just described in Section 3? Does the availability and use of laptops by teachers and students translate into higher achievement? The answer is that it depends. An underlying premise of the MLTI program is that the State will make the laptops available to all middle school students and their teacher, but that how they are used is a local school decision. Consequently, use levels vary, as reported in Section 1 of this report, and types of use also vary across classrooms and schools. A further consequence of this underlying premise is that there is little consistent statewide evidence of the impacts of the laptops on student achievement, except in the area of writing. But there is some evidence of the positive impacts of the laptops on achievement in cases where use of the laptops is specifically targeted to improve achievement. These results are described in this section of this report.

The research team has conducted five research studies to assess the impacts of the laptop program on student achievement. Thus far, research has been completed in the areas of mathematics, writing, and science. Additionally, two research projects have been completed to determine what impact the introduction of ubiquitous computing may have on students' ability to 'evaluate' sources, specifically sources found on the Internet. This section of the status report provides summaries of five studies. Full reports of each of the studies summarized here are available at www.usm.maine.edu/cepare/publications.htm.

Report 1: MISTM: Maine's Impact Study of Technology in Mathematics

The purpose of Maine's Impact Study of Technology in Mathematics (MISTM) was to investigate the impact of a sustained technology-infused teacher professional development program on student mathematics achievement. As mentioned earlier, the ongoing overall

evaluation of the Maine Learning Technology Initiative (MLTI) has provided evidence that, indeed, the introduction of the laptops in Maine's middle schools has impacted teaching and learning in many ways. However, access to technology tools alone will not ensure that all teachers in all disciplines will know how to use the technology to improve students' abilities to meet curriculum standards. This was evidenced in the MLTI program evaluation data for use of the laptops in teaching mathematics.

The fundamental premise of this study was that changes are needed in both teachers' content knowledge and pedagogical practices to improve students' mathematical knowledge and understanding. Thus the logic underpinning this study was that a robust professional development intervention would result in changes in teachers' mathematical content and pedagogical knowledge and skills, classroom practices, beliefs about teaching, and their use of technology in instruction. These changes would in turn have a positive impact on students' mathematics achievement.

A randomized control trial (RCT) research design, the so-called gold star of research designs, was used in this study. Figure 3 presents the research design. A total of 56 schools participated in the study, and the schools were randomly assigned to two groups.

Figure 3: Overview of Research Methodology, Randomized Pretest-Posttest Control Group Design

Sample	Random Assignment of Schools & Treatment	Pretest Year One	Treatment	Posttest 1 Year One	Treatment Continued	Posttest 2 Year Two
Volunteer sample of purposive population of schools	Experimental Group	7th Grade Teachers and Students	Professional Development Phase 1	7th Grade Students	Professional Development Phase II	8th Grade Teachers and Students
	Control Group	7th Grade Teachers and Students	None	7th Grade Students	None	8th Grade Teachers and Students
Additional Data Collection Strategies: Teacher, Student, and Principal Surveys, Logs, Observations, and Case Studies						

Twenty-eight (28) schools were randomly assigned to each of the two study groups (Experimental and Control). The goals of the experimental professional development intervention in this study were fourfold:

- Content – deepen teachers' mathematical content knowledge in the areas of *Numbers and Operations* and *Patterns* in Maine's statewide learning standards.
- Pedagogy – improve teachers' pedagogical practice in technology infused mathematics classrooms.
- Technology Integration – develop and apply strategies that support the integration of technology for the teaching, learning, and assessment of mathematics.
- Professional Learning Community – engage teachers in meaningful interaction and dialogue about mathematics through face-to-face and online environments.

The experimental intervention consisted of four interrelated professional development components. These were: (1) face-to-face workshops; (2) online workshops; (3) peer coaching and mentoring; and (4) site visits.

Two separate achievement tests were developed for assessing student learning in two core mathematics areas. One focused on Numbers and Operations, and the second focused on Patterns and Relationships. Teacher assessments were designed to assess teachers' content and pedagogical knowledge in the same two content areas. Pedagogical knowledge included understanding students' mathematical thinking, as well as understanding how to effectively build upon and develop mathematical thinking.

Table 22 reports the student achievement scores at the beginning and end of the two year intervention. As the results indicate, the experimental group classroom students and control

Table 22
Student Total Test Score Results After Two Year Intervention

Mathematics Test Total Score	Experimental (n=281)	Control (n=692)	t=	p=	Effect Size
Fall 2004	32.1%	27.8%	3.80	<.01	0.29
Spring 2005	54.6%	47.9%	3.62	<.01	0.39

group classroom students did differ in prior achievement levels at the beginning of the study. But an analysis of covariance (ANCOVA) for group effects indicated overall test score results

were also significantly different at the end of the two year intervention, in favor of the experimental group students. Overall, the experimental group students gained more over the two years in which their teachers participated in the sustained technology-infused professional development program. That is to say, it appears if a teacher actively participated in the intervention activities for 20 months or more, increased their own content knowledge, and implemented classroom technology use practices, then student achievement improved.

Report 2: Maine's Middle School Laptop Program: Creating Better Writers

The purpose of the research detailed in *Maine's Middle School Laptop Program: Creating Better Writers* was to begin to determine the impact that Maine' laptop program may be having on students' writing ability. The one area assessed by many existing standardized tests where the impacts of a laptop program on achievement may be more easily discernible is in the area of writing; that is, if writing is assessed authentically by means of evaluating student writing samples.

Student test scores on the Maine Educational Assessment (MEA), the annual statewide test, were examined by researchers for two separate years. The primary examination looked at student test scores for the years 2000 and 2005 in order to determine if there was a difference in scores at two points in time: before the laptop program was implemented in even the Exploration Schools (2000) and after the program had been implemented for several years (2005). A secondary analysis looked at test scores in more detail to determine if there was a link between student test scores and how students used the laptop during the writing process. A final examination compared test scores of students who completed the writing section of the MEA using the computer and those who completed the writing section using a more traditional, longhand approach.

Table 23 on the next page reports the MEA Writing Scale Scores for 2000 and 2005. The writing portion of the MEA at that time consisted of a writing prompt that was double scored. Scale scores could range from 500-580. As may be seen in the table, in 2005 the average writing scale score was 3.44 points higher than in 2000. Analysis of these average scale scores indicated that, in fact, there was a statistically significant difference in writing scores between the two years ($t = 31.51$; $df = 32806$; $p < .001$). Thus, the results indicated writing performance had improved. Undoubtedly other factors beyond implementation of the laptop program may have contributed to improved writing performance over the course of five years (implementing new

writing programs in schools, more teacher professional development, etc.), but since these other interventions did not occur in all Maine middle schools, and the results are based on the total

Table 23
MEA Writing Scale Scores 2000 and 2005

Year	Number of Students	Average Scale Score	Standard Deviation	Effect Size
2000	16,557	534.11	10.61	0.32
2005	16,251	537.55	9.17	

population of all 8th graders and all Maine middle schools, the results may be attributed, at least in part, to the laptop program.

A secondary analysis of the 2005 scale scores revealed an additional key finding. How the laptops are being used in the writing process influences writing performance. As shown in Table 24, writing scale scores are related to how, and how extensively students use their laptop to produce writing. Students who reported not using their laptop in writing (No Use Group) had

Table 24
Type of Laptop Use in Writing

Survey Question		Number of Students	Scale Score	
Stem	Responses		Average	Standard Deviation
How do you use your laptop for writing?	Drafts and Final copy	11593	538.8	8.97
	Final copy only	3413	537.7	8.89
	Drafts only	233	533.0	9.74
	Not at all	642	532.0	9.63

the lowest scale score, whereas students who reported using their laptops in all phases of the writing process (Best Use Group) had the highest scale score. Analysis of variance revealed a significant difference between the groups ($F=123.67$; $df=3, 15{,}877$; $p<.001$), and post hoc analysis indicated significant differences between all four groups shown in the table. In essence the findings revealed greater levels of use of the laptop in the writing process as a writing development tool (e.g., drafts, edits, final copy) was related statistically to writing scores.

However, did the laptops help students to become better writers in general or just better writers when using the laptops? To answer this final key research question, the way in which students produced their MEA writing sample was examined. In 2005, some Maine students completed the MEA writing assessment online, while many others produced their writing sample in longhand. Table 25 reports the average writing scale scores for students who produced their writing sample online and those who were developing their writing sample in the traditional paper and pencil fashion. As shown in the table, the scale scores are almost identical. In fact,

Table 25
MEA 2005 Writing Scale Scores by Mode of Writing (Assessment)

Writing Sample	Number of Students	Average Scale Score	Standard Deviation
Online	3,251	537.68	10.52
Longhand	13,000	537.52	8.80

an analysis of these scores using an independent sample t-test statistic indicated no statistically significant difference between the scale scores of the two groups ($t = .810$; $df = 16249$; $p > .05$). In other words, writing improved regardless of the writing test medium.

Thus, the evidence indicated that implementation of Maine's one-to-one ubiquitous laptop program was related positively to middle school students' writing. Five years after the initial implementation of the laptop program, students' writing scores on Maine's statewide test had significantly improved. Furthermore, students scored better the more extensively they used their laptops in developing and producing their writing. And finally, the evidence indicated that using their laptops in this fashion helped them to become better writers in general, not just better writers using laptops.

Report 3: Using Middle School Laptops to Facilitate Middle School Science Learning: The Results of Hard Fun

The primary goal of a third research project was to examine how the MLTI program might impact the academic achievement and general engagement of students within a science classroom. This action research study was designed to answer the following research question:

> *Is the use of the laptops to create narrated animations more effective than having students create traditional paper diagrams and reports in helping students learn the concepts related to Earth's axis angle?*

The research team for this project consisted primarily of researchers from the Maine Education Policy Research Institute, and one classroom teacher and his two 8th grade science classes at a school in Midcoast Maine. The basic design of the study was that both classes would be taught the same information in the same way, but that they would have to *demonstrate* their learning differently; one group would use computer-generated animation while the other group would use a traditional poster/paper approach. The teacher with whom the research team worked chose the science unit during which the observations and data collection would occur. He introduced the concept of Earth's axis angle and the cause for the seasons to both of his eighth grade science classes. One of his classes (Control Group) was taught in the traditional manner and was asked to complete a traditional paper diagram and report as a final project. The other class (Experimental Group) was also taught the material in the traditional manner; however, they had access to interactive, educational websites for their final project and were asked to turn in a narrated animation podcast.

In order to examine how the technology impacted academic achievement and general classroom engagement, a number of measures were used in the study. First, a pre-assessment was administered to all of the students in order to establish a benchmark comprehension level of axis angle concepts. This pre-assessment measured comprehension, as well as attitudes about science, comfort-level and skill-level with regard to making animations, and 21st Century skills. A post-assessment measured student comprehension and contained several opinion questions, which asked students to explain what they liked and disliked about completing their science projects. A retention assessment was also administered roughly a month after the teacher had completed the unit in order to measure the students' retention of learning. This assessment contained questions that were similar to those asked in the pre- and post-assessments, but were not identical to these earlier assessments.

In addition to the assessments and the teacher log, observations and interviews were conducted with both the teacher and his students. These were conducted in an effort to gather more information about how the technology was being introduced to the students, to measure student engagement levels, and to gather a better understanding of the level of student interest regarding the projects.

Table 26 on the next page provides a comparison between the Experimental and Control Groups performance. Based on the data displayed in Table 7, the students in the experimental

group answered more questions correctly than the students in the control group on the post-assessment. In fact, the average of the students' scores in the Experimental Group increased from 42.36% to 90.97%, while the student's scores in the Control Group increased from 52.38% to only 81.25%. In addition, the Effect Size on the post-assessment was .61, indicating that the

Table 26
Pre- and Post-Assessment Results

Group	Pre-Assessment		Post-Assessment		
	Average of Student Scores	Standard Deviation	Average of Student Scores	Standard Deviation	Post-Assessment Effect Size
Control Group	52.38%	20.52	81.25%	15.94	.61
Experimental Group	42.36%	19.93	90.97%	12.03	

Experimental Group students scored approximately 2/3 of a standard deviation above the Control Group students. Thus, academic achievement of the students in the Experimental Group was greater in comparison to the students in the Control Group.

The information in Table 27 provides a comparison between the two groups with regard to the average of the students' scores on the retention assessment. When comparing the results

Table 27
Retention Assessment Results

Group	Retention Assessment		
	Mean	Standard Deviation	Effect Size
Control	63.08%	17.02	1.42
Experimental	87.27%	9.04	

of the retention assessment, it is clear that the students in Group B, the Experimental Group, answered more of the questions correctly in comparison to the students in the Control Group. Based on the results of the pre- and post-assessment, as well as the retention assessment, it is apparent that the students in Experimental Group had a higher level of comprehension in regard to axis angle concepts. In addition, nearly a month after the class had completed the unit, the Experimental Group had a higher level of retention of learning. Thus, the results of this project indicate the students who completed the animation podcast project had a higher level of

comprehension and, a higher level of retention. In addition, interviews with students revealed that these appear to be higher levels of engagement by students who completed the laptop generated diagrams and reports. As one student remarked, "It took more effort, but it was more fun."

Report 4: Using Technology in Helping Student Achieve 21st Century Skills: A Pilot Study

The primary goal of this pilot research study involving teachers from a Maine school district and researchers from MEPRI was to create a model/process to help students in 7th-9th grades learn how to evaluate electronic/digital resources within the context of authentic learning activities. The design for this pilot project was relatively straight-forward. Technology integrationists within a school district and the research team developed materials to help teachers more effectively help students learn how to evaluate electronic/digital resources. Teachers at each school level (high school – 9th grade: and middle school – 7th & 8th) participated in this study and provided useable data for the analysis. A set of guidelines detailing what to teach was given to each of the teachers and they were asked to incorporate the information into their curriculum during a two-month period of time. Students were pre- and post-tested before and after receiving the intervening material to determine what, if any, knowledge they had gained about how to evaluate electronic/digital media over the two months.

The intervention focused on enabling students to gain skills in answering three key questions: Does the content of the website appear to be useful? What is the apparent purpose of the website? How reliable is the information contained on the website? The amount of time teachers spent providing the intervention to their students was determined by the teachers themselves and varied among teachers and grade levels. No guidelines for *how* to teach the material were specified by the project team, and teachers were encouraged to use the materials in whatever content area they deemed appropriate. The experimental classroom teachers reported spending a total of 30 minutes of instruction in 7th & 8th grades and two hours of instruction in 9th grade.

Analysis of the pre- and post-assessment scores indicated that the scores of students who received the intervention were significantly higher on the post-assessment than scores of students who did not receive the intervention for the 7th, 8th and 9th grade students combined. This information appears in Table 28 on the next page. Further analysis indicated there were no statistically significant differences in pre-test scores for the experimental and control groups

(p>.05), but there were significant post-test differences (p<.05). The experimental group students outperformed their control group cohorts. In addition, analysis of the data for different grade levels indicated that the intervention was most effective with 8th graders, and somewhat mixed for the other grade levels.

Table 28
Pre-Post Test Differences – Experimental vs. Control Groups

7th - 9th Grades		Average	Standard Deviation	Effect Size
Pretest	Experimental	14.55	4.49	0.19
	Control	15.52	5.11	
7th - 9th Grades		**Average**	**Standard Deviation**	**Effect Size**
Posttest	Experimental	16.47	5.50?	0.41
	Control	14.19	5.58	

An analysis of student responses to individual assessment questions also revealed mixed results. The majority of students (57%) were able to determine how useful a website would be to them when given an assignment and were able to determine the main purpose of the website. The majority (58%) were also able to distinguish fact from opinion. Only 25%, however, were able to correctly identify a website as being a primary or secondary source. It was found that many students confused the word "primary" with the words "most important or main" in the one-on-one interviews. In summary, this pilot study demonstrated the potential impact of interventions specifically designed to address 21st Century Skills.

Report 5: 21st Century Teaching and Learning: An Assessment of Student Website Evaluation Skills

This study was undertaken by the science department at a Maine junior high school and MEPRI research and evaluation team. The primary goal of this project was to build upon the pilot study described above and to help students learn how to evaluate Internet resources in a systematic way, thus enhancing their ability to evaluate websites.

In order to achieve the primary project goal, a number of important actions were required by the project team. Teachers and researchers worked together to create benchmarks that would outline the concepts that 7th and 8th grade students at the middle school would need to learn in order to evaluate electronic/digital resources within the context of authentic learning activities, specifically, science classrooms. In addition, project leaders and researchers worked together to

help participating teachers effectively implement the benchmarks in their curriculum. Using the agreed-upon benchmarks, each teacher was asked to adapt or construct materials/concepts, determine frequency of use of those materials/concepts, and implement materials/concepts into their curriculums based on their own curricula agenda.

The assessments were developed by MEPRI staff, and pre-tested for appropriateness and clarity in conjunction with the pilot project described above which was conducted at another Maine school. A scoring rubric for the assessment was developed by MEPRI staff and the technology integrationist who helped create the assessment.

The intervention was implemented by the science teachers over approximately five months. The method of implementing the intervention generally followed one of two types of formats. The first format was in conjunction with an existing lesson. This involved all students looking at the same web page and discussing as a class the factors that contributed to it being identified, according to the benchmarks, as a "good or bad" website. Instruction usually revolved around dissecting the site to reveal differences for research purposes. The second format was conducted as a research project. This consisted of the teacher assigning students a research project or topic and the students identifying and explaining the webpage layout in relation to the benchmarks.

The pre- and post-assessments completed by the students were scored by MEPRI project staff and two science teachers (project leaders). As shown in table 29, results for the middle school revealed that the students performed well on the post-assessment in June 2008 when compared to the pre-assessment taken in December. The students' average scores on the post-assessment were above the pre assessment (17.8 vs. 15.0). In fact, statistical analysis of these

Table 29
Pre and Post Assessment 7th & 8th Grade Student Results

	Pre Assessment			Post Assessment		
	n	average	Standard Deviation	n	average	Standard Deviation
Students	297	15.01	4.58	347	17.80	5.59

results revealed there was a statistically significant improvement in student performance. Furthermore, analysis of the average scores, using Effect Size procedures, indicated students as a group improved their scores by 2/3 of a standard deviation. These Effect Size results suggest

that the work science teachers did to prepare students for website evaluation as part of this project has substantially increased student skills in that area. Thus, the findings indicate the intervention was effective in improving students' skills in evaluating web-based resources. In summary, this study demonstrated the potential impact of interventions specifically designed to address 21st Century Skills. Furthermore, the project demonstrated the importance and feasibility of developing individual curriculum interventions tailored to specific content areas.

Section 5: Costs of the Laptop Program

The previous sections of the report have focused on describing how the laptops are being used in Maine's middle schools, and the impacts the laptop program is having on teaching, knowledge, and student achievement. Many teachers believe the laptops have provided benefits to them and their students. But one may ask if the benefits are commensurate with the costs? In effect, one may ask if the MLTI program is cost-effective.

This is not an easy question to answer. There is a considerable body of literature on determining cost-effectiveness and how to conduct a cost-benefit analysis. But it is difficult to apply these business-type analyses to fields such human services and education. For one, it is virtually impossible to objectively quantify benefits. How does one put a price on deeper learning, for example? Second, most cost-benefit type analyses are premised on the availability of an alternative solution or program to calculate costs; to provide a comparison between an existing program and a new program. But in the case of the MLTI program this was not possible. Schools were using technology before the implementation of the one-to-one laptop program, but there was no documentation of the specific costs of this earlier technology use. In addition, at the time of the implementation of the one-to-one laptop program, no alternative use of resources was proposed to compare with the MLTI program.

This is not to suggest that cost analyses are impossible to conduct with programs such as MLTI. It just means one has to be more careful in tying costs to benefits. In fact, they cannot, in actuality, be tied directly to one another. The best on can do is document each, and use judgment in reaching cost and benefit conclusions.

Given this background, what can be documented about the costs of the MLTI program? First, there are two major cost components; (1) State costs, and (2) local school district costs. Second, identifying costs for each component requires different methodologies. And third, these methodologies impact the quality of evidence one may obtain.

Beginning with annual State costs, there are costs associated with the laptops and accompanying software, network costs, and state personnel costs. First the lease-purchase cost of each laptop and accompanying software is $242 per year for four years. A second State cost is for Networks. Each school is provided a network infrastructure that provides both wired and wireless bandwidth and storage capacity. It includes servers, data storage devices, routers, switches and fire walls and built-in redundancy for this equipment as well as the cooling and power systems in the data centers where the equipment is stored in order to ensure uptime. Apple provides personnel and equipment to ensure performance of the network. The annual cost of each network in each of the 225 middle schools is $7,817 per school.

A third State cost is for the MLTI staff. Currently the staff consists of ten full-time and part-time professional personnel responsible for managing the technical component of the MLTI program and providing professional development for school personnel statewide.

In the early years of the MLTI program, a large part of the statewide professional development program was provided in face-to-face activities. However, as resources have become more limited the number of face-to-face professional development activities has been reduced, and the MLTI project staff has begun to rely more and more on digital resources for providing professional development opportunities.

In 2009-10 the MLTI evaluation team attempted to document the extent of the professional development program. Table 30 summarizes some of this evidence. As shown in

Table 30
2009-2010 MLTI Professional Development Activities

Type of Professional Development	Number	Percent of Schools or Staff
1. School visits and consultations		
a. MLTI staff	64	18% of schools
b. Apple staff	62	18% of schools
2. Workshops	11	Unknown
3. Online Support		
a. Website	Continuous	No data available
b. Webinar	36	10% of Maine teachers
c. Online learning environments	Continuous	No data available
4. iTunes U	Over 4200 "hits" per week	11% or less Maine IP addresses

the table, the data on the extent of professional development activities is sketchy. Some of this sketchiness is due to the nature of the activity (e,g., virtual environments) and some is due to lack of a comprehensive system for tracking activities. The evaluation team attempted to obtain more comprehension information but was unsuccessful. In addition, the evaluation team attempted to collect evidence from participants in the professional development activities, but this information was also limited because only a small minority of participants chose to complete the evaluation surveys. Those that did, however, gave the professional development activities positive ratings.

Table 31 provides a summary of the State costs for 2009-10. The total yearly cost is approximately $10.5 million, for a per-unit cost of $308 ($10,467,926 / 34,038 laptop units).

In the case of calculating local district costs, determining costs are more difficult. Local school districts do not report the middle school laptop costs separately from other technology costs. Accordingly, in order to determine these costs, a cost survey was distributed to all public school districts (n=155) that had deployed MLTI laptops to all their 7th and 8th grade students and

Table 31
2009-10 State MLTI Costs

Item	Units	Cost
1. Middle School Student	29,570 @ $242 per unit	$7,155,940
2. Middle School Staff	4,468 @ $242 per unit	$1,081,256
3. Network Fee per School	225 @ $7,817 per unit	$1,758,825
4. MLTI Staff	Ten full and part-time staff	$471,905
	Total Costs	**$10,467,926**
	Cost per Unit	**$308 per Unit**

staff. A copy of the cost survey appears in Appendix B.

Unfortunately the return rate for the surveys from the school districts was very low. Only 28 school districts returned useable surveys, for a useable return rate of 18%. But those 28 districts represent approximately 31% of all middle school students, and useable surveys were returned from small, medium, and large school district. Thus, for purposes of this report, the evidence on local school district costs of the MLTI program should be viewed as preliminary, and not definitive. This is an important caveat, and caution must be exercised in interpreting these cost results.

Notwithstanding this caveat, what can be determined about local school district costs for the laptop program? Table 32 presents a summary of the results of the cost information submitted by the 28 SAUs. The table reports the total and per pupil MLTI expenditures for each

Table 32
MLTI Local Costs (n=28 SAUs)

SAU	Total Spending 7th & 8th Grades	Enrollment 7th & 8th Grades	Per Pupil Amount
1.	$12,478.00	42	$297.10
2.	$20,998.00	61	$344.23
3.	$95,568.00	64	$1493.25
4.	$21,600.00	66	$327.27
5.	$31,068.00	86	$361.26
6.	$36,596.00	95	$385.22
7.	$2,620.00	111	$23.60
8.	$31,600.00	132	$239.39
9.	$15,800.00	144	$109.72
10.	$170,727.00	165	$1034.71
11.	$104,513.00	186	$561.90
12.	$90,160.80	214	$421.31
13.	$130,038.00	275	$472.87
14.	$80,661.00	276	$292.25
15.	$134,500.00	325	$413.85
16.	$66,000.00	350	$188.57
17.	$127,067.90	350	$363.05
18.	$125,081.30	362	$345.53
19.	$18,298.00	390	$46.92
20.	$184,737.00	402	$459.54
21.	$186,250.00	406	$458.74
22.	$113,236.00	422	$268.33
23.	$145,950.00	436	$334.75
24.	$183,383.00	464	$395.22
25.	$89,989.00	547	$164.51
26.	$224,320.00	576	$689.44
27.	$139,091.00	640	$217.33
28.	$205,000.00	1045	$196.17
Total	**$2,787,705.18**	**8,991**	**$310.06**

of the 28 school districts, along with the 7th and 8th grade enrollment in each district. What is very apparent is the differences in expenditures for similar size districts. For example, District 3,

with 64 middle school pupils spends approximately $1,490 per pupil, while district 4, with 66 pupils, spends on average $327 per pupil. A similar pattern may be found between Districts 13 and 14.

These differences are further apparent when the districts are clustered by school size. Table 33 displays this information, and in this case, the cost per unit is reported as "cost per laptop" to reflect the fact that there are more laptops per school than just for pupils (e.g., teacher laptops). The table indicates that the average for all these districts is approximately $283 per laptop. The range among the 28 school districts is from a low of $24 per laptop in one of the small middle school to a high of $976 per laptop in one of the medium size middle schools.

Table 33
Cost Per Laptop Unit for Differing District Size

Local District	No of Laptops	Ave Cost Per Laptop	Range in Cost Per Laptop	
			Low	High
Small SAUs (0-149 pupils)	1247	$215	$24	$333
Medium SAUs (150-399 pupils)	3062	$342	$39	$976
Large SAUs (400-2000 pupils)	5113	$288	$146	$412
All Districts (n=28)	9422	$282?	$24	$976

Table 34 on the next page provides a further breakdown of costs by category of expenditures for the 28 SAUs. Individual breakdowns of expenditures by the three clustered school sizes appear in Appendix C. Collectively these breakdowns reveal that the largest expenditure categories are for salaries and benefits for (a) technology integrationists/mentors; and/or (b) technical support personnel. Not all SAUs had expenditures for these categories and it does not appear to be related to school size. That is, some small, medium, and large schools funded these personnel positions while others did not. In fact, this is true for all the categories of expenditures. Thus, while the average local MLTI expenditures in 2009-10 for these 28 SAUs was approximately $283 per laptop, expenditures vary greatly among the SAUs. This suggests different SAUs are making different choices on what they will expend local level funds on in support of their middle school laptop programs.

Table 34
Local Expenditures by Category (n=28) Middle Schools

Question 1: Did your school pay for the following items that are not covered by MLTI?	N SAU	Expenditure	Number of Laptops	Average Cost Per Laptop	Range of Per-Laptop Costs	
					High	Low
a. Salary and benefits for middle school technology integrationists/mentors	22	$1,032,653	7,930	$104.82	$26.67	$376.99
b. Salary and benefits for middle school computer technicians/technical support staff, including Ed Techs	26	$1,031,974	9,311	$104.75	$8.44	$537.91
c. Stipends for middle school teacher leaders who receive a stipend to help teachers with technology integration/issues in their classrooms	15	$43,435	6,023	$4.41	$1.87	$19.10
d. Repair and replacement not covered by MLTI	24	$114,193	7,987	$11.60	$.42	$59.09
e. Property insurance related to the laptops	5	$92,460	2,857	$9.38	$.00	$61.22
f. Infrastructure in addition to what is covered by MLTI	18	$119,059	6,464	$12.08	$.21	$64.10
g. Professional development for teachers and staff on using laptops for instruction	16	$43,881	6,823	$4.45	$.84	$46.67
h. Travel and substitute costs for professional development for teachers or staff	18	$15,512	6,048	$1.57	$.15	$13.54
i. Any additional MLTI laptops purchased that were not covered by the MLTI program	5	$43,916	1,909	$4.46	$.23	$42.18
j. Hardware	21	$147,179	6,627	$14.94	$2.86	$48.12
k. Software	15	$31,984	4,801	$3.25	$.42	$45.45
l. Supplies	25	$57,154	8,245	$5.80	$.13	$66.21
m. Other	6	$13,931	1,533	$1.42	$2.07	$44.40
Total	**28**	**$2,787,331**	**9,852**	**$282.92**	**$23.60**	**$975.58**

Given these state and local cost analyses, what is the total average yearly cost per laptop of Maine's middle school program? If one combines the two average cost figures (State and local school district) it appears that on average, Maine's yearly cost per laptop is approximately $591(State average cost of $308 and local district cost of $283 = $591).

How are these costs to be interpreted? Are they low, average, or high? Do they match benefits? As discussed earlier, these are questions which are difficult, if not impossible, to answer directly or definitively. However, to provide some context for interpreting these cost figures, two approaches have been taken.

First, how do these costs compare to other costs the State and local school districts incur in providing K-12 education in Maine? Table 35 reports average per pupil expenditures for K-12 education in Maine for 2009-10. It includes both State and local community expenditures, and is reported as average per pupil expenditures by 11 cost categories. This data indicates that the

Table 35
2009-2010 K-12 Maine Expenditures

Cost Category	Average Per Pupil Expenditure	Percent of Total
1. Regular Instruction	$4,438	40.2%
2. Special Education Instruction	$1,620	14.7%
3. CTE Education Instruction	$236	2.1%
4. Other Instruction	$344	3.1%
5. Student & Staff Support	$885	8.0%
6. System Administration	$332	3.0%
7. School Administration	$579	5.3%
8. Transportation and Buses	$578	5.2%
9. Facilities Maintenance	$1,274	11.5%
10. Debt Service	$711	6.5%
11. All Other	$42	0.4%
Total	$11,039	100.0%
Total Instruction (1-4)	$6,638	60.1%

average costs for the middle school laptop program is approximately 5.4% of the total K-12 per pupil expenditures ($591/$11,039 = 5.4%). The average of $591 is approximately 9% of total instructional costs, and about one-third of what was spent on special education. This average amount is similar to what was spent in 2009-10 for school level administration or transportation.

Second, how does the cost of Maine's one-to-one laptop program compare to costs of

other laptop programs? Surprisingly, few systematic attempts have been made throughout the country to document costs. An extensive review of the literature surfaced scant evidence of program costs. What was uncovered was a limited study by one national K-12 computing association. Beginning in 2003, the consortium on School Networking (CoSN), in collaboration with Gartner, an information technology research firm, developed a tool and protocol for calculating what was called Total Cost of Ownership (TCO). Using the protocol CoSN conducted cost studies of three school districts in which school district costs before and after implementation of one-to-one programs were calculated. In addition, one other cost analysis was uncovered by the MLTI evaluation team, a cost analysis conducted by another school district that used the CoSN protocol for analyzing their costs.

Table 36 reports the cost figures for the four school districts and Maine's program. The protocols used in the four studies were slightly different than the protocol used for Maine study, but they were similar enough to provide some comparison, albeit cautious ones.

As shown in the table, the cost per unit in the 1-to-1 programs ranged from a low of $516 per unit (District 3) to a high of $780 per unit (District 1). Maine's cost per unit of approximately $591 places it in the middle of the five programs, and approximately $55 below the average of the other four programs. And although Maine does not have any evidence of pre 1-to-1 laptop program costs, if the pre 1-to-1 per unit costs in the three other programs are used as surrogate evidence, the incremental or marginal cost of Maine's implementation of the middle school laptop program would be approximately $110.

Table 36
Average Cost per Laptop Unit

District\State	No. of Units	Cost per Unit Pre 1-to-1	Cost per Unit Post 1-to-1
District 1	4401	$262	$780
District 2	850	$577	$541
District 3	1079	$603	$516
District 4	540	N/A	$748
Non-Maine 1-to-1 Program Cost Average	$481	$646	N/A
State of Maine	34,038	N/A	$591

To summarize this section of the report, one has to exercise considerable caution in interpreting costs of the middle school program. Costs at the State level are fairly clear cut, but not so in the case of local district costs. The evidence that is available indicates that for 2009-10, the average costs of the laptop program, including both State and local costs, was approximately $591 per laptop unit. This amount represents approximately 5% of total K-12 expenditures, and 9% of total K-12 instructional expenditures. The $591 average costs is lower than the reported costs of other 1-to-1 laptop programs, and may represent an incremental cost of approximately $110 over other non-1-to-1 laptop/computer programs. Does this mean Maine's middle school program is cost effective? As mentioned at the beginning of this section of the report, it is impossible to determine in any objective, definitive way the answers to this question. But the evidence from this section, and the two previous sections describing benefits of the program, suggests that if the laptops are used extensively in curriculum and instruction, and are used specifically to focus on achieving targeted learning goals, the answer would appear to be in the affirmative.

Section 6: Summary and Recommendations

The evidence presented in this report, indicates that the MLTI program has had a significant impact on curriculum, instruction, and learning in Maine's middle schools. In the areas of curriculum and instruction, the evidence indicates many teachers have reached the tipping point in the adoption and integration of the laptop into their teaching. However, the adoption is uneven for some teachers, and in some areas. Relatively speaking, mathematics teachers use the laptops less frequently than their colleagues in other core disciplines. Most teachers are not using the laptops as frequently in assessment as one might expect, and too few teachers report using the laptop to frequently teach 21st Century Skills.

Middle school teachers report substantial benefits from the laptop program. Teachers indicated the laptops helped them teach more, in less time, and with greater depth, and they also reported that laptops helped them to individualize their curriculum and instruction. For their students, many teachers reported that their students learned more and with greater depth and understanding.

There is some evidence of the direct impact of the laptops on student achievement. Results indicate that students' writing has improved. In mathematics there is evidence that a well-designed and executed professional development resulted in improved student performance

in mathematics. A science study also found significant gains in student achievement when students used their laptop to learn science. In addition, two studies demonstrated the power of students' laptops in learning an important 21st Century Skill; the skills of locating and evaluating information.

In light of these benefits of the laptop program, it is important to also consider the costs of the program. Although some of the evidence in this area must be used cautiously, it appears Maine's one-to-one laptop program costs are in line with the average costs found in other laptop programs. That is to say, Maine's per unit costs were very similar to the average found in four other cost studies, and the incremental costs appear to be reasonable.

Thus, it appears the MLTI program has been successful in many ways. But this review has also surfaced some areas which need attention. A fundamental premise of the MLTI program is that technology integration is more about professional development than about hardware. The evaluators agree with this premise, and recommend that the project staff make some important changes and/or additions to the MLTI professional development program.

More specifically, the evaluation team recommends that for the near future the MLTI project staff focus professional development programs in the following areas:

1. increasing the use of technology in differentiating instruction
2. increasing the use of technology in teaching and learning mathematics
3. integrating technology with student assessment systems
4. integrating technology into the teaching of 21st Century skills
5. helping school level administrators become more effective in supporting the integration of technology into curriculum and instruction.

Second, the MLTI project staff should continue their efforts to deliver professional development program in the most effective and efficient ways possible, given limited resources. Using technology to provide professional development is critical, but the early evidence indicates that the efforts to date are not particularly encouraging. Only a small portion of teachers, administrators, and other school personnel are being reached by means of electronic technology. It is important that other strategies be identified and implemented in order to reach a wider audience.

Third, the project staff should continue to document the impacts of the laptop program on student achievement. This will entail engaging and assisting more teachers in designing and

implementing action research studies which are targeted toward achieving specific learning goals.

The evaluation team believes that implementing these recommendations will enhance the effectiveness and impacts of the middle school laptop program. In addition, they will bring the program closer to achieving the original goal of the Maine Learning Technology Initiative.

REFERENCES

Berry, A. M., Wintle, S. W. (2009). *Using Laptops to Facilitate Middle School Science Learning: the Results of Hard Fun.* University of Southern Maine, Gorham, Maine: Center for Education Policy, Applied Research and Evaluation.

Frechtling, J., & Sharp, L. (Eds.) (1997) *User-Friendly Handbook for Mixed Method Evaluation.* Washington D. C.: National Science Foundation.

Gladwell, M. (2000) *The Tipping Point: How Little Things Can Make a Big Difference.* New York: Little Brown & Company.

Gritter, A. L., Silvernail, D. L. *Maine's Middle School Laptop Program: Creating Better Writers.* University of Southern Maine, Gorham, Maine: Maine Education Policy Research Institute.

Johnson, R. B., Onweugbuzie, A. J., & Turner, L. A. (April 2007). Toward a Definition of Mixed Methods Research". Journal of Mixed Methods Research, Vol 1, No.2 (p.112.113).

Maine Department of Education, Task Force on the Maine Learning Technology Endowment, Augusta, Maine (2001). *Teaching and Learning for Tomorrow: A Learning Technology Plan for Maine's Future. http://maine.gov/mlti/resources/history/mlterpt.pdf*

Pinkham, C., Silvernail, D. L, Wintle, S. W. (2008). *21st Century Teaching and Learning: An Assessment of Student Website Evaluation Skills.* University of Southern Maine, Gorham, Maine: Center for Education Policy, Applied Research, and Evaluation.

Rogers, E. M. (1995). *Diffusion of Innovations.* New York: The Free Press.

Silvernail, D. L. (2008). *Using Sustained Professional Development as a Catalyst for Improving Middle School Mathematics Performance: Evidence from Maine's Impact Study of Technology in Mathematics (MISTM).* University of Southern Maine, Gorham, Maine: Maine Education Policy Research Institute.

Silvernail, D. L, Small, D., Walker, L., Wilson, R. L., Wintle, S. W. (2008). *Using technology in helping students achieve 21st century skills: A pilot study.* University of Southern Maine, Gorham, Maine: Maine Education Policy Research Institute.

Appendix A

MLTI Teacher Survey Spring 2010

This survey is being conducted by a research team from the Maine Education Policy Research Institute (MEPRI), on behalf of the Maine Department of Education. The Maine Learning Technology Initiative laptop program is being studied to find out how laptops are being used in classrooms across Maine. The research team will report its findings to the Department of Education and to the state legislature.

Over the course of several years, teachers have offered a variety of opinions about the benefits of the laptop program. In an attempt to more systematically collect teacher perceptions, we ask you to complete this survey. Completion of the survey should take no more than 15 minutes.

Your participation in the survey is voluntary, and your identity and responses will be kept strictly confidential.

Thank you for your participation.

If you have any questions, you may e-mail the evaluation team directly at cepare@usm.maine.edu.

MLTI Teacher Survey Spring 2010

*** 1. What is your school name?**

2. THIS SCHOOL YEAR, on average, how frequently do you perform the following tasks?

	never	less than once per week	once per week	a few times per week	once daily	often during the day
a. Use your laptop to conduct research that contributes to lesson plans and curriculum design.	◯	◯	◯	◯	◯	◯
b. Use your laptop to develop instructional materials (handouts, tests, etc.).	◯	◯	◯	◯	◯	◯
c. Use your laptop to manage student information.	◯	◯	◯	◯	◯	◯
d. Use your laptop to communicate with colleagues inside and outside the school.	◯	◯	◯	◯	◯	◯
e. Use your laptop to communicate with parents and students.	◯	◯	◯	◯	◯	◯
f. Use the laptops to assess student understanding and to inform my teaching (formative assessment).	◯	◯	◯	◯	◯	◯
g. Use the laptops to assess student understanding and to assign grades (summative assessment).	◯	◯	◯	◯	◯	◯
h. Use your laptop to adapt an activity to students' individual needs (e.g., differentiate instruction, etc.).	◯	◯	◯	◯	◯	◯
i. Use your laptop and/or student laptops together or individually for student learning during class time.	◯	◯	◯	◯	◯	◯
j. Use your laptop to record student grades.	◯	◯	◯	◯	◯	◯
k. Use your laptop to look up quick facts to inform your teaching.	◯	◯	◯	◯	◯	◯

3. Indicate how much you agree or disagree with the following statement about the laptop program.

	strongly disagree	somewhat disagree	neither disagree nor agree	somewhat agree	strongly agree
a. Because of the skills my students are gaining through work with the laptops, I believe they will be better prepared to compete in the new, knowledge-based economy than will students without a 1:1 laptop program.	◯	◯	◯	◯	◯

4. This school year during class time, how often have students in your class performed the following activities?

	never	less than once per week	once per week	a few times per week	once daily	often during the day
a. Students perform research or find information without using a laptop.	◯	◯	◯	◯	◯	◯
b. Students perform research or find information using a laptop.	◯	◯	◯	◯	◯	◯
c. Students work in groups on schoolwork without using a laptop.	◯	◯	◯	◯	◯	◯
d. Students work in groups on schoolwork using a laptop.	◯	◯	◯	◯	◯	◯
e. Students present information to the class without using a laptop.	◯	◯	◯	◯	◯	◯
f. Students present information to the class using a laptop.	◯	◯	◯	◯	◯	◯
g. Students use a laptop for writing.	◯	◯	◯	◯	◯	◯
h. Students use a laptop to gather information from multiple Internet sites to solve a problem.	◯	◯	◯	◯	◯	◯
i. Students use their laptop to consult with "experts."	◯	◯	◯	◯	◯	◯
j. Students use their laptop to communicate with students in other schools.	◯	◯	◯	◯	◯	◯
k. Students use a simulation on their laptops to better understand a concept(e.g. density, relationships in mathematics).	◯	◯	◯	◯	◯	◯

5. Please tell us HOW MUCH you agree or disagree with each of the following statements about student learning and laptop use in your classroom.

	strongly disagree	somewhat disagree	neither disagree nor agree	somewhat agree	strongly agree
a. Students in my classroom are more actively involved in their own learning when we use the laptops.	◯	◯	◯	◯	◯
b. The quality of my students' work increases when we use the laptops.	◯	◯	◯	◯	◯
c. My students are better able to understand when they use the laptops.	◯	◯	◯	◯	◯
d. My students are more organized when they use their laptops.	◯	◯	◯	◯	◯
e. My students are more engaged when we are using the laptops.	◯	◯	◯	◯	◯
f. Use of the laptops has facilitated my students' ability to integrate information from multiple sources.	◯	◯	◯	◯	◯
g. My students are more self-directed learners because of the laptops.	◯	◯	◯	◯	◯
h. As a result of using the laptops, my students are learning to critically assess the quality of information they obtain from different sources on the Internet.	◯	◯	◯	◯	◯
i. My students are able to present/express their ideas more effectively when they use laptops.	◯	◯	◯	◯	◯
j. Laptops make it easier for my students to gather information from different sources.	◯	◯	◯	◯	◯
k. The laptops help my students better grasp difficult curricular concepts.	◯	◯	◯	◯	◯
l. My students' writing quality is better when they use laptops.	◯	◯	◯	◯	◯
m. My students communicate better with teachers as a result of having laptops.	◯	◯	◯	◯	◯
n. My students learn some content faster using laptops.	◯	◯	◯	◯	◯
o. Laptops make it easier for my students to demonstrate their learning.	◯	◯	◯	◯	◯
p. My students work harder at their assignments when they use the laptops.	◯	◯	◯	◯	◯

6. Over the past 12 months, how many times have you participated in each of the following types of professional development?

	0	1-2	3-5	6-10	10+
MLTI live webinar	◯	◯	◯	◯	◯
MLTI recorded webinar and/or podcast	◯	◯	◯	◯	◯
MLTI regional content meetings	◯	◯	◯	◯	◯
MLTI leadership meetings	◯	◯	◯	◯	◯
Professional development provided by MLTI that your school requested at your location	◯	◯	◯	◯	◯
Professional development offered by your school or district	◯	◯	◯	◯	◯
Other, online/virtual professional development (not offered by MLTI)	◯	◯	◯	◯	◯
Other professional development, not included above	◯	◯	◯	◯	◯

7. Please rate the effectiveness in meeting your needs of each of the following types of professional development you have participated in within the past 12 months (if you attended more than one session, please rate the effectiveness ON AVERAGE).

	did not participate	not effective	somewhat effective	effective	very effective
MLTI live webinar	○	○	○	○	○
MLTI recorded webinar and/or podcast	○	○	○	○	○
MLTI regional content meetings	○	○	○	○	○
MLTI leadership meetings	○	○	○	○	○
Professional development provided by MLTI that your school requested at your location.	○	○	○	○	○
Professional development offered by your school or district	○	○	○	○	○
Other, online/virtual professional development (not offered by MLTI)	○	○	○	○	○
Other professional development, not included above.	○	○	○	○	○

8. Which of the following types of professional development would be most beneficial to you as you continue to use laptops in your classroom? (check all that apply)

- ☐ Interdisciplinary, project-based
- ☐ Integrating technology within the existing curriculum
- ☐ Teaching 21st Century skills using technology within the existing curriculum
- ☐ Using a particular software program (e.g. Noteshare or other MacBook software)
- ☐ Using a particular web-based software (e.g. Google Docs)

Other (please specify)

_____

9. Which of the following professional development formats would be most appealing to you? (check all that apply)

- [ ] School-based professional development
- [ ] In-person mini-courses during the summer
- [ ] In-person regional content meetings during the school year
- [ ] University courses (attend in-person)
- [ ] Webinars
- [ ] Podcasts
- [ ] Online/virtual courses

Other (please specify)

10. What would you say is the greatest strength of the laptop program as it pertains to teaching and learning?

11. What would you say is the greatest challenge of the laptop program as it pertains to teaching and learning?

12. Concentration area in which you teach: *(Check all that apply.)*

- [ ] Science
- [ ] Foreign Languages
- [ ] Mathematics
- [ ] Language Arts
- [ ] Social Sciences
- [ ] Fine Arts
- [ ] Technology
- [ ] Special Education
- [ ] Physical Ed./Health
- [ ] Gifted/Enrichment
- [ ] Library Services
- [ ] Guidance

Other (please specify)

MLTI Teacher Survey Spring 2010

13. How many years have you been teaching?

- ◯ 1-2 Years
- ◯ 3-5 Years
- ◯ 6-10 Years
- ◯ 11 or More Years

14. Highest level of education completed

- ◯ Bachelor's Degree
- ◯ Bachelor's Degree plus credits
- ◯ Master's Degree
- ◯ Master's Degree plus credits
- ◯ Certificate of Advanced Study
- ◯ Doctorate

15. Gender

- ◯ Male
- ◯ Female

16. Age:

- ◯ 20-29
- ◯ 30-39
- ◯ 40-49
- ◯ 50-59
- ◯ 60+

17. Are you a.....

- ☐ Teacher
- ☐ Educational Technician
- ☐ Administrator
- ☐ Other

18. If you have any comments about the laptop program that you would like to share with the research team, please share them here.

Appendix B

MLTI Local Costs Survey

This survey is being conducted by a research team from the Maine Education Policy Research Institute (MEPRI), on behalf of the Maine Legislature and Maine Department of Education. As required by legislation, we are attempting to determine the costs associated with the middle and high school laptop programs. The research team will report its findings to the state legislature and the Department of Education.

Your participation in the survey is voluntary, and your identity and responses will be kept strictly confidential.

Thank you for your participation. Please return the survey by August 16.

If you have any questions, you may e-mail the evaluation team directly at cepare@usm.maine.edu or call Jim Sloan at (207) 228-8220 or toll-free at (888) 800-5044.

Instructions:

Part A of the survey asks about your MIDDLE SCHOOL MLTI laptop program costs.

Part B of the survey asks about your HIGH SCHOOL computer program costs.

If you are a superintendent of a School Union or AOS, please complete a form for each discrete member unit (reporting separately for each municipal, SAD, RSU, or CSD unit in the Union or AOS) that has a school with students in 7th through 12th grade.

After completing the form, please print it by clicking the "**Print Form**" button, and mail it to us at the address below. You may also save the completed form to your hard drive by clicking the save icon.

CEPARE
University of Southern Maine
McLellan House
140 School Street
Gorham, ME 04038

Telephone: (207) 780-5044 or 1-888-800-5044
Fax: (207) 228-8143
Email: cepare@usm.maine.edu

SCHOOL ADMINISTRATIVE UNIT NAME..... [ ]
(Municipality, SAD, CSD, or RSU – do not report by Union or AOS)

Part A – Middle School MLTI Laptop Program Costs

Questions 1 through 6 refer to your middle school computers for 7th and 8th graders that are part of the Maine Learning & Technology Initiative (MLTI). Please do not include any expenses related to other computers when answering the questions.

1. Some superintendents have reported that they must pay for items out of their local budget because the items are NOT paid for by the State as part of the middle school MLTI program. For each of the items listed below, please indicate how much you spent in 2009-10 for that item.
   - If an item supported more than 7th and 8th graders, or computers other than those that are part of MLTI, please allocate on an actual or pro-rata basis on the portion that applied to MTLI laptops for 7th and 8th graders only.
   - If your district had no expenditures on an item, please enter '0'.
   - Additional notes or comments may be placed in your response to Question 6.

Did your school pay for the following items that are NOT covered by MLTI?	**Spending by your school district in 2009-10 for 7th & 8th grade**
a. Salary and benefits for middle school technology integrationists/mentors	[ ]
b. Salary and benefits for middle school computer technicians/technical support staff, including Ed Techs.....	[ ]
c. Stipends for middle school teacher leaders who receive a stipend to help teachers with technology integration/issues in their classrooms.....	[ ]
d. Repair and replacement not covered by MLTI.....	[ ]
e. Property insurance related to the laptops.....	[ ]
f. Infrastructure in addition to what is covered by MLTI (e.g., wiring, servers, routers, etc.).....	[ ]
g. Professional development for teachers & staff on using laptops for instruction (excluding PD provided by MLTI).....	[ ]
h. Travel and substitute costs for professional development for teachers or staff.....	[ ]
i. Any additional MLTI laptops purchased that were not covered by the MLTI program.....	[ ]
j. Hardware (e.g., printers, scanners, probes, thermometers, projectors, smartboards, other hardware)	[ ]
k. Software.....	[ ]
l. Supplies.....	[ ]
m. Other (please specify [ ]).....	[ ]
n. Other (please specify [ ]).....	[ ]

2. What was your student enrollment in April 2010 for 7th & 8th grade?

3. How many MLTI laptops did you have during the 2009-10 school year for use by your 7th and 8th graders, their teachers, and staff that were:

   a. Paid for by the State.....

   b. Paid for locally.....

4. Has your school district purchased digital/online textbooks for 7th and 8th graders that have replaced hard-copy textbooks? O Yes O No

   If so, how much, if anything, do you estimate that you save annually by not purchasing the hard-copy textbooks? (Annual cost of hard-copy textbooks – annual cost of digital or online books = net annual savings)

5. You may know of other ways in which your school district has saved money as a result of having the 7th and 8th grade MLTI laptops. If so, please describe the item and give an estimate of how much you save annually.

Item description	Savings per year

6. If you have any other comments about costs associated with the laptop program in your middle school or have been able to provide students with things you would not be able to afford otherwise, please let us know in the space below or, alternatively, you may call us in Gorham at (207) 228-8220 or toll-free at (888) 800-5044.

Part B – High School Computer Program Costs

Questions 7 through 13 refer to your high school computers for 9th through 12th graders.

7. Which of the following types of access to computers did students in your HIGH SCHOOL(s) have during the 2009-10 school year?

Student Computer Access for 2009-10:	**In which grades?** (*check all that apply*)	**Total # of computers of this type in your high school** *(include teacher, staff, student and backup computers):*	**Average cost <u>per year</u> for each laptop?** *(Annual lease payment or total price divided by number of years of expected life)*
a. One-to-one – each student had his or her own **MLTI** MacBook purchased for 2009-10 school year through the MLTI program	☐ 9th ☐ 10th ☐ 11th ☐ 12th Other ☐		
b. One-to-one – each student had his or her own **Apple** laptop, e.g., an older MLTI laptop or one purchased directly from Apple, but **NOT** part of the 2009-10 MLTI program	☐ 9th ☐ 10th ☐ 11th ☐ 12th Other ☐		
c. One-to-One – each student had his or her own **non-Apple** laptop (e.g., Netbooks).	☐ 9th ☐ 10th ☐ 11th ☐ 12th Other ☐		
d. One-to-One – Laptops (any type) were available **on carts** that classroom teachers may request for their class	☐ 9th ☐ 10th ☐ 11th ☐ 12th Other ☐		
e. Computer lab	☐ 9th ☐ 10th ☐ 11th ☐ 12th Other ☐		
f. Other type of access – (*please explain*) ☐	☐ 9th ☐ 10th ☐ 11th ☐ 12th Other ☐		

For questions 8 through 13, please consider all of the laptops of any type (Apple, Netbook, Acer, HP, etc.) you have available for your high school students, teachers, and staff that are either assigned to individuals or available on carts. Do <u>not</u> include computers in a computer lab.

8. Below is a list of items that some superintendents have indicated are necessary to run their high school laptop program. For each of the items listed, please indicate how much you spent in 2009-10 for that item.
   - If an item supported more than 9th through 12th graders, or computers other than laptops, please allocate on an actual or pro-rata basis on the portion that applied to laptops for 9th through 12th graders only.
   - If your district had no expenditures on an item, please enter '0'.
   - Additional notes or comments may be placed in your response to Question 13.

Did your school pay for the following items?	**Spending by your school district in 2009-10 for 9th -12th grade**
a. Salary and benefits for high school technology integrationists/mentors	
b. Salary and benefits for high school computer technicians/technical support staff, including Ed Techs	
c. Stipend for high school teacher leaders who receive a stipend to help teachers with technology integration/issues in their classrooms	
d. Repair and replacement	
e. Property insurance related to the laptops	
f. Infrastructure not covered by MLTI (e.g., wiring, servers, routers, etc.)	
g. Professional development for teachers & staff on using laptops for instruction (excluding the PD provided by MLTI)	
h. Travel and substitute costs for professional development for teachers or staff related to technology and teaching (could be MLTI training or other, non-MLTI training)	
i. Hardware (e.g., printers, scanners, probes, thermometers, projectors, smart boards)	
j. Software	
k. Supplies	
l. Other (please specify _____)	
m. Other (please specify _____)	

9. What was your student enrollment in April 2010?

9th grade..... ☐

10th grade..... ☐

11th grade..... ☐

12th grade..... ☐

10. If you have laptop access for any grades in your high school (a laptop of any type assigned to the student or available on carts), how long has any type of laptop access been in place?

O This year ('09-'10) was the first year

O 2-3 years

O 4-5 years

O More than 5 years

11. Has your school district purchased digital/online textbooks for the high school that have replaced hard-copy textbooks? O Yes O No

If so, how much, if anything, do you estimate that you save annually by not purchasing the hard-copy textbooks? (Annual cost of hard-copy textbooks – annual cost of digital or online books = net annual savings) ☐

12. You may be able to think of other ways in which your school district SAVES money as a result of having laptops in the high school. If so, please describe the item and give an estimate of how much you save annually.

Item description	Savings per year
	.....
	.....
	.....
	.....

13. If you have any other comments about costs associated with computers in your high school or have been able to provide students with things you would not be able to afford otherwise, please let us know in the space below or, alternatively, you may call us at (207) 228-8220 or toll-free at (888) 800-5044.

Please print your responses by clicking the "Print Form" button, and mail it to us at the address below. You may also save the completed form to your hard drive by clicking the save icon.

Print Form

CEPARE
University of Southern Maine
McLellan House
140 School Street
Gorham, ME 04038

Thank you for taking the time to complete our survey. Your input is very much appreciated.

Appendix C

Small Middle Schools = Enrollment from 0 – 149

N = 9 **Average Enrollment = 89**

Total students = 801 **Ranges of Enrollment = Low: 49 High: 144**

Total Laptops = 1,247

Question 1: Did your school pay for the following items that are not covered by MLTI?	**N (SAU)**	**Expenditure**	**Number of Laptops**	**Conditional Per Laptop**	**Range of Conditional Per-Laptop**	
					Low	**High**
a. Salary and benefits for middle school technology integrationists/mentors	5	61,576	814	75.65	26.67	100.00
b. Salary and benefits for middle school computer technicians/technical support staff, including Ed Techs	8	129,339	1136	113.85	42.25	165.42
c. Stipends for middle school teacher leaders who receive a stipend to help teachers with technology integration/issues in their classrooms	4	5,820	445	13.08	7.37	19.10
d. Repair and replacement not covered by MLTI	6	11,418	912	12.52	2.72	59.09
e. Property insurance related to the laptops	0	0	0	0	0	0
f. Infrastructure in addition to what is covered by MLTI	5	12,669	802	15.80	2.38	64.10
g. Professional development for teachers and staff on using laptops for instruction	4	5,060	638	7.93	1.19	46.67
h. Travel and substitute costs for professional development for teachers or staff	5	2,450	492	4.98	2.11	13.54
i. Any additional MLTI laptops purchased that were not covered by the MLTI program	1	948	95	9.98	9.98	9.98
j. Hardware	5	18,937	748	25.32	15.35	30.91
k. Software	3	8,236	304	27.09	12.42	45.45
l. Supplies	7	5,644	1,008	5.60	.68	66.21
m. Other	3	6,231	307	20.30	6.32	44.40
n. Other	0	0	0	0	0	0
TOTAL =	**9**	**268,328**	**1,247**	**215.18**	**23.60**	**332.69**

Medium Middle Schools = Enrollment from 150-399

N = 10 **Average Enrollment = 296**

Total students = 2,893 **Ranges for Enrollment = Low: 165 High: 390**

Total Laptops = 3,062

Question 1: Did your school pay for the following items that are not covered by MLTI?	**N (SAU)**	**Expenditure**	**Number of Laptops**	**Conditional Per Laptop**	**Range of Conditional Per-Laptop**	
					Low	**High**
a. Salary and benefits for middle school technology integrationists/mentors	9	383,761	2,618	148.28	41.46	376.99
b. Salary and benefits for middle school computer technicians/technical support staff, including Ed Techs	9	363,641	3,062	137.02	8.44	537.91
c. Stipends for middle school teacher leaders who receive a stipend to help teachers with technology integration/issues in their classrooms	4	4,000	1,562	2.61	2.11	4.18
d. Repair and replacement not covered by MLTI	9	59,740	3,062	19.51	4.72	31.53
e. Property insurance related to the laptops	2	35,000	680	53.85	33.47	61.22
f. Infrastructure in addition to what is covered by MLTI	8	49,429	2,473	18.88	.21	63.49
g. Professional development for teachers and staff on using laptops for instruction	5	4,950	1,687	2.93	.84	8.52
h. Travel and substitute costs for professional development for teachers or staff	6	4,442	1,687	2.63	.15	5.64
i. Any additional MLTI laptops purchased that were not covered by the MLTI program	2	22,848	760	30.06	19.61	42.18
j. Hardware	9	83,927	2,651	31.66	4.22	48.12
k. Software	6	6,092	1,793	3.10	.56	7.10
l. Supplies	9	27,717	2,648	10.59	.42	23.36
m. Other	1	1,500	214	7.01	7.01	7.01
n. Other	0	0	0	0	0	0
TOTAL =	**10**	**1,047,047**	**3,062**	**341.95**	**38.60**	**975.58**

Large Middle Schools = Enrollment from 400 – 2000

N = 9 **Average Enrollment = 549**

Total students = 4,938 **Ranges for Enrollment = Low: 402 High: 1,045**

Total Laptops = 5,113

Question 1: Did your school pay for the following items that are not covered by MLTI?	**N (SAU)**	**Expenditure**	**Number of Laptops**	**Conditional Per Laptop**	**Range of Conditional Per-Laptop**	
					Low	**High**
a. Salary and benefits for middle school technology integrationists/mentors	8	587,316	4,498	130.57	32.73	251.34
b. Salary and benefits for middle school computer technicians/technical support staff, including Ed Techs	9	538,994	5,113	105.42	53.42	186.01
c. Stipends for middle school teacher leaders who receive a stipend to help teachers with technology integration/issues in their classrooms	8	33,615	4,016	8.37	1.87	8.30
d. Repair and replacement not covered by MLTI	8	43,035	4,013	10.72	.42	20.10
e. Property insurance related to the laptops	3	57,460	2,177	26.39	14.24	34.60
f. Infrastructure in addition to what is covered by MLTI	5	56,961	3,189	17.86	5.66	39.75
g. Professional development for teachers and staff on using laptops for instruction	7	33,871	4,498	7.53	2.86	16.36
h. Travel and substitute costs for professional development for teachers or staff	7	8,620	3,869	2.23	.48	4.02
i. Any additional MLTI laptops purchased that were not covered by the MLTI program	2	20,120	1,054	19.09	.23	37.74
j. Hardware	7	44,315	3,228	13.73	2.86	34.23
k. Software	6	17,656	2,704	6.53	.42	9.43
l. Supplies	8	23,793	4,589	5.18	.13	8.44
m. Other	2	6,200	1,012	6.13	2.07	9.81
n. Other	0	0	0	0	0	0
TOTAL =	**9**	**1,471,956**	**5,113**	**287.88**	**146.32**	**412.36**

*** It should be noted that SAUs 2, 9 and 26 were excluded due to missing data.**