One to One Laptop Program CIPP Evaluation

By

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Abstract

The purpose of this study was to evaluate the 1:1 laptop programs in two New Hampshire K-8 schools and to develop a more manageable evaluation model for school administrators. Using Stufflebeam's (1971) Context, Input, Process and Product (CIPP) model, this evaluation posed and answered key questions that addressed professional development, technology integration, and student engagement as related to the 1:1 programs in both schools. Data were collected from interviews, surveys, observations, focus groups, and field notes. The evaluation revealed that the programs were instituted successfully. However, it became clear that teachers needed significant support and initiative to redesign tasks to infuse technology and transform learning into experiences that encompass creative thinking, collaboration, and problem solving. The process of using the full CIPP evaluation model revealed that this method is too time consuming and labor intensive for a school principal. Using the CIPP model as a base, a new model, the Essential Embedded Evaluation Model (EEEM), was developed.

Dissertation of Lori Ferretti Collins

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I understand that my dissertation will become part of the permanent collection of Plymouth State University, Lamson Learning Commons. My signature below authorizes release of my dissertation to any reader upon request.

Lori Ferretti Collins, Author, March 23, 2017

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CHAPTER 1

INTRODUCTION

Across the nation, many classrooms, schools, and districts are going one to one (1:1). Though these programs might look different from place to place, they all have at least one thing in common: every student gets their own computing device. One-to-one initiatives provide every student and teacher with a personal wireless device that provides access to the Internet at home and at school (Penuel, 2006). Due in part to 1:1 programs, young people's access to computer technologies at school and at home is increasing at a rapid pace. A 2014 International Society of Technology Educator (ISTE) survey highlights the increasing role technology plays in the transformation of education. This survey (ISTE, 2014) indicates that 50% of students ages 10 to 18 go online for homework help at least once a week and students who study on mobile devices spend 40 minutes more per week studying than those who do not. The data also reveals that 75% of students ages 5-7 regularly use technology to play educational games (ISTE, 2014).

Nevertheless, digital equity is a growing concern for K–12 educators and technology professionals, according to the 2014 Speak Up survey by Project Tomorrow. The data illustrates that 46% of district technology leaders cited digital equity as the most challenging issue they face, up from 19% in a survey conducted in 2014 (Project Tomorrow, 2015). Giving students access to digital tools throughout the day and into the evening in a 1:1 initiative ensures that all students have equal access to technology. Nonetheless, the move toward this model challenges teachers to rethink and redesign learning activities to capitalize on their schools' investment in technology.

Educational leaders believe that the increased use of computers will lead to improved teaching and learning and the development of technology skills that will help students become college and career ready (Daggett, 2010). As network speeds have increased and the cost of technology has declined, the number of devices in the classrooms has increased, and so has the variety of ways teachers and students use technology. Daggett (2010) contends that educational technology programs require a major shift in the way teachers and schools function. This necessity resonates in the National Educational Technology Plan (U.S. Department of Education, 2016) released in January 2016. The plan describes the use of technology in teaching and learning and explains how technology can be leveraged to provide engaging and powerful learning experiences. Daggett (2010) and the U.S. Department of Education (2016) both argue that because of the increasing use of technology at home and in business, society demands a higher level and different set of technological skills than schools were ever designed to teach. According to this research, educators must create meaningful learning experiences in which students are taught how to apply their knowledge to solve real-world problems.

Within this context of increased implementation of 1:1 programs and increased interest in how schools and teachers are leveraging technology to improve teaching and learning, two NH elementary schools within the same district have opted to become 1:1 schools. However, these initiatives have not been evaluated, and evaluation research is needed to support further development and implementation of these programs. I have served as a technology director in a different district and I am the current school principal at Auburn. I am also serving as the principal investigator for this research. In this role, my intention was to aid in the Auburn Village School's understanding of its program implementation and its effects by evaluating the first year of the program in which every 6th grade student and teacher utilized a Chromebook. In addition, I provided data to the Candia Moore School's understanding of their program and effects as they completed their second year of program implementation in their 7th, and 8th grades. The aim of this research, which evaluates two programs in different phases of implementation, is to contribute to the knowledge base and guide similar schools that plan to institute this type of initiative. Finally, through the process of conducting this evaluation, I was able to develop a practicable evaluation model that will provide other administrators the ability to measure the effectiveness of 1:1 programs within their schools.

An evaluation of these two schools' initiatives helps answer important questions about the kinds of investments necessary to accomplish the successful integration of technology into the classroom. These investments include personnel, time, equipment, and various teaching and learning activities. This evaluation captures essential integration metrics, presented by McLeod & Richardson (2013), such as frequency of use ('how often do students and teachers use technology for learning and teaching purposes?'), type of use ('what do students and teachers do when they use technology?'), and depth of cognitive work enabled by such use ('are learning technologies being used for deeper learning or merely low-level thinking work?'). As technology has become more prevalent in schools, the focus of many studies has shifted from whether educators and students have access to digital technologies toward how they use the learning tools that they have. Some researchers have focused on teachers' lack of usage (e.g., Collins & Halverson, 2009; Cuban, 2001), while others claim that teachers may use technology in their instruction but may not use it very well (Richardson & Mancabelli, 2011). This evaluation provided information both on teachers' and students' access to and utilization of provided technologies. Additionally, because of this extensive process, an evaluation model that will be useful for administrative teams was developed. This new model enables administrators to evaluate their technology initiatives and approaches and to communicate these findings to district level administration and budget committees more quickly that traditional evaluation models.

Problem Statement

The number of one device per student or 1:1 schools, both public and private, around the nation has grown significantly (Project Tomorrow, 2015). According to an online survey of 2,274 American students in grades 4-12 by Harris Poll on behalf of Pearson (Pearson, 2015), 78% of elementary school students reported that they regularly use a mobile device in school, an increase from 66% in 2014. The same survey illustrates that a majority of students (55%) feel that it is important for their schools to provide them with a laptop on a 1:1 basis. As school administrators make the decision to move to technology intensive programs, stakeholders expect to detect a concurrent change in teaching and learning. Evaluation of a program's impact on learning is an important part of determining whether the program has been successful in accomplishing its established goals (McLeod & Richardson, 2013). The decision to move to a 1:1 environment requires major investments of time, money, and other resources.

However, relatively little longitudinal data documents the impact of modern 1:1 programs on teaching and learning. Many studies have focused on certain features of a program or have been limited to very small sample sizes (McLeod & Richardson, 2015).

Furthermore, many of these studies were conducted in early stages where implementation issues had an effect on the results of the programs (Bebell & O'Dwyer, 2010; Zucker & Light, 2009). Thus, it is critical that schools adopt an evaluation model for their 1:1 device programs to ensure that they are meeting their intended objectives and to promote continuous improvement for future years.

Principals can serve important educational roles when it comes to laptop policy evaluation and implementation. When board members, parents, staff, or community members express concerns about certain technology-related aspects of schooling, principals have the responsibility to educate and inform them about the needs of students in today's world. An evaluation can be seen as an essential communication instrument for sharing the impact and to inform stakeholders of forthcoming plans for a program (Stufflebeam & Stinkfield, 2007). Evaluation is also beneficial to address essential integration issues such as the frequency with which the technology is used for teaching and learning, the actual activities conducted with the technology, and whether the technology is being used for deeper learning or only rote skills (Law, Plegrum & Plomp, 2008; Zucker & Light, 2009). The issue that many schools confront is that once the technology is physically present in the classroom, a subsequent evaluation of the initiative is not undertaken. An evaluation can provide useful information about the strengths and weaknesses of the strategies used for implementation so that the strategy of the program might be strengthened (Bebell & O'Dwyer, 2010; Zucker & Light, 2009). In a 1:1 technology initiative, it is important to ask the questions: What should we do? How should we do it? Are we doing it correctly and did it work? (Stufflebeam, 1971). Staff and administrators involved in school technology projects often do not consider these evaluative questions.

Learning Theory Supporting Instructional Technology

The evolving idea of educational technological integration has theoretical roots in constructivism as well as the work of both Piaget and Vygotsky. The Constructivist Learning Theory has its foundations in the work of Jean Piaget. Piaget (1936) advocated that knowledge is a construction and not a reality, the understanding of which is continuously revised and reconstructed as new experiences are acquired. Therefore, the construction of new knowledge can only take place when that new knowledge is actively assimilated and incorporated into existing knowledge (Piaget, 1936). The constructivist approach to learning encourages students to explore and personalize instructional materials during the learning process. However, intertwined in the Constructivist Theory is Vygotsky's (1987) concept of the Zone of Proximal Development. Vygotsky's (1987) belief that children should be actively encouraged to move through the zone of proximal development and be given the opportunity to engage in problems which are beyond their current ability level, but within their zone of proximal development, supports the use of technology-centered, project-based learning. Vygotsky's (1987) theory that a child's development is advanced by input from peers, as well as a more knowledgeable other, underscores the importance of learning in a collaborative environment, which can be facilitated by technology. Thus, both theorists provide a foundation for the current movement toward an innovative model of teaching and learning which is supported by appropriate use of technology.

Current educational literature supports using technology to facilitate a constructivist approach in teaching and learning that will allow children to engage in their lessons, test out theories, and try to make sense out of the world and themselves (Means, Blando, Olson, Middleton, Morocco, & Zofass, 1993). This approach does not imply spontaneous, free-form classrooms or simply leaving the child alone to learn. It means supporting children as they build their own intellectual structures with materials drawn from the surrounding culture. In this approach, educational intervention means changing the culture, planting new constructive elements, and eliminating noxious ones (Papert, 1980, p.31-21). Both Piaget and Vygotsky appreciated the essence of building constructs and internalizing knowledge, rather than accepting the information as presented through rote memorization. Constructivist learning environments encourage the learner to gather, filter, analyze, and reflect on the information provided, and to comment on this knowledge, resulting in individualized comprehension and personalized learning. Whether it is developmental or social, as suggested by Piaget and Vygotsky respectively, this type of learning emphasizes knowledge construction, where information is absorbed and knowledge is built by the learner.

In the early 1990's, Means, Blando, Olson, Middleton, Morocco, and Zofass (1993) suggested that technology could transform classroom practices and school structure. Instead of merely using technology as a tool to supplement instruction, Means et al. (1993) reasoned that technology could support constructivist-learning activities. The idea is to move the teacher from the traditional stage in the front of the classroom to beside the students who are constructing their own knowledge, engaging in long-term meaningful projects (Means et al., 1993). As important as technology is, schools have had difficulty establishing how to use technology in a way that does not replace instruction, but instead reinforces it. In 2005, Wenglinsky contributed evidence to this theory by analyzing data from the National Assessment of Educational Progress (NAEP) in 1996, 1998, and 2000. He found a consistently negative interaction between frequency of technology use and test score outcomes in fourth and eighth grade mathematics and reading. He attributed this outcome to the negative effects of using technology for drill and practice activities that are used most often with low socioeconomic students. In contrast, the more constructivist educational technology activities typically used with high socioeconomic students were correlated with higher test score outcomes (Wenglinsky, 2005). The 2016 National Education Technology Plan (U.S. Department of Education, 2016) builds on this research by outlining the importance of using technology to enable students to personalize their learning through active and collaborative learning activities. The NETP encourages teachers to collaborate in designing instruction that supports student voice and choice in the design of learning activities and the means of demonstrating learning.

Research exploring the possible role and influences of technology on instruction and learning suggests a variety of advantages such as increased student engagement, more personalized learning, and critical thinking skills that prepare students for the future workplace. Lei and Zhao (2007) investigated how the quantity and quality of technology use affected student learning outcomes. Their results imply that the quantity of technology use alone is not critical to student learning. The quality of technology use is the critical issue. Lei and Zhao (2007) recommend that education policy should endeavors be focused on improving efforts toward technology integration. Evaluating schools based on their successful integration of technology into teaching practice, and not solely on how much technology is used, can help create conditions that have a positive impact on students. Lei and Zhao (2007) identify the need to explore evaluation methods and instruments to evaluate student learning with technology.

Based on the work done by Lei and Zhao (2007), the NETP (U.S. Department of Education, 2016) lays the foundation to shift practices to serve students better through technology. The plan encourages educators to design short pilot studies that impact a small number of students, to ensure the chosen technology and the implementation approach have the desired outcomes. As schools continue to invest heavily in education technology, there is a pressing need to generate evidence about the effectiveness of these investments and to develop evaluation tools that developers and practitioners can use to conduct their own evaluations that take less time and incur lower costs than do traditional evaluations (U.S. Department of Education, 2016).

The purpose of this evaluation was to collect data that will facilitate decisions. The Concept Input Process Product Model or CIPP created by Daniel Stufflebeam was chosen as the evaluation approach because Stufflebeam (1971) contends that his approach provides a sound framework for proactive evaluation to serve decision-making (Fitzpatrick, Sanders, Worthen, 2011). Evaluation involves delineating, obtaining, and providing useful information about a program so that assessments and decisions can be made. The CIPP model is comprised of three steps: 1) delineating (the decision of what information will be used); 2) obtaining (the method of collecting and analyzing the data); and 3) providing (reporting the information to decision makers). The approach defines four types of decision-making categories: context evaluation (provides rationale for educational goals); input evaluation (provides determinant for using resources); process evaluation (indicates deficiencies in the procedure); and product evaluation (measures the attainments of the program at its conclusion). Although each stage is designed to address specific aspects of a program that are important to decision makers, the advantage of this model is that it is not linear (Fitzpatrick, et al., 2011), and can be modified to capture only the specific information required by those in decision-making positions (Stufflebeam, 2003). A further argument for the use of this approach is that it was designed for use in schools and has been used to evaluate numerous educational projects and entities (Zhang, Zeller, Griffith, Metcalf, Williams, Shea & Misulis, 2011).

Evaluation Research Questions

According to Anderson and Dexter (2000), school technology leadership is linked to decision-making about technology goals, policies and budgets for improving technology's role in learning. The focus of this evaluation research is to assist administrators in making decisions about future integration of technology in their schools by examining the impact of 1:1 devices on students' learning experiences in two K-8 schools within the same district. The guiding evaluation questions are:

1. What is the effectiveness of 1:1 devices in improving learning and teaching based on:
    a. Student experience with respect to learning and instruction?
    b. Teacher experience with respect to learning and instruction?
2. What improvements should be made when 1:1 devices are rolled out to other grade levels?

3. What elements of this evaluation can be adapted to create a feasible evaluation model that can be utilized by other districts?

Assumptions

The inputs, activities, and desired outcomes of the 1:1 device initiative at both schools are grounded in several assumptions. One of the assumptions is that district leaders believe that all students can benefit from the use of technology in instruction, as evidenced by their commitment of funds and other resources. Another assumption is that the teachers have enough pedagogical knowledge to create technology-infused lessons that will promote increased student outcomes. These assumptions were examined as part of the Context evaluation.

Limitations

The primary use of a CIPP evaluation is not for generalization to other settings or populations. However, it is worth noting that contextual limitations are inherent in the proposed study. Contextual limitations are related to the conditions surrounding the initiation and completion of an evaluation study (Locke, Spirduso, & Silverman, 2013). A contextual limitation to this research is that the study was performed within two relatively small schools in a single district in Northern New England. However, since the intent of the evaluation is not to generalize the data to a larger population, but to establish a protocol for evaluation, the results may still be helpful to other districts looking to analyze their programs.

Finally, this evaluation research study is relying on self-reported data. Self-reported data is limited by the fact that it rarely can be independently verified (Crandall, 1976). The majority of data, aside from the test scores and experience sampling, is comprised of what people say in interviews, focus groups, or on surveys. The observational data, along with achievement data and principal, student and parent survey data, will be triangulated; however, the context for this evaluation will not lend itself to generalization.

The Internal Evaluator

Because I am the evaluator as well as an administrator at the Auburn Village School, there is the need to disclose a potential conflict of interest. I feel that the involvement and feedback of many differing parties will reduce the potential for bias, and my relationship with the institutions will not serve as an impediment to my evaluation of the 1:1 programs. Stufflebeam (2007) believes that there is merit to internal evaluation. Internal evaluations tend to be quicker and better at providing immediate and direct feedback since the evaluator is well versed in the contextual knowledge. Internal evaluators tend to be lower cost and easier to procure than an outside professional evaluator. Since internal evaluators are invested in the success or direction of a program, they are committed to and own the recommendations. Hallam (2011) feels that using internal evaluators also brings the important benefit of retaining the experience and knowledge gained by those carrying out the evaluation. It is expensive to hire external evaluators to learn huge amounts about the organization, only for them to take away this knowledge when their work is completed. While internal evaluators can aid in facilitating improvement within an organization, an external evaluator may bring in expertise and experience in evaluation, as well as in technical areas. In some instances, they may be in a better position to act as facilitators between parties, as they are not part of existing power structures. Expert external evaluators can construct recommendations that will fit the culture and be amenable to the internal stakeholders. They can bring in a fresh perspective, and objectivity where it is needed (Hallam, 1998).

In the cases of Auburn Village School and Candia Moore School, it was more beneficial to utilize an internal evaluator because she has firsthand knowledge of both organizations' philosophies, policies, procedures, personnel and management. This allowed the selection and development of evaluation methods to be aligned with the organizations' philosophies and processes. According to Goldberg & Silfonis (1994, p. 237-8) an internal evaluator is able to respond quickly to monitor and address some of the schools' performance issues.

The CIPP model was designed for use in evaluations led by an organization's evaluators; alternatively, it can be used for self-evaluations conducted by project teams or individual service providers (Stufflebeam, 2003). The model was created to provide guidance to evaluators and stakeholders in posing relevant questions and conducting systematic inquiry at various stages of a program: at the beginning (context and input evaluation), while in progress (input and process evaluation), and once it has concluded (product evaluation). The most fundamental tenet of the CIPP model is "not to prove, but to improve" (Stufflebeam & Shrinkfield, 2007, p. 331). Thus, the use of an internal evaluation, and an internal evaluator, for this study is essential to provide information for decision makers relative to program improvement. The internal evaluation process helps to formalize the program processes and provide structure that will enable sustainability.

While bias must always be guarded against in an internal evaluation, this process reduced subjectivity due to the inclusion of all stakeholders in the evaluation. Furthermore, applying the American Evaluation Association (AEA) Program Evaluation

Standards and ethical guidelines so that the evaluator and stakeholders know them, subscribe to them, and practice them further reduced bias and increased credibility (Worthen, Fitzpatrick, and Sanders, 1997).

Significance of the Study

As Lei and Zhao (2005) concluded in their longitudinal study, *The Effect of Technology on Student Achievement*, the need to explore evaluation methods and instruments to appraise student learning with technology is strong. The process of judging the value of technology use in the classroom is complex and challenging. Higgins, Xiao and Katsipataki (2012) conducted a meta-analysis about the impact of the use of digital technology in schools on children's attainment and they found that a number of student learning outcomes are positively impacted by technology. Yet, these outcomes are varied and not consistently supported by empirical evidence. They concluded that there is no doubt that technology engages and motivates young people. However, this benefit is only an advantage for learning if the activity is effectively aligned with what is to be learned. It is key that the technology is conceptualized as a tool to be used to further curricular goals rather than as an end in itself.

Using evaluation results, school administrators can better understand how their program is working as well as the direction in which it is headed. Rather than focusing on increasing the number of devices within a school, administrators need to determine if technologies are used to support educational outcomes (Noeth & Volkov, 2004). With this greater understanding, they are better able to make decisions that will improve the program in the end. To begin an evaluation, it is vital to review the motives for why the program originated. Did the school do a needs assessment prior to purchasing the devices? Were devices are added to a classroom without consideration of curriculum design implications and the devices' use in a particular subject? (Cox & Marshall, 2007). By evaluating technology implementation in schools, the individual educational context can be considered. As part of this evaluation, pedagogical approaches and beliefs, teacher attitudes, infrastructure, leadership and lesson planning can be appraised as part of the complete implementation. True technology integration is not based upon the amount of technology, but how and why it is used. The basic presumption that technology enables a more student-centered classroom is not always the case in the actual application (Bebell & Burraston, 2014).

This study is important for several reasons. It is important that schools use an evaluation model in order to make continuous improvement in their programs. The creation of an evaluation model, as a result of this study, will allow administrators to more easily take on the evaluation of a program and contribute to the school's understanding of their program implementation and its effects. School data such as teacher surveys, student surveys, observational data and interviews with administrators and technology staff support the analysis of the program impacts. The outcomes of the analysis can help the districts and other educational policymakers to think about the importance of how districts measure and define the success of a program. When districts adopt an evaluation model, they accumulate evidence that supports their communication to vested parties such as school boards and budget committees. This knowledge enables them to convey the opportunities and effectiveness of their programs.

Scope

The evaluation study took place in the spring of 2016. The study consisted of two evaluations, both at kindergarten through grade eight (K-8) schools in Southern New Hampshire. Auburn Village School has an enrollment of 588 students and consists of primarily white middle class students. Candia Moore School is slightly smaller with 352 students and has a similar demographic makeup as Auburn Village School. Technology committees at both schools agreed that to increase access to devices, a 1:1 technology pilot would be implemented. Auburn Village School was in the first year of implementation in grade 6, while the Candia Moore School was in its second year of implementation in grades 7 and 8. The two schools had purchased Chromebook laptops that are limited to using Google Apps and web based applications. The students in Candia Moore School were able to bring their devices home, whereas, the devices in Auburn Village School were used only in school.

Definitions of Terms

Educational Technology: The study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources. (Association for Educational Communications and Technology, 2014)

Effective use of Technology and Effective Technology Integration: Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally. The technology should become an integral part of how the classroom functions -- as accessible as all other classroom tools. (ISTE, 2009)

Google Apps: Web-based applications from Google that includes e-mail, calendar, word processing, spreadsheet and presentations. (pcmag.com, 2015)

Conclusion

The 2016 National Education Technology Plan (NETP) maintains that the "conversation has shifted from whether technology should be used in learning to how it can improve learning to ensure that all students have access to high-quality educational experiences." (U.S. Department of Education, 2016, p. 9). The NETP (U.S. Department of Education, 2016) describes a digital use divide that separates many students who use technology in ways that transform their learning from those who use the tools to complete the same activities but now with an electronic device (e.g., digital worksheets, online multiple-choice tests). The plan urges schools to move students to the center of learning and empower them to take control of their own learning. According to the National Education Technology Plan (U.S. Department of Education, 2016), educators should be collaborators in learning, seeking new knowledge and constantly acquiring new skills alongside their students. The Partnership for 21st Century Learning Framework for 21st Century Learning (2011), cites that schools must "promote an understanding of academic content at much higher levels by weaving 21st century interdisciplinary themes into core subjects" (p.2). The idea of 21st century learning promotes a deeper understanding of information by conveying the ownership for that learning back to the student. The learner must break out of the dependent role and become the owner of his or her own learning. Recommendations, such as these, have driven many school districts, such as my own, to move toward 1:1 laptop programs. Still, the overall goal of any technology deployment should not be merely to make technology available to students and teachers, but also to ensure it is used properly (McLeod, & Richardson, 2013). This underscores the need to assess how effectively the technology itself is applied as well as how successfully it is being used in the classroom to enhance student learning.

Program evaluation provides a feedback loop that allows leaders to examine an initiative. It can help administrators focus on areas of strength and weakness that need to be addressed. This study of two programs in different phases of implementation contributed to decision making within the districts. It provided feedback on implementation fidelity and is helping teachers and staff ensure that their strategies are effective and aligned with program objectives. The overarching goal of this evaluation research was to develop a feasible evaluation model that would provide other administrators the ability to assess 1:1 programs within their schools. The resulting model, Essential Embedded Evaluation Model (EEEM), can be used by principals who need feedback on their technology implementations.

CHAPTER 2

REVIEW OF LITERATURE

In the constructivist classroom, the focus tends to shift from the teacher to the students. The classroom is no longer a place where the teacher ("expert") pours knowledge into passive students, who wait like empty vessels to be filled (Bruner, 1996). In the constructivist model, the students are urged to be actively involved in their own process of learning. The teacher supports the learner by means of suggestions that arise out of ordinary activities, by challenges that inspire creativity, and with projects that allow for independent thinking and new ways of learning information. Students work in groups to approach problems and challenges in real world situations, this in turn leads to the creation of practical solutions and a diverse variety of student products (Ozer, 2004). Constructivist theories have become more popular with the increase of technology in the classroom as well as at home. Technology provides individual students with tools to construct their own learning at their own pace (Martinez & Stager, 2013). The student can now conduct research, collaborate with others, converse with experts, and share their ideas using the web. Instead of a test, the student assessment tool is a product that has been designed by the learner.

Jean Piaget and Lev Vygotsky are two prominent figures in the development of constructivist theories. They share the belief that the classroom should be a constructivist environment, however, they differ in their views of the way it should be implemented in the classroom (Ozer, 2004). Piaget's developmental theory of learning and constructivism is based upon discovery. According to his constructivist theory, an ideal learning environment consists of students being allowed to build knowledge that is important to them. Vygotsky (1987) shared many of Piaget's (1936) assumptions about how children learn, but he placed more emphasis on the stages of development to get to that knowledge. In Vygotsky's theory, both teachers and older or more experienced children play very important roles in learning. A greater emphasis is placed on learning through social interaction, as well as the value placed on cultural background.

Both Piaget and Vygotsky appreciated the principle of building constructs and internalizing the knowledge given, rather than accepting the information as presented through rote-memory. In an effective technology integration model, the computer provides individual students with tools to experiment and build their own learning and the Internet provides the social context and information access that gives the child the cognitive tools needed for development. Both theorists have been integral for educators who are looking to design meaningful learning activities and educational technology projects where knowledge is constructed, not transmitted, and the students' show their learning through different forms, not just written tests. This use of technology gives students a chance to collaborate and interact with one another, which is essential for the activities that provide new information to build the child's schemata.

During the fall of 2014, over 431,231 K-12 students participated in the 12th annual Speak Up online surveys facilitated by the national education nonprofit organization, Project Tomorrow (2015). Almost three-quarters of students with school-provided devices, as well as students with limited or non-existent technology access at school, agreed that every student should be able to use a mobile device during the school day to facilitate learning (Project Tomorrow, 2015). Wireless and mobile devices currently provide students with personalized access to numerous learning tools, resources, and content while in school or at home. The National Technology Plan (U.S. Department of Education, 2016) encourages schools to instill academic rigor in the school curriculum, and at the same time, provide students with the workforce skills they need to compete in a global economy that is increasingly driven by technological tools. Even students report that they connect the use of technology tools to the development of college, career, and citizenship skills that will empower their future capabilities (Project Tomorrow, 2015).

As schools and students rely more on laptops and mobile devices, it is crucial to determine when students benefit from the use of computers and when other methods are more beneficial. The evidence of the effect of educational technologies on student outcomes is inconclusive, as there is no single research study that can address the general question of whether technology produces improved student outcomes (Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011). According to Tamim et al. (2011), since the late 1960's, there have been literally thousands of comparisons between computing and technology free classrooms from kindergarten to graduate school. Each study focused on a specific technological issue addressing different attributes such as subject matter, grade level, and type of technology. Since 1980, the literature reveals that over 60 meta-analyses have been generated to attempt to answer the overarching question of the overall impact of technology on student achievement. No single analysis is capable of answering this question (Tamim et al., 2011). Thus, Tamim et al. (2011) employed a second-order approach to meta-analysis of these studies in order to synthesize the research results that could answer the question of the impact of technology use on students' performance as compared to student performance in the absence of technology. Tamim et al. (2011)

anticipated that the study would lay the groundwork for new forms of quantitative research that investigates advantages or disadvantages of more or less technology use or functions of technology such as interactive tools or computer aided review. For his study, the researchers reviewed 429 document abstracts of which 146 were reviewed as full-text.

Results from the second-order meta-analysis indicate that the average student in a classroom where technology is used will perform 12 percentile points higher as compared to the average student in a traditional setting that does not use technology to enhance the learning process. The findings as stated by Tamim et al. (2011) showed, "The synthesis of the extracted effect sizes, with the support of the validation process, revealed a significant positive small to moderate effect size favoring the utilization of technology in the experimental condition over more traditional instruction (i.e. technology free) in the control group"(p.16). However, Tamim et al. (2011) warn that the results should be interpreted carefully because of the wide variability that surrounds it. Consequently, instruction, pedagogy, teacher effectiveness, subject matter, age level, and possibly other factors may influence outcomes more than the technology intervention.

Tamim et al.'s study (2011) also supports the findings of Ross, Morrison & Lowther (2010) that "educational technology is not a homogeneous 'intervention' but a broad variety of modalities, tools, and strategies for learning. Its effectiveness, therefore, depends on how well it helps teachers and students achieve the desired instructional goals" (p.19). Both sets of researchers concluded that evaluation of educational technology over the past few decades addresses varied types of technology interventions with countless student outcomes and has incorporated a variety of designs, ranging from qualitative-descriptive to randomized experiments. The studies isolate the need for continued basic research on cognition and learning using technology (e.g., Azevedo & Cromley, 2004; Azevedo, Cuthrie, & Seibert, 2004) as well as formative evaluation and design-based research (Morrison et al., 2010; Richey & Klein, 2008; van den Akker, & Kuiper, 2008) to develop and refine technology products (Ross, Morrison & Lowther, 2010).

It is inferred from the meta-analyses completed by Ross et al. (2010) and Tamim et al. (2011) that simply providing access to technology does not ensure that technology will effectively enhance teaching and learning, and, therefore, result in improved achievement. Nor does providing access suggest that all teachers and students will make optimal use of the technology. Technology may mean little without appropriate objectives and goals for its use, structures for its application, trained and skillful deliverers, and clearly envisioned plans for evaluating its effectiveness (Noeth & Volkov, 2004).

Statistics supporting the benefits of technology in the educational process continue to mount, but carry important conditions such as the student outcomes that are measured, and the type and implementation of technology tools that teachers utilize. Technology is an integral part of our educational system, and it is a formidable task to isolate the effects of technology from the impact of other factors that influence teaching and learning. As our policy leaders continue to promote the development of 21st century learning environments (U.S. Department of Education, 2016) the goal is to use technology to allow students to engage in the learning in their own way. Increasingly powerful and more accessible web-based tools have put tools for interpretation and knowledge creation in the hands of learners of all ages and abilities. Word processing and desktop publishing, databases and spreadsheets, digital photography and art applications, multimedia and Web-authoring programs have greatly enhanced students' potential for expression. These computer-based tools have tapped into students' multiple intelligences, and enabled those with aptitude in visual learning, for example, to demonstrate knowledge creation more effectively. The research has shown that technology has had an effect on a number of student outcomes over the last decade. The ability to make meaningful connections with information and knowledgeable experts complements the constructivist theories of Vygotsky and Piaget. Yet, the research has not delivered conclusive evidence that there is one specific outcome that improves with the use of technology. Researchers have identified links between technology and factors that lead to high achievement, including improved student behavior, engagement and attendance; improved opportunities for educator professional development; increased efficiency in classroom administrative tasks; and improved communication among stakeholders, including parents, teachers, students and administrators (Tamim et al., 2011). My review of research uncovered ample evidence from the last 10 years that particular technologies can enhance certain student outcomes; however, within the review of literature there were no reports of any student outcomes that had declined due to the use of technology.

Student Outcomes

The impact of the use of technology on student outcomes is a very relevant concern to school administrators, local government officials, and educational policymakers. The high cost of technology and the pressure of standardized testing have forced the need for more rigorous evidence that education funding is increasing student achievement (Grinager, 2006). This review of research identifies specific student outcomes and the impact of the integration of specific technologies. The literature review examined student attendance, discipline, achievement, and engagement. These are the primary outcomes that have been studied over the last ten years of educational technology research.

Attendance

Successful schools hire creative teachers and offer a challenging, engaging curriculum infused with innovative technological tools in an attempt at increasing school attendance. Students who attend school regularly have higher grades than those students with high absence rates (Redick & Nicoll, 1990). "One crucial element of a child's success in school is school attendance (Atkinson, 1998, p.12). When student non-attendance increases, there is a corresponding decrease in student achievement (Herberling & Shaffer, 1995). Though there are few research studies that have directly focused on technology's impact on student attendance, this student outcome has emerged as a secondary factor in a number of research reports. In 2004, D. Silvernail and D. Lane prepared the *Phase One Summary of Evidence Report on The Impact of Maine's One-to-One Laptop Program on Middle School Teachers and Students*. The report revealed anecdotal data that pointed to the positive impact of laptops in terms of student attendance. Approximately 30 to 40% of the principals reported that the laptop program had a positive impact on student attendance. One principal interview in the winter of 2003 revealed: "I think it's going to have a positive impact on student learning. We've noticed for instance those students that had attendance problems in the past. They don't appear to have attendance problems now" (p. 27). Unfortunately, the Maine Laptop initiative research has not published any current reports; therefore, there is no data to determine if this trend endured.

Findings regarding the improvement of student attendance with an increase in technology use are mixed. Of the five studies found, Wesley Fryer (2004) was the only researcher who attempted to directly address, with a limited data set, whether rates of student attendance are higher within a technologically immersed school environment in his publication, *Assessing the Impact of One to One Technology Immersion on Student Attendance: Chasing Shadows or the Panacea for Educational Reform?* Fryer (2004) reviewed student attendance rates of one of the twenty-two immersion campuses participating in the 2004-2006 statewide Technology Immersion Pilot (TIP) project in Texas. The results of the study indicated that the immersion school did not have a significant increase in student attendance. Fryer (2004), though, reasoned that this new program may have had an impact, but it was constrained because students likely had insufficient time with the unfamiliar technology when the study occurred. Further analysis in 2009 by Shapley, Sheehan, Maloney, & Caranikas-Walker unexpectedly found that students at the laptop schools attended school less regularly than the control students across the first three years. For Cohort 1 students, school attendance rates declined across years, and by the end of seventh grade, the estimated average attendance rate for economically-advantaged immersion students was 95.9% compared to 96.4% for control students (rates were lower for disadvantaged students). Results for Cohort 2 students, similarly, showed statistically significant but small differences in attendance rates favoring students in control schools (ES = 0.07). Nonetheless, contrary to what might be expected, immersion students' lower attendance rates were not associated with lower academic achievement (Shapley et al., 2009).

In a second year Evaluation Report of the Beaufort County School District, South Carolina, 1998, Stevenson (1998) performed an additional analysis focused on the relationship of school attendance and participation in the laptop project. Stevenson (1998) reported a positive relationship between laptop computer usage and academic achievement using standardized test scores during the middle school years, versus students not using laptops who tended to decline during this same period. This may be due to the fact that participation in the laptop project was associated with fewer days absent and fewer tardy arrivals. Students with laptops attended school more regularly and scored better on achievement tests.

In 2008, more than 13,000 students in 28 high schools in North Carolina participated in one-to-one initiatives. Schools implementing initiatives varied in size, location, and income-level (Corn, 2009). North Carolina high schools experienced a drop in student withdrawals the first year the laptops were introduced; however, this trend did not persist in the second year of implementation (Corn, 2009). Analysis of attendance data showed overall high rates of attendance at each of the 1:1 pilot high schools and comparison schools for two years. Student attendance rates across 1:1 schools and their comparisons for the 2006-07 and 2007-08 school years were all above 90% and remained virtually unchanged over the two-year period.

Overall, the review of attendance outcomes in technology-rich schools is inconclusive. Two reports, Beaufort South Carolina and Maine Laptop Initiative, support the claim that technology may positively influence student attendance, while the other two Texas Immersion Schools and North Carolina high schools report a decline or no differences in student attendance. One challenge to the Maine Laptop Initiative Schools' report on increased attendance was that it was substantiated through anecdotal data and not actual attendance data. The principals and teachers reported during the interview process that they believed that attendance improved because of the use of technology in the classroom (Silvernail & Lane, 2004). For that reason, the claim that data cannot support student attendance being positively affected by technology is strengthened.

Discipline

Results regarding the impact of the technology initiatives on discipline are mixed. Maine teachers and principals reported that laptops had a positive impact on student behavior (Silvernail & Lane, 2004). Approximately 30 to 40% of the principals reported anecdotally through surveys that the laptop program had a positive impact on student behavior. Maine teachers also reported via surveys that students were more collaborative and eager to help one another (Silvernail & Lane, 2004). In the Final Outcomes of the Four-Year Study of the Texas Technology Immersion Pilot, Shapley et al. (2009) collected student-level data from schools on disciplinary actions occurring during the 2007-08 school year. Overall, results for all four years of the study indicate that students attending Technology Immersion schools have fewer disciplinary referrals than their counterparts do in control schools.

On the other hand, the Henrico County, Virginia's Public School's Laptop Initiative, which was evaluated from 2005-2008, did not have any effect on student behavior. The evaluation used surveys from teachers and administrators over the three-year period to evaluate the student outcomes. Teachers reported that the technology did not make a difference in behavior, and they had difficulty enforcing the district's acceptable use policy. Administrators also did not believe that laptops had a positive impact on behavior and, in fact, the survey data and focus group data suggested that administrators believed that the laptops distracted students from direct instruction (Mann, 2008).

Having fewer disciplinary actions per student may have important practical benefits in terms of student learning. The present knowledge base cannot support a strong argument that laptop implementation contributes to a decline in school-wide discipline problems.

Achievement

Student achievement is one of the most critical outcomes studied in conjunction with technology programs. In general, teachers and students in districts that implement technology believe that the use of technology positively influences student achievement (Holcomb, 2009). Tamim et al. (2011) found that technology is more impactful when used to support instruction rather than provide direct instruction. These researchers maintain that there is a variety of ways to use technology. Some instructional methods might use technology to replace rote instruction, utilizing the tools for traditional drill and kill exercises. Other instruction strategies harness technology's potential to capture student interest, individualize instruction, and connect students to learning beyond classroom walls (Tamim, 2011). Despite the dramatic differences in resources and abilities from classroom to classroom, school to school, and district to district, technology can make an impact if it is used in ways that can impact engagement and learning for all students.

Lei and Zhao (2007) address two major issues concerning technology use in schools. The first issue involves the quantity of technology use or ‘how much’ technology is used and why. The second is the quality of technology or “how” technology is used. This suggests a link between student achievement and pedagogy and methodology. The researchers collected data through surveys, interviews and student grade point averages (GPA) for one year in middle schools across the state of Ohio. The results illustrated that when students increased computer time up to a threshold of three hours per day, their GPA’s improved. However, students who spent more than 3 hours a day on computers were likely to experience a lower GPA. The results suggest that although the amount of time spent on computers has a general positive effect on student academic achievement, this effect may depend on how they spent their time, with which specific technology, and on which activities. (Lei & Zhao, 2007). Unfortunately, the research results from this study have some limitations. Other factors such as socioeconomic, teacher quality, class size and other resources were not controlled, hence making it impossible to determine if technology was the sole contributor to the GPA improvement. The review that follows identifies the impact of technology on students’ achievement or performance in different academic disciplines including mathematics, reading, writing and science.

Mathematics. In one of the first studies of how technology is used in the classroom, Wenglinsky (1998) performed a statistical analysis of the relationship between technology, academic achievement in mathematics, and other educational outcomes. He found that the usefulness of technology depends upon how the technology is used; some uses are positively related to academic achievement and other educational outcomes, while others are not. Nevertheless, in 1999, Mann, Shakeshaft, Becker, & Kottkamp suggest that a Basic Skills/Computer Education program in West Virginia made a major impact on student achievement in math as well as reading and language arts skills. The program entailed a statewide approach that provided intensive professional development along with the installation of standardized hardware and software. The study attributes eleven percent of West Virginia's increase in mathematics and language arts scores on the NAEP (National Assessment of Educational Progress) assessment to the computer interventions. This study was a landmark study that evaluated a long-term statewide learning technology program. The integration of the technology into the instructional program, rather than the isolation of computer skills, contributed to the success of the program. The report also revealed the importance of timely and comprehensive teacher training as another key factor in the success of West Virginia's technology program (Mann, Shakeshaft, Becker, & Kottkamp, 1999).

Along the same lines, in 2008, the Maine Learning Technology Initiative (MLTI) schools participated in a study that addressed a statewide concern that Maine 8th grade students were failing to achieve high levels of proficiency in mathematics. Based on the results of their previous laptop research, Silvernail (2008) hypothesized that changes were needed both in teachers' content knowledge and pedagogical practices, and that combining these with effective use of the laptop technology would lead to improved student mathematics performance (Silvernail, 2008). Results of the experimental study revealed that this type of professional development was effective in changing teaching and technology practices, which in turn led to improved student performance on standardized mathematics tests. Again, the professional development and focus on best practices in teaching may have had an impact on the math scores without the technology. The knowledgebase inadequately supports the theory that technology alone can contribute to increased student achievement. Because of the MILTI research, Silvernail (2008) also accentuates the importance of maintaining high levels of implementation fidelity to achieve improved student performance.

All three research studies emphasize the importance of strong, sustained professional development as a fundamental part of a successful laptop program. The researchers in all three cases suggest that there is a clear link between professional development, the integration of laptop technology into classroom instruction, and student achievement in mathematics.

Writing. Researchers have agreed that the most significant use for technology was the use of word processing software, and language arts was the most frequent subject area of technology activities (Lei & Zhao, 2007). There is just one study, the MLTI evaluation, which utilized standardized writing scores to illustrate that writing improved for eighth grade students that had been issued a laptop. Eighth grade Maine Educational Assessment (MEA) writing scores were examined during two time periods: for 2000, a year prior to implementation of the statewide laptop program, and for 2005, five years after the initial implementation of the program. They reported the 2005 average writing scale score was 3.4 points higher than it was in 2000: “This difference represents an Effect Size of .32, indicating improvement in writing performance of approximately 1/3 of a standard deviation. Thus, an average student in 2005 scored better than approximately two thirds of all students in 2000” (Silvernail & Gritter, 2007, p. i). This result weakly demonstrates that laptop computer use positively correlates with an increase in writing achievement.

In the Year 3 Final Report of the Walled Lake Consolidated Schools Laptop Program in Michigan, Ross, Lowther, Wilson-Relyea, Wang, & Morrision (2003) discovered via teacher surveys, that the laptops helped to improve student writing and research skills, students' overall performance and grades, and the ability to work with other students. Teachers in the laptop program felt that laptop students were doing more sustained writing in class and were demonstrating more skill in writing. Ross et al. (2003) further investigate student achievement in terms of writing performance on a prompted essay. The researchers scored the student work using a four-point rubric and compared students in a laptop program versus those in a traditional writing class. The results significantly favored the laptop group on all evaluation dimensions: organization, ideas, style, and conventions. Ross et al. (2003) suggest that "students with continuous access to laptops have advantages over those who only use laptops during class, and even a greater advantage over students in classrooms limited to 5 or more computers to be shared by all students" (p. 10).

Lending support to the evidence that technology does improve writing achievement, Goldberg, Russell, & Cook (2002) performed a meta-analysis of 26 studies conducted between 1992 and 2002. The studies focused on the comparison between K-12 students' writing with computers versus paper and pencil. These results indicate that the writing process generally becomes more collaborative and the students tend to make revisions while writing in computer classrooms as compared to paper-and-pencil environments. Overall, the results of the meta-analyses suggest that, on average, students who use computers when learning to write are not only more engaged and motivated in their writing, but they produce written work that is of greater length and higher quality. Interestingly, the study also revealed that the effect of writing with computers on both the quality and quantity of writing was larger for middle and high school students than for elementary school students (Goldberg, Russell, & Cook, 2002).

However, unlike Goldberg, Russell, & Cooks' (2002) meta-analysis and the evaluations in Maine and Michigan, the evaluation of Henrico County's Teaching and Learning Initiative presented mixed results concerning writing. A significant positive relationship surfaced between writing scores and computer use during the first year, but the relationship was significantly negative during the second and third years. The researchers attributed the negative relationship between writing scores and laptop use to the fact that teachers may be reluctant to use laptops since students take a paper-based writing test. By the end of the third year, feedback from teachers and administrators from the Henrico laptop program concluded that they believed the laptops made a difference in bridging the performance gap for students (Mann, 2008).

Overall achievement. In general, participating teachers believe the use of laptops positively influences student achievement. Specifically, in feedback from the Michigan laptop program, teachers reported that laptops increased student learning (Ross et al., 2007), while in Texas, teachers observed improved quality of students' products (Shapley et al., 2008). Most of the research reviewed ascertained the level of student achievement through teacher, student, and administrator surveys. A minimal number of studies showed increased achievement when analyzing data from standardized test scores. One study using MLTI data did support increased achievement using standardized test scores.

Muir, Knezek, and Christensen (2004) analyzed three years of standardized achievement data for eighth grade students who took the 2002 and 2003 Maine Educational Assessments (MEA) and participated in one of the nine laptop schools that implemented the initiative ahead of the other 214 middle schools. Results indicated that students' writing had improved. In mathematics, there was evidence that well-designed and executed teacher professional development training resulted in improved student performance in mathematics. A science study also found significant gains in student achievement and content retention when students used their laptops to demonstrate science learning. The analysis also indicated that students from the laptop schools had gained the equivalent of two extra months of achievement in these subjects.

One empirical study reported no difference in student achievement when researchers evaluated student outcomes such as standardized tests and GPAs. With the original goal of immersing middle schools in technology to increase students' academic achievement as measured by state assessments, the Texas laptop program produced lackluster results (Shapley, 2010). After four years of solid research of student laptop usage in Texas, results demonstrated no statistically significant outcomes on the state assessment, Texas Assessment of Knowledge and Skills, also known as TAKS (Shapley et al., 2009). However, they did uncover differences in achievement in schools where technology integration was strong. Shapley et al (2009) investigated the relationships between technology implementation levels and student academic achievement. The technology implementation strength was consistently a positive predictor of students' TAK reading and mathematical scores. Their results illustrated the importance of the implementation of technology from school-to-school and from classroom-to classroom.

The findings acknowledged “teachers at a school who shared understandings about the use of technology for learning and were supportive of technology integration, created stronger implementation at both the classroom and student levels (p. 44).” Further research has also proven that using technology as an instructional tool can enhance student learning and educational outcomes specifically after more than a year in a laptop program.

Gulek & Demirtas (2005) examined a sixth grade laptop program at Harvest Park Middle School in California. The data collection measures included GPAs, district writing assessment scores, California Standardized Testing and Reporting (STAR) Program, norm-referenced test scores (California Achievement Test Survey Form Sixth Edition), and criterion-referenced test scores from the STAR California Standards Tests. The goals of the study included determining whether the program had an impact on students’ grade point averages, students’ end-of-course grades, students’ essay writing skills, and students’ standardized test scores (Gulek & Demirtas, 2005). A baseline measurement showed no difference in English language arts, mathematics, writing, and overall grade point average achievement between laptop and non-laptop students prior to enrollment in the program. However, laptop students showed significantly higher achievement in nearly all measures after one year in the program. For example, Gulek, & Demirtas (2005) revealed that a substantially higher percentage of laptop students (95% in Grade 6; 91% in Grade 8) met or exceeded grade level expectations in writing compared to Harvest Park school-wide averages (84% in Grade 6; 83% in grade 8) and district-wide averages (81% in Grade 6; 84% in grade 8). In addition, Gulek, & Demirtas (2005) found that a substantially higher percentage of laptop students (95% in Grade 6;

91% in grade 8) met or exceeded grade level expectations in writing compared to Harvest Park school-wide averages (84% in Grade 6; 83% in Grade 8) and district-wide averages (81% in Grade 6; 84% in Grade 8).

In conclusion, there are no strong correlations between student achievement in certain discipline areas and technology utilization. As Lei and Zhao (2007) acknowledge in their study, *Technology Uses and Student Achievement*, the type of technology and how it is used are both important criteria in evaluation. They also conclude that determining which technology uses are popular among students and which technology uses are effective for increasing student academic achievement are the most important criteria to evaluate. Results suggest that the quantity of technology use alone is not critical to student learning, and additional research needs to be conducted to identify which technology uses are most educationally meaningful (p. 285). Lei and Zhao (2007) maintain that it is also important to determine which positive impact technology uses are popular. Some of the more popular uses of technology included using word-processing software for writing and taking notes, and research using the Internet. The more unpopular uses of technology included using science probes and automated tutor-type software for math. Technology uses that have a positive impact may not be the most popular among students; in fact, they may be the least frequently used (p. 294).

Some, but not all, of the researchers found an association between technology use and increased student achievement. However, there is a common theme summarized by Shapley et al. (2009). They maintain that:

> Effective technology integration involved much more than just buying laptops for students. Technology immersion requires a comprehensive approach that

> transforms the school culture, changes the nature of teaching and learning, and expands the educational boundaries of the school and classrooms. This study confirms that fundamental school change is difficult and requires a long-term commitment at all levels of the school system: board members, superintendent, principals, teachers, students, and parents. (p. 51)

Engagement and Motivation

Researchers, educators, and policymakers often focus on student engagement as an important factor in addressing problems of low achievement, student boredom, and high dropout rates (Fredricks, Blumenfeld, and Paris 2004). In evaluating the effectiveness of technology in schools, one challenge researchers confront is how to measure engagement. Most often, the methodology employed is a student interview or self-report. Student self-reports are measures in which students respond to items using specified response formats such as strongly agree to strongly disagree. In addition to student reports, the researchers will utilize teacher reports that are scores assigned to students based on teacher responses to a set of items using a specified response format such as very true of student to not true of student (Fredricks, McColskey, Meli, Mordica, Montrosse, & Mooney, 2011). At times, researchers will observe targeted student behaviors to measure the outcome of engagement.

In a recent national study, a majority of both middle and high school students report that using technology in their classes increases their interest and engagement in what they are learning (Project Tomorrow, 2015). Project Tomorrow’s (2015) survey results characterize today’s students as deeply interested in learning.

> While they may not always be interested in typical classroom instruction, they are very engaged when learning mirrors the holy trinity of the student vision for a 21st century educational experience: learning that is socially-based and collaborative, learning that is untethered from the traditional constraints or limitations of education institutions, and learning that is digitally rich in context and relevancy (p.16).

Multiple studies and reviews reveal teachers and students generally agree that laptops increase student engagement. Evaluators of Maine's MLTI project reported that students were more engaged and more actively involved in their own learning (Lane, 2003; Silvernail & Lane, 2004). Maine students also conveyed that the technology led to "an increase in their school work and an increase in the amount of work they are doing both in and out of school" (Silvernail & Harris, 2003, p.ii). A study by Berry and Wintle (2009) concluded that even though Maine students found a technology-centered project to be more challenging and time consuming than a traditional one, they all felt the technology projects were more enjoyable and appealing.

In Florida, the Department of Education provided about 20,000 students with laptops as part of the US Department of Education's 2006 Title II-D Program. During this time, evaluators Cavanaugh, Dawson, & White (2006) assessed the project based upon goals set by each individual district but centered upon student achievement related to classroom use of laptop computers. The researchers observed significant increases in student attention and engagement (Dawson, Cavanaugh, & Ritzhaupt, 2008). They also reported that more than half of the teachers' focus group interviews documented an increase in enjoyment, motivation, engagement, and on-task behavior (Dawson et al., 2008).

Evaluators of the Texas laptop program found that teachers believed that the technology increased student engagement (Shapley et al., 2008). North Carolina teachers also felt that technology enhanced student engagement, though they noted that it could also be a distraction during class (Corn, 2009).

Overall, there is strong support for 1:1 technology initiatives contributing to enhanced engagement and motivation. There is evidence in this literature review that technology initiatives improve students' attitudes toward technology, subject matter, and teacher-student relationships. Technology-rich projects that lend themselves well to interaction with other students and problem-solving strategies have an impact on student enthusiasm. In a large study conducted by Gulek and Demirtas (2005), it was reported that laptop students spent more time engaged in collaborative and project-based instruction than did non-laptop students. The research reveals that in terms of student outcomes, technology integration across the country has been consistent and successful in increasing at least one student outcome, student engagement and motivation.

Communication and Home School Relations

As a result of No Child Left Behind (NCLB, 2002), schools became more aware of which educational programs and practices have been proven effective through research. NCLB (2002) highlighted the need for schools to get parents more involved in their children's education and in improving the school. The research has shown that communication plays an important role in the type and quality of parent/community involvement. In fact, evidence suggests there is a positive relationship between family and community involvement and improved academic achievement, including higher grade point averages and standardized test scores (McNeal, 2014).

The majority of studies analyzed in this literature review did not address the direct implication of technology use and its effect on home school relations. Only one study, Penuel, Kim, Michalchik, Lewis, Means, Murphy, Korbak, Whaley & Allen's (2002) *Using Technology to Enhance Connections Between Home and School*, synthesized research on the effectiveness of programs that use technology to improve links between home and school, with the aim of guiding future evaluation and policy. The specific contribution of technology is difficult to measure because many of the programs studied that used technology to link home and school were embedded within larger school reform efforts. Just seven studies reported any data on parent outcomes, and only two had enough data to compute the magnitude of the effect of programs. The most frequently used source of data about parents originated from self-report surveys about parent perceptions, usually administered at one point toward the end of the program or school year.

The results of a meta-synthesis by Sell, Cornelius-White, Chang, Mclean, & Roworth, (2012) showed the highest positive associations between technology and home school connection were found embedded within larger reform initiatives. The results of the synthesis revealed that schools with a strong commitment to the technology effort were more effective in building a strong link between home and school. The study also claimed that in order to understand the impact more thoroughly; additional studies need to be conducted that examine the broad impact these programs might have on parent-teacher and parent-child relationships. One area of interest suggests the importance of engaging parents in order to realize higher-quality student usage, particularly the use of 1:1 technology to enhance student exploration and self-expression.

A number of studies, including the Ross et al. (2010) evaluation of the Walled Lake Consolidated Schools, highlighted that the teachers felt the laptop program not only increased the frequency of project based learning and higher order learning, but also increased school-related interactions with parents and students.

The Maine Learning Technology Initiative invested resources in parent information sessions, parent training sessions and code of conduct communication material (Silvernail & Lane, 2004). Results from the evaluation claimed teachers believed parent and home school communication increased. Much of this increase was attributable to the expectation that parents attend 90-minute training before the laptops were allowed to go home (Silvernail & Lane, 2004).

Summary

All of the studies, included in the literature, employed an evaluation that was summative in nature. No evidence was found that supported evaluations grounded in the improvement/accountability approaches. Because of the summative nature of these studies, the majority of them did not collect data that would support program improvement. The reports focused upon the appraisal of the viability of the programs based upon student and teacher outcomes (Figure 2.1). Actually, there was no established model of evaluation employed in any of these studies. The absence of the utilization of a framework emphasizes the need for a standardized process that can help organizations better understand their program and implement changes for improvement. The development and use of an effective, but straightforward evaluation approach can help educational institutions understand a program's intended outcomes or promote an analysis of the program's efficiency and cost-effectiveness.

Figure 2.1. Most recent significant district laptop evaluation studies.

Researchers	Location	Year	Type/Evaluation Model	Focus
Silvernail-USM	Maine	2009	Summative/No Model	Use technology to improve teaching practices
Cavanaugh	Florida	2009	Summative/Mixed method approaches, no model employed	Develop effective model for enhancing student achievement through integration of laptop as a tool for teaching and learning
Corn	North Carolina	2009	Summative/Mixed method approaches, no model employed	Use technology to improve teaching practices
Peck	Pennsylvania	2007	Summative/Mixed method approaches, no model employed	Transform high schools into future ready environments
Lowther	Michigan	2007	Summative/Mixed method approaches, no model employed	Goal: to improve student achievement
Shapley	Texas	2003	Summative/Mixed method approaches, no model employed	Immerse schools in technology to integrate into teaching
Mann	Virginia	2001	Summative/Mixed method approaches, no model employed	Close digital divide, reduce dependence on textbooks

In the current climate of increasing accountability and decreasing budgets, student outcomes outweigh many other factors; however, without a sound implementation with researched-based instructional strategies, technology will not thrive (U.S. Department of Education, 2016). With the substantial capital outlay necessitated by these technology programs, policymakers and administrators are taking a closer look at the success of technology and laptop programs. It is important to appraise whether learning with laptops is a viable and effective way to improve learning and instruction. Silvernail

(2011) identified a strong correlation between teachers classifying themselves as constructivists and their frequency of technology use. In addition, Silvernail (2011) also found that the use of laptops appeared to have helped some teachers shift their teaching philosophy to more student centered or constructivist. What is unclear is how and why this happened. Silvernail (2011) suggests further exploration into this teaching philosophy shift.

Summarizing my review of the available literature, there is a mixed review of positive outcomes for the use of technology, the most compelling being the increase in student engagement. Because of the lack of hard data on the efficacy of technology programs, it is important for educational systems to develop and identify metrics that are pertinent in evaluating the effectiveness of certain technologies.

The former National Education Technology Plan (U.S. Department of Education, 2010, p.9) urges our education system at all levels to:

- Be clear about the outcomes we seek.
- Collaborate to redesign structures and processes for effectiveness, efficiency, and flexibility.
- Continually monitor and measure our performance.
- Hold ourselves accountable for progress and results every step of the way

The NETP (U.S. Department of Education, 2010) outlines five goals and recommendations that support transforming education in America using technology. The goals that address the key components of the plan are learning, assessment, teaching, infrastructure, and productivity. As part of the last goal, the NETP (U.S. Department of Education, 2010) recommends districts develop useful metrics that go “beyond the number of computers and Internet connections and move toward gathering data on how technology is actually used to support teaching, learning, and assessment" (p. 16). Districts must be clear about the outcomes they seek and evaluate programs for effectiveness, efficiency, and flexibility, and be willing to design and implement new procedures where needed. In line with NETP (U.S. Department of Education, 2010), the new, updated NETP (U.S. Department of Education, 2016) emphasizes that districts must hold themselves accountable.

Uses of Program Evaluation

The NETP's (U.S. Department of Education, 2016) recommendations include systematic evaluation and redesign to monitor and measure the performance of technology programs in schools. If schools embrace continuous improvement, they must invest the effort needed to evaluate educational practices over time. Program evaluation can be useful in a number of circumstances, including facilitating a concrete understanding of a program's intended outcome or promoting analysis of the program's efficiency and cost effectiveness (Wang, 2010). According to Wang (2010), "program evaluations have expanded to encompass more complex issues….they are increasingly utilized for making program decisions that relate to effectiveness, efficiency, value, and adequacy based upon a variety of collections and analyses" (p. 130). In addition, McNamara (2000) contends that program evaluations, sometimes implemented differently, must provide a basis for valid comparisons between similar programs. Thus, program evaluations can also contribute to extending knowledge and inform future decision-making.

Program evaluation can assess the performance of a program at all stages of a program's development. There are many types of evaluative measures contingent on the objective(s) being measured as well as the purpose of the evaluation (Fitzpatrick, et al., 2011). The purpose of the program evaluation determines which type of evaluation is needed. The evaluator will determine the most appropriate type of evaluation (McNamara, 2000; Wang, 2010).

The primary purpose of evaluation is to help stakeholders make a judgment or decision about what is being evaluated. In the case of a laptop program, it is important for the stakeholders such as the school board, taxpayers, and district administration to determine if the cost, training, and efforts of the program are producing the intended student outcomes. The sustainability of the project is dependent upon the cost and the impact the program yields (Stufflebeam & Shinkfield, 2007). As already discussed, many of the major technology initiatives across the country have delivered a number of diverse outcomes (Cornelius-White, et al., 2012). Zucker (2004) claims that the 1:1 initiatives are too intertwined and complex to evaluate using only student outcomes. As a result, he proposes that evaluation include several mediating factors for 1:1 technology instruction including leadership, infrastructure and support, culture, and funding. He proposes that evaluation frameworks focus on critical features of 1:1 initiatives (e.g., the technology used), interactions and intermediate outcomes (e.g., impacts on teaching and instruction), and ultimate outcomes (e.g., impacts on students and their learning). Zucker (2004) observed that reviews of research on 1:1 computing provide "soft" evidence and have not provided policymakers with enough hard evidence of the benefits and costs of 1:1 computing to help them determine if the initiatives are worth what they cost. Zucker

(2004) suggests that following a “model” for future evaluation research, with its added variables and multiple interactions, more closely reflects the range of challenges for successful 1:1 technology initiatives in K-12 education. Notably, Cornelius-White, et al. (2012) also propose that a systematic framework can serve as a tool for inventorying what is known and not known about the 1:1 initiative.

Both Zucker (2004) and Cornelius et al. (2012) propose that in order to evaluate digital technologies and their effect on student learning and school effectiveness, contextual aspects of policy and practice need to examined. Evaluators need to determine the degree to which teachers have supported access, as well as offered opportunities to learn to integrate technology. Thus, classroom processes are conditioned by school-wide factors and these are conditioned by district-wide factors. Varying conditions at each level in the system cause variation in classroom processes and outcomes. Based upon findings from their meta-synthesis in which gaps were identified in technology outcomes, implementation, and funding, the authors recommend that an evaluation research framework that includes these features be developed.

Generally, in the review of literature, researchers found that positive relationships exist between laptop environments and various aspects of the teaching and learning process. Nonetheless, there were no specific outcomes that improved as a direct response to technology. Thus, it is important for stakeholders to communicate their criteria for student outcomes in order to bring purpose to the evaluation. Moreover, many of the studies concluded that more than just student outcomes needed to be examined, and an evaluation research framework that includes these additional aspects lends a more comprehensive approach to determining the effectiveness of 1:1 laptop initiatives.

Role of Stakeholders

A process of laptop evaluation that looks at things through three different lenses: the lens of curriculum and content; the lens of the culture of the building; and the lens of technical needs is important (Zucker, 2004). An organizational framework with which to plan, implement, and evaluate a one-to-one laptop program needs to consider the context in which the program is implemented. Major components of the context are the stakeholders who have key roles in the successful implementation.

Policymakers and their constituents are important members in the 1:1 program success. Policymakers considering a laptop program must articulate their goals and address five key issues: planning, training and professional development, hardware and software, managing change, and program monitoring and evaluation. According to Weston & Bain (2010):

> The widespread availability of laptop computers can be a driver for the more expansive efforts that must happen in order for schools to meet the educational needs of all students. School communities, by adopting a self-organizing vision, could contribute to the arrival of a new paradigm for all of education. While the original mission of 1:1 laptop computer initiatives did not include shifting the educational paradigm, turning those initiatives toward the creation of self-organizing schools may be the best way forward for techno [sic] advocates and critics alike. Realizing this unique opportunity requires that both see the same – but a very different – forest. (p.14)

Parents are another vital stakeholder for 1:1 initiative success, especially in light of the lack of hard data on the efficacy of the programs. Data from the Lowther et al.

(2008) study demonstrated that parents played an important part in the success of the Walled Lake Consolidated Schools laptop program. The results showed that parents, teachers and students believed that the program was positively changing teaching and learning both at school and at home. Many parents, however, may feel frustrated that their children spend too much time on video games and may express concerns with the 1:1 laptop programs in actual classrooms (O'Donovan, 2009). Today's student is attracted to learning with technology (Project Tomorrow, 2015), however, their parents may need further education to describe for them how learning will take place and how the school will evaluate the success of the program (O'Donovan, 2009). Their role as stakeholders can have a major impact on the effectiveness of the program.

While students and parents are important in the laptop initiative, district and school leaders are also significant stakeholders in the laptop program, reflecting the importance of their role in establishing goals and culture for the program. A strong leadership team that can look towards members who will commit long-term to the initiative and provide ongoing support is essential. However, realizing the importance of the individual teachers in the success or failure of 1:1 computing cannot be overlooked. In the study of the Berkshire 1:1 program, Bebell & Kay (2010) attributed the poor implementation to lack of teacher knowledge and buy-in. They recommend ensuring uniform integration of technology in every class and providing time for teacher learning and collaboration. Teachers must have ownership of the decision-making, or as in the Texas 1:1 implementation; teachers reported that the tools are more of a distraction than a learning tool (Shapley, 2009). In the more successful 1:1 initiatives, teachers shifted away from traditional pedagogical approaches and became facilitators and coaches

(Cavanaugh et al., 2007; Corn, 2009; Ross et al., 2008), and students became more engaged in student-centered activities (Lowther et al., 2008).

School leadership teams must create a culture that is receptive to the use of laptop computers as learning tools. In addition, they must address the needs and interests of the key stakeholders in the learning community. It is important to understand the different perspectives of what is considered credible evidence of outcomes and impacts.

Program Evaluation Purpose

A laptop initiative requires a deep investment of time and resources by a number of stakeholders. A 1:1 evaluation provides a feedback loop to inform program improvements and allows leaders to measure return on investment, and implemented assessments of teachers, students, parents, and leaders help track the program's progress toward meeting the intended objectives. As previously noted, this can be a challenging task if the stakeholders have not originally established their goals for the program. Watson (2001) argued that lack of clarity in purpose for educational technology at the local and national curriculum level contributed to irregular adoption. To accurately assess and evaluate technology use within a school, leaders need clearly defined goals and metrics for measuring success as well as a process for applying the findings through a continuous feedback loop. Each measurement should serve a clear purpose and be used to ensure continual improvement and progress toward the program's goals.

Another purpose for program evaluation is to attain continuous program improvement. Evaluation results in decisions and actions regarding program improvement (Patton, 2002). Too often, improvement-oriented evaluations of educational technology are ineffective because the data is not timely, systems are too inflexible to be revised in the light of new data, resources needed to make the changes are limited, or it is unclear who executes the changes (Baker & Herman, 2003).

According to Stufflebeam et al. (2007), evaluation serves to facilitate a program's development, implementation, and improvement by examining its processes and/or outcomes. It is different from an assessment that focuses on determining a group's performance by measuring their skill level on a variety of subjects, such as reading comprehension. The primary purpose of an improvement evaluation is to provide timely and constructive information for decision-making about enhancement. It is also necessary to evaluate the technology program for overall impact. The technology is evaluated on how it affects the outcomes, both intended or unintended (Fitzpatrick et al., 2011). An impact evaluation can answer the question of whether the program is working or not and therefore contribute to decisions about expansion or contraction.

Many school leaders seek to evaluate laptop programs in their own unique context and populations. Those who want to measure the impact of their educational technology programming, beyond student achievement scores, need to look toward an organized approach. The implementation of a model will yield results that will lead to cultural and systemic change in practice and aid in long range planning and goal setting.

Evaluation Models for Educational Technology

Daniel Stufflebeam (2001), in his article, "Evaluation Models. New Directions for Evaluation," attempts to sort twenty-two evaluation approaches into four categories by their strengths and weaknesses and considered whether, when, and how they are best applied.

> Of the twenty-two program evaluation approaches that are described, two are classified as pseudoevaluations, thirteen as questions/methods oriented approaches, three as improvement/ accountability-oriented approaches, and four as social agenda/advocacy approaches (p. 11).

The category of improvement/accountability approaches is preferred above the other three because of its decision-oriented nature. Psuedoevaluations, methods oriented approaches and social agenda/advocacy approaches are not considered because they were not designed specifically for improvement purposes (Stufflebeam, 2001). The improvement/accountability-oriented evaluation approaches evaluate and communicate a program's merit and worth. The programs within this category facilitate the "systematic collection of information about the activities, characteristics, and outcomes of programs to make judgments about the program, improve program effectiveness, and/or inform decisions about future programming." (Patton, 1999, p. 23). These three improvement/accountability-oriented approaches need to be examined to warrant consideration for a school-based program.

Using an improvement/accountability method will allow schools to expand their knowledge base of best practices and lessons learned which would drive future decisions and adjustments to ongoing programs. Schools and districts across the country are expanding their use of technology by providing students with their own laptops. Many of these programs have had mixed success, therefore heightening the importance of continual evaluation and improvement (Holcomb, 2009). Furthermore, school decision makers must justify the cost of these endeavors by demonstrating that they can improve student learning outcomes (Sell et al., 2012). The improvement/accountability approaches seek to determine the needs identified by the program's stakeholders to build the foundation for assessing the program's value. These approaches to evaluation look for all significant outcomes, not just the ones that have been identified by the stakeholders (Stufflebeam, 2001). The methods utilized by these evaluation approaches include multiple qualitative and quantitative assessment methods to validate the findings (Fitzpatrick et al., 2011). The questions addressed by this category of approaches focus on all concerned participants, including persons and groups who make decisions related to initiating, planning, funding, implementing, and using the program's services (Stufflebeam, 2001).

Stufflebeam & Shinkfield (2007) classify improvement/accountability approaches into three types that include Scriven's (1972) Goal-free evaluation; Scanlon, Jones, Barnard, Thompson & Calder's (2000) Context Interactions and Outcomes (CIAO!) model; and Stufflebeam's (1971) Context, Input, Process, and Product (CIPP).

Goal-free evaluation, according to Scriven (1972), has the purpose of identifying what the program is actually doing without the knowledge of what it is intended to do. Thus, in this type of evaluation, the evaluator does not know the purpose of the program. According to Scriven (1972), if the program is doing what it is supposed to be doing, then the accomplishments should be evident in the observation and interview process. His goal is to direct evaluators to look more closely at what the program is actually doing. Scriven's (1972) intention is to push evaluators to analyze what the program is improving, even if those goals were not the originally-intended outcomes of the program.

The use of Scriven's (1972) Goal-free evaluation model is more of a consumer-oriented approach (Stufflebeam et al, 2007). The primary objective of this model is to view the evaluator as the consumer and aims to provide information that helps produce and deliver products and services that are of excellent quality and of great use to consumers. In the case of a laptop evaluation, this model would view the students and teachers as the consumers of the program. “The main evaluative acts in this approach are scoring, grading, ranking, apportioning, and producing the final synthesis” (Scriven, 1994; Stufflebeam, 2001).

Stufflebeam (2001) claims the advantage of the Goal-free evaluation model (Scriven, 1972) is that it stresses independent assessment that benefits consumers by protecting them from inferior programs and products. It provides for a summative evaluation that leads to a bottom-line judgment of merit or worth. In terms of a laptop program evaluation, the summative evaluation of this method is applied near the program’s end, which would not enable the stakeholders to reassess the implementation and make changes to the instruction or management of the laptop program. In addition, the approach does not take into consideration surveys, case studies, or observations that have collected important data in the evaluation of a number of laptop programs (Cavanaugh et al., 2007; Corn, 2009; Ross et al., 2008; Silvernail & Harris, 2003).

Figure 2.2. Scriven's (1972) Goal-free Evaluation Model

Stufflebeam et al. (2007) also identifies another improvement/accountability approach for evaluation, CIAO!, developed by Scanlon et al. (2000). This framework outlines three scopes of evaluation: context, interactions, and attitudes and outcomes (Oliver, 1998). Unlike Scriven's (1972) Goal-free model, Scanlon et al. (2000) claims the programs cannot be examined in isolation but rather in the school context or learning environment. One important phase of examining context is the implementation and how the program introduces the new technology (Oliver, 1998). Thus, the evaluator's questions are driven by the teacher's intentions for the technology, however, it is not the only criteria, and it is the program designer's goals that influence the evaluation.

In the case of educational technology evaluations, stakeholders and policymakers often start out with trying to determine if students learn faster or better when using technology (Holcomb, 2009). Most often, it is an experimental or quasi-experimental design that answers this question. Stufflebeam (2001) also notes, "Experimental studies tend to provide terminal information that is not useful for guiding the development and improvement of programs and may in fact thwart ongoing modifications of programs" (p.28). Many characteristics of a laptop program affect the evaluation design. One of the major issues is that each student's learning context is very different, and the technology is only one component, making it difficult to control all the other variables except the technology being investigated (Oliver, 1998). A second concern when evaluating educational technology is the impact it has on changing teaching and learning. Computer use can transform the learning environment to a more collaborative setting, thus a comparison to a traditional classroom is problematic (Scanlon, 1997). Last of all, as Draper, Brown, Henderson & McAteer (1996) elaborate, using pre and post tests to measure learning before and after the students' use of technology can be difficult. Tests given to students just after they have used the technology may indicate their mastery at this point, but will not reveal whether the material is retained. Delayed tests can be useful, but changes may then be due to factors other than technology, such as extra help sessions (Draper et al., 1996).

Scanlon (1997) argues that the CIAO! framework includes experimental analysis, but also includes qualitative data such as observations, journals, interviews, and questionnaires because all serve different functions but are equally important in the collection of information about students' perceptions and attitudes. It is important to note that Scanlon (2000) feels that using both questionnaires and interviews serves the function of getting focused questions answered, but also allows a two-way dialogue to identify concerns of the participants. Collecting information about the process by tracking interactions with technology is a key component of Scanlon's (2000) CIAO! approach. The "C" or the context dimension concerns how the technology fits within the course and where and how it is used; the "I" and "A" or the interactions refers to how students interact with the technology and with each other; and "O" or outcomes deals with how students change as a result of using the technology. Changes in perceptions, attitudes, or motivation are considered outcome data in this framework. Scanlon (2000) emphasizes that although the outcome data is critical, it is equally important to understand the process.

Scanlon's (2000) method focuses on the process by looking in detail at the students' use of software and analyzing their interactions. Disadvantages of the method include the dependence on access to the Computer Aided Learning (CAL) developers to determine suitability for used in a different contexts. Jones, Scanlon, & Blake (1998) warn that the model was developed at the Open University to evaluate their own software. They argue that it would be important to understand the rationale in order to judge its suitability for use in a different context as well as for its evaluation. The lack of prescription in the CIAO! framework means that there is no detailed guidance on how to apply particular methods to contexts where they have not traditionally been used. Students are observed working with the software, and computer logs of the utilization are analyzed. Because of this focused analysis and the fact that CIAO! was developed to analyze software at the Open University, it is not the best approach for evaluation of a laptop initiative. The CIAO! approach analyzes the student interaction with the software, but does not take into consideration the effect of that software on the teacher. The focus in the CIAO! model is on student learning, however, teacher instruction is not at the heart

(Scanlon, Jones, Barnard, Thompson, & Calder, 2000). Due to the intense use of observations and interviews, it is most realistic to implement it through an evaluation team approach (Oliver, 1998). This is another reason that this approach may not be the most practical for a school looking to evaluate their laptop implementation. Human resources are at a premium in K-12 education and the appropriation of that resource for evaluation purposes is questionable. Although the CIAO! approach emphasizes a wide range of tools, there is a lack of direction in the form of particular methods or checklists. The lack of detailed guidance on how to apply particular evaluation methods such as surveys, interviews, or observations to programs other than that at the Open University as well as the high utilization of human resources prevents the CIAO! approach for being suitable for a school based 1:1 laptop evaluation.

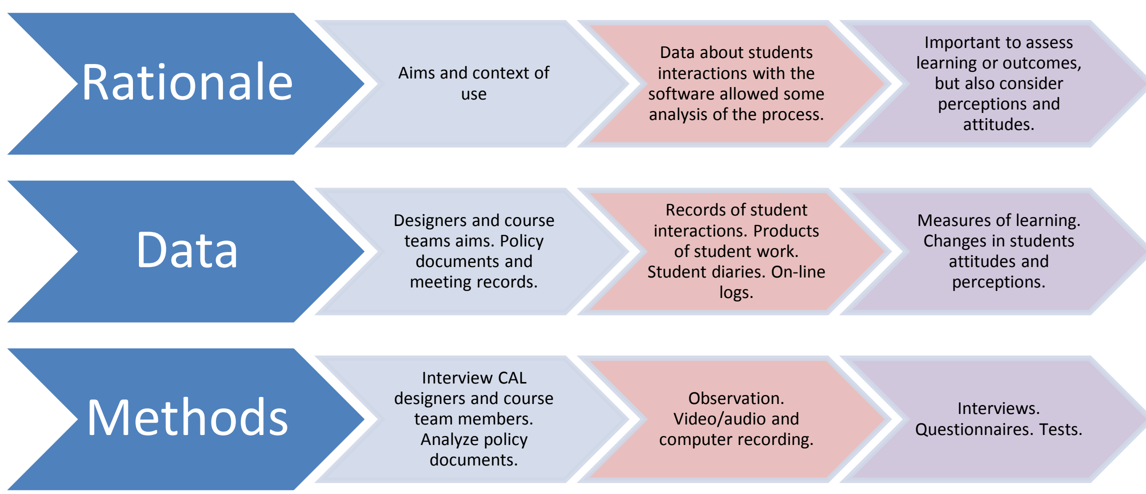

Figure 2.3. Scanlon et al.'s (2007) CIAO! Model.

Though there are three management oriented or accountability models presented in the literature, the first two presented here have shortcomings relative to their use for the proposed evaluation. The Goals-free approach has the purpose of determining what a program is actually doing without being cued to what it is trying to do. This makes it a challenge for program staff to conduct an internal evaluation in a goal free manner. The Scanlon's (2007) CIAO! approach has an origin in the evaluation of distance learning courses. This approach focuses on the student interaction with a particular computer program. The focus on the students' interaction with a particular software program and the lack of analysis of interaction with teachers and other peers makes it inappropriate for use in the evaluation of a school-based laptop program. The approach most aligned to this proposed evaluation is the improvement/accountability model outlined by Stufflebeam (2001). This is his own Context, Input, Process and Product Model (CIPP). Context evaluation includes examining and describing the context of the program, conducting a needs and goals assessment, determining the objectives of the program, and determining whether the proposed objectives will satisfy the identified needs. This benefits and improves the process of program planning decisions (Stufflebeam et al., 2007). The Input evaluation function of the method includes description of the program inputs and resources, a comparison of how the program might perform compared to other programs, an evaluation of the proposed design of the program, and an examination of what alternative strategies and procedures might be considered for the program. This evaluation examines what the program plans on doing and helps in making structuring decisions (Stufflebeam, 2001). The Process function includes examining how a program is implemented, monitoring the performance and identifying possible flaws. In a program evaluation, this type of feedback is valuable as it can be provided to program participants and is helpful in making formative evaluation decisions such as about how to modify or improve the program (Owston, 2008).

The fourth part of the approach is the Product evaluation, which includes determining and examining the general and specific outcomes of the program, measuring anticipated outcomes, attempting to identify unanticipated outcomes, and assessing the merits of the program. Product evaluation is very beneficial in making summative evaluation decisions such as whether the program should be continued (Stufflebeam et al. 2007). In a newly implemented program, a product evaluation may not be beneficial. In fact, an early analysis of outcomes may lead to a premature decision to discontinue the program. Stufflebeam (2007) notes the Product evaluation component can be used more as a formative assessment by dividing it into impact, effectiveness, sustainability, and transportability evaluations. Moving through the CIPP process will enable administrators to gain more knowledge and make informed decisions about the effectiveness of such programs and what lessons were learned.

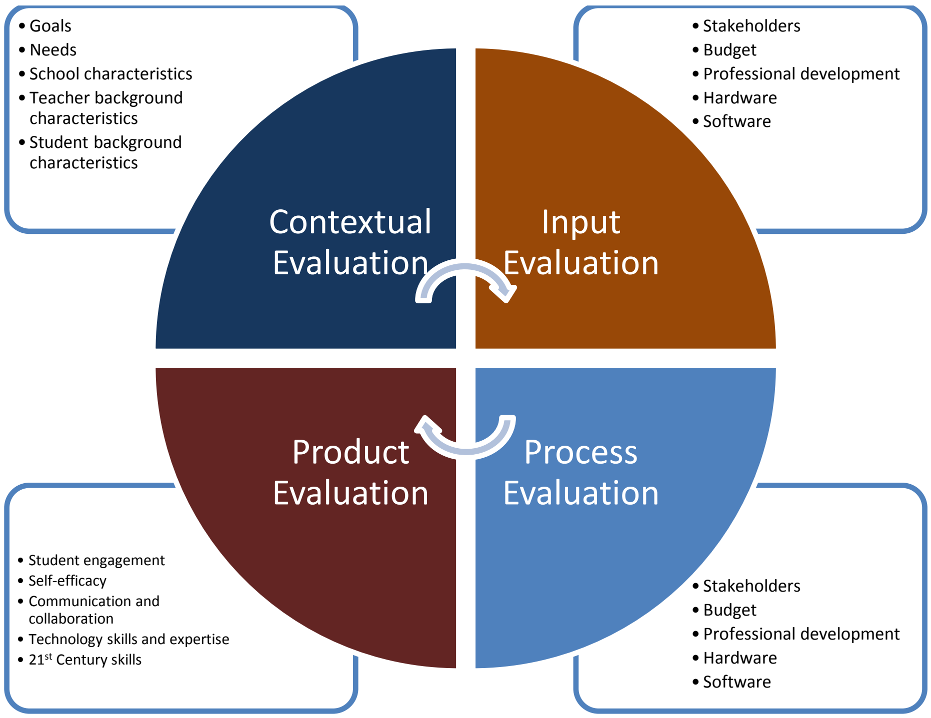

Figure 2.4. Stufflebeam's (1971) CIPP Evaluation Model

Ascertaining an evaluation method that will meet the needs of all stakeholders is a challenging process. In order for stakeholders to be secure with the purpose of the evaluation, it is important to convey that the evaluation is targeted more for improvement than judgment; however, the judgment piece should not be eliminated altogether.

The CIPP model, more than Goals-free and CIAO! models, is designed to assist administrators in making informed decisions; it is a popular evaluation approach in educational settings (Fitzpatrick et al., 2011; Zhang et al., 2011). The support for the CIPP model in the educational setting is based on the fact that both short-term and long-term outcomes can be assessed.

Using the CIPP model in the evaluation of a 1:1 program would start with what is known about the 1:1 laptop program implementation and outcomes, or the Context. The effectiveness of the program can be explained as a system of interactions between the elements of program implementation. These elements include the technology (hardware, software, training), the teachers (skills, attitudes and experience), the classrooms (facility, resources), the students (attitude, skills, knowledge), and the parents and policymakers (beliefs). The Context component of the CIPP model includes needs assessment, problems, assets and opportunities within the specific school setting. Data collection can use multiple formats. These include both formative and summative measures, such as environmental analysis of existing documents, program profiling, case study interviews, and stakeholder interviews (Mertens, & Wilson, 2012). As all schools differ in resources, it is important to consider their uniqueness. Characteristics such as curriculum goals and student body demographics are important features in the assessment. The Input component of the CIPP model may include the professional development offered to the teachers to support the program and the equipment itself. The resources (both financial and human) that are dedicated to the program can influence, limit or advance the overall progression. The Process element of the model includes analysts of the implementation strategies, such as device storage, teacher training, and technical support. Again, the ease and flexibility of the equipment will have a major impact on the overall process and eventually the student outcomes. The Product component includes the student outcomes such as attendance, discipline, achievement, engagement, and motivation. The methods for evaluating these components is a combination of qualitative methods such as interviews, surveys, and observations and quantitative methods that include standardized test scores pre and post laptop usage.

Evaluation can help program staff ensure that their strategies are explicit and realistic, and it can provide feedback on implementation fidelity, which is useful in realigning strategies for efficient use of limited resources. The goal of a laptop initiative or any education program evaluation is not to prove, but to improve (Stufflebeam, 2003).

As technology integration becomes a necessity in more classrooms, a greater need for access to the technologies emerges (Project Tomorrow, 2015). In order to address this, many schools have invested in mobile carts, pockets of devices in the classroom, and computer labs. Each of these investments has brought schools closer to the idea of just-in-time access to the tools, which is an important part of 21st century education (Project Tomorrow, 2015; U.S. Department of Education, 2016). The questions individual schools must respond to are: How will teaching and learning change in this technology infused environment? Will a student’s learning be positively influenced by the addition of these tools? Will a teacher’s instructional strategies be positively influenced by the additional tools? What is effective teaching using technology?

Effective technology integration is not about devices. It is about challenging our students' thinking and trusting in our classroom teachers to develop and design creative paradigms for instruction (U.S. Department of Education, 2016). The theory and practice of student-centered learning has been built over the past century. Piaget and Vygotsky have made influential contributions to the understanding of learning and how best to maximize human potential through education. As these theorists and practitioners saw it, learning involves a careful coordination between the individual’s capacities, abilities, and tendencies and the learning environments in which new information and skills are presented to them. Essential attributes of the student-centered learning environment, rooted in a constructivist approach, embrace a blending of instructional practices such as construction of learning, collaborative learning, educator/student partnerships, and authentic assessment. Research on constructivism is prevalent. Marlowe and Page (2005) concluded that research on active constructivist learning is both extensive and consistently supportive. With origins in constructivism, the International Society for Technology Educators (ISTE) has designed a set of standards and performance indicators that effective teachers utilize as they design, implement, and assess learning experiences to engage students and improve learning. The majority of these standards promote knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments (ISTE, 2009).

Schools have often been uncertain about the outcomes they want to achieve with technology. Is the goal to increase test scores, prepare students for jobs, increase student access to information, or prepare critical thinkers? The evaluation of a program begins and ends with establishing objectives that is valuable in informing current practice and future directions and decisions. The information obtained from a program evaluation can help to streamline and target program resources in the most cost-efficient way.

CHAPTER 3

METHOD

The purposes of this evaluation were continued improvement of the technology initiative (formative evaluation) as well as information gathering to assist the administration and school board in future decision-making. The goal of both 1:1 programs was to provide every 6th grader at one school and every 7th and 8th grader at the other with their own Chromebooks in order to increase their access to technology (Collins, personal communication, December 9, 2015; St. Cyr, personal communication, December 12, 2015). Considerable material, personnel, and financial resources, as well as professional development efforts, were dedicated to supporting the initiative.

The focus of this evaluation research was to assist the administrators of these two schools in making decisions about future integration of technology by examining the impact of 1:1 devices on students' learning experiences. The guiding evaluation questions were:

1. What was the effectiveness of 1:1 devices in improving learning and teaching based on:
    a. Student experience with respect to learning and instruction?
    b. Teacher experience with respect to learning and instruction?
2. Which improvements should be made when 1:1 devices are rolled out to other grade levels?
3. Which elements of this full CIPP evaluation can be adapted to create a feasible evaluation model that can be utilized by other districts?

Another noteworthy underlying outcome of the evaluation was the communication of results to stakeholders including the school boards and the superintendent of both schools. This chapter describes the design and procedures that were used to achieve the identified goals of this study.

Program Evaluation vs Traditional Research

According to Stufflebeam (2007), program evaluation and research share similar outcomes as they both have the goal of answering a question. He distinguishes between the two disciplines by noting that the purpose of evaluation is to improve an existing program for a target population, while research is intended to prove a theory or hypothesis. Scriven (2003) claims that a researcher adds to a body of knowledge on a particular issue, while an evaluator determines which information is valuable; which method is best for data collection; how to analyze the data; and how to relay findings to stakeholders. This requires a higher level of judgment than that of a traditional researcher.

There have been many uses of evaluation studies in the field of education. For example, evaluations are used to assess the quality of a curriculum, to determine the value of a specific program, or to provide evidence of project outcomes for government funding agencies. Program evaluation was selected as the study design over other methods of inquiry for several reasons. Purely quantitative research designs (e.g., correlational designs or experimental designs) were not deemed appropriate because the purpose of the evaluation was not to validate nor confirm relationships between variables, and then to generalize that information to the larger population (Creswell, 2003). Instead, this evaluation's goals were to identify the elements affecting the implementation and outcomes of the 1:1 initiative, discover the relationships and themes among those elements, and then use that information to communicate the project outcomes, inform ongoing decisions, and improve the program. Likewise, qualitative research (e.g., case study research and grounded theory) methodologies were deemed inappropriate because the study was not being conducted simply for the purpose of description or to develop theories that explain educational phenomena (Creswell, 2003). Rather, the goal was to identify what was working and should remain unchanged in the initiative and, equally, what was not working and should be altered, as well as to gauge initial outcomes of the program. Therefore, program evaluation as a study design was considered the most appropriate for the current research because the purpose of the analysis was to collect data that will enable decision-making. Some of these decisions included determining the next steps and establishing the value of the program in relation to student learning and teacher instruction. The evaluation proposed to increase the understanding of their 1:1 programs by assessing the current implementation as well as providing information on the future direction of the program, contributing to stakeholders’ understanding. The study also contributed to the literature by developing an abbreviated model that will support practitioners in evaluating their own programs. The need for such a tool has been emphasized recently in the 2016 National Educational Technology Plan. The plan outlines that traditional research approaches do not meet the needs of evaluating rapidly changing education technology. The report cites that these evaluations take too long, cost too much, and serve different purposes than school leaders need. The development of an evaluation based upon Stufflebeam’s CIPP model ensured that the evaluation met the evaluation standards of utility, feasibility, propriety, and accuracy. Because the CIPP approach was designed for educational programs, using this approach as a foundation further ensured that the evaluation activities were well designed and worked to their full potential.

Evaluation Design

Fournier (2005) defined evaluation as an applied inquiry process for collecting evidence that culminates in conclusions about the state of affairs, value, merit, worth, significance, or quality of a program, product, person, policy, proposal, or plan. Fournier (2005) distinguishes evaluation from other types of inquiry, such as basic science research, investigative journalism, or public polling by highlighting its value feature. Scriven (1996) refines evaluation into the categories of formative evaluation and summative evaluation. Yet, Patton (2002) enhances the approaches by complementing formative evaluation with the developmental evaluation approach. He ascertains that there are three main forms of program evaluation: formative, summative, and developmental. Formative evaluations typically occur when programs are in development and focus on program processes. Summative evaluations occur at the end of a given intervention or project cycle, focusing on program outcomes. Developmental evaluation focuses on assessment in rapidly changing environments with a primary focus on building long-lasting relationships and design teams to analyze evaluation related questions as programs evolve (Patton, 2002).

Developmental evaluation was used primarily during the initial background gathering stage of the evaluation. It provided information that assisted in understanding the activities of the laptop program and how this initiative interacted with the rest of the schools' environments. The formative approach was used during the impact and process stage since Scriven (1996) explains that formative evaluation seeks to inform program managers and other stakeholders with advice intended to improve the program "on the ground" (p. 151). The product stage employed some summative measures, since Scriven (1996) contends that summative evaluations deal with whether the program has achieved its intended objectives. The current evaluation research study used primarily formative evaluation because the information gathered was intended to improve the program initiative and to determine the next steps in its implementation, however, the developmental evaluation supplied information to support the program and its interaction with the school environment as a whole. While some initial outcomes of the initiative were studied, the goal of the evaluation was not to determine the overall value of the program based on these outcomes; consequently, this study did not focus on summative evaluation. This evaluation strove to assist in continuous improvement, so formative evaluation was employed. There also were particular circumstances where development evaluations added value, especially where the knowledge base was not well established.

Reliability and Validity in Qualitative Research

Formative research for program improvement involves different purposes and, therefore, different criteria of quality compared to summative evaluation aimed at making fundamental continuation decisions about a program (Patton, 1999). Patton (2002) explains that credibility in quantitative research depends on the instrument construction, while in qualitative research the researcher is the instrument. Both reliability and validity are viewed together in qualitative research, and they depend upon the ability and effort of the researcher. Patton (2002) recognizes that issues of quality and credibility intersect with the audience and intended research purposes. He emphasizes that the researcher should use rigorous techniques and methods for gathering high quality data. The data should then be carefully analyzed with consideration to issues of validity, reliability, and triangulation. Patton (2002) identifies that the credibility of the researcher is dependent on training and experience.

The process of evaluating the two school programs using the traditional CIPP design allowed me to determine which components would yield results that will support practitioners in making evidence-based decisions regarding their 1:1 programs. Once these components were identified, online tools were developed to further simplify the process. This project established a template for a low-cost, quick-turnaround evaluation that can be regularly employed to continually assess the initiatives.

Context Input Process and Product (CIPP) Evaluation

As noted in the literature review, Stufflebeam (2001) identified four broad categories of program evaluations based upon their strengths and weaknesses. These four categories included approaches that promoted incomplete findings or pseudo evaluations, questions or methods-oriented approaches, improvement/accountability approaches, and social agenda/advocacy approaches. Since the improvement/accountability oriented evaluation approaches evaluate a program on their success, but also provide feedback in order to make enhancements, this category of evaluation best suited the assessment of these 1:1 device programs. Additionally, these approaches, also called management-oriented approaches, can be used at any time during program implementation to support decision-making. Because two 1:1 device programs, in different stages of implementation, was evaluated, a management oriented approach such as the Context Input Process and Product (CIPP) Evaluation model best suited this study. Stufflebeam

(1971) developed the CIPP evaluation model that contributes to the decision-making process many school administrators face at different points in a program's implementation. He meaningfully points out in his 1971 paper; *The Relevance of the CIPP Evaluation Model for Educational Accountability*, that evaluation always includes three steps: delineating the information to be collected, obtaining the information, and providing the information to decision makers. Stufflebeam (1971) emphasizes that the CIPP model is intended to facilitate educational improvement though a proactive approach to evaluation, but also can be used as a post hoc accounting for decisions and actions.

Since evaluation assists in decision-making, it is important to determine which kinds of decisions are supported. According to the Stufflebeam's (1971) CIPP Model, the four kinds of decisions are planning, structuring, implementing, and recycling. These decisions account for context, input, process, and product evaluation. The CIPP model offers a framework to systematically guide the conception, design, implementation and assessment of a project and provides valuable feedback and judgment of a project's effectiveness for continuous improvement.

Context evaluation or the "C" in the CIPP model provides information about the strengths and weaknesses of the system in order to identify the inadequacies to be addressed by the program. The input evaluation, or "I" in the approach, refers to the information that is gathered concerning the resources available and the specific plan for implementation. The next stage in the CIPP models outlines the process evaluation, or "P", which provides a framework for the implementation plan and the changes that are needed to improve the process. The second "P" in CIPP stands for product evaluation, which addresses the decisions that are made regarding whether or not to continue the program and which changes may be needed to improve the program outcomes. According to Stufflebeam (1971), the CIPP model has been developed to answer four kinds of questions: What should we do? How should we do it? Are we doing it correctly? And finally, did it work?

Despite much enthusiasm, there is very little long-term, large-scale research and evaluation that focuses on teaching and learning in intensive technology-infused environments and implementation of 1:1 programs (Lei, Conway, & Zhao, 2007; Penuel, 2006).

Program Description and Evaluation Plan

The evaluator had basic knowledge of both programs; nevertheless, an in-depth evaluation of the context of both programs was undertaken. The first program (Auburn Village School) was in the planning stages of the project and involved 76 sixth grade students having their own devices. The second program (Candia Moore School) was a year old, involved 39 seventh grade students the first year, and added 39 seventh grade students in the second year. Both schools utilized Chromebooks in their implementation. A Chromebook is a laptop running the Chrome Operating System. The devices are designed to be used primarily while connected to the Internet, with most applications and data residing "in the cloud." A Chromebook is an example of a thin client. This device offers much of the same technology resources as a traditional computer and provides a suite of word-processing, spreadsheet, and presentation applications. In addition, the equipment can take advantage of all Web 2.0 applications that are offered on the Internet.

The use of this device did not limit the students to basic computer applications, but rather offered them a robust technology experience.

Evaluation should be a periodic process of gathering data and then ordering it in such a way that the resulting information can be used to determine whether the program is effectively carrying out planned activities, and the extent to which it is achieving its stated objectives and anticipated results. These results are derived from good leadership and good leadership is based on good decision-making. Good decisions depend on good information, and this information requires good data and careful analysis of the data. These were all critical reasons to implement continuous evaluation. Senge & Sternman (1992) claims that individuals within organizations have difficulty seeing the whole pattern. He argues that systems thinking is a conceptual framework that involves triangulating data from different people with different points of view who are seeing different parts of the system. This information must come together in order to collectively see something that individually none see. Systematized data can be ascertained through an organized model of evaluation such as the CIPP model, which Stufflebeam (1971) developed as a form of logic model. Using this model, data is gathered and then analyzed or ordered in such a way that the resulting information can be used to determine whether the program is effectively carrying out planned activities, and the extent to which it is achieving its stated objectives and anticipated results. Decisions are then made to refocus resources to move closer to the desired outcome. A continuous evaluation should be exercised as an ongoing management and learning tool to improve the program's effectiveness.

The next three sections address the inputs, actions or process, and outcomes or products of the technology initiative. This type of analysis mirrors the components of a logic model. A logic model is used as a planning tool to clarify and graphically display what a project intends to do and what it hopes to accomplish and influence (W. K. Kellogg Foundation, 2004). According to the W. K. Kellogg Foundation (2004), the components of logic models vary because there is no one single logic format. One of the biggest challenges is to determine realistic priorities about what will be assessed and how best to gather and analyze the data (W. K. Kellogg Foundation, 2004).

The previous chapter built a strong argument for the utilization of the Context Evaluation, Input Evaluation, Process Evaluation, and Product Evaluation or CIPP framework of evaluation as defined by Stufflebeam (1971). Using this framework is similar to the format of the logic model and provides a structure for guiding evaluations of programs, projects, personnel, products, institutions, and evaluation systems (Stufflebeam, 2003).

Context Evaluation

The context evaluation investigated how both programs operated in each school’s particular social, political, physical, and economic environments. According to Stufflebeam (1971), the context evaluation stage of the CIPP model creates a framework that outlines where both program and evaluation unite. This stage assists decision-makers in planning, and enables the evaluator to identify the needs and resources of an organization. The context of evaluation should answer the question ‘What needs to be done?’ (Stufflebeam, 2007). To accomplish this, the evaluator collected background information and interviewed program leaders and stakeholders. Stufflebeam and

Shinkfield (2007) define stakeholders as the individuals who participated in or are affected by the program being evaluated. This involves needs assessment; but it also searches for opportunities, such as human resource expertise or special funding sources, that are potentially available for meeting the needs. Because the laptop programs were in the early stages of innovation, a developmental evaluation focused on the changes that need to be made within a context of uncertainty. Social change innovations occur when there is a change in practice, policies, and programs. This innovation is distinct from improvement in that it causes reorganization at any level (Patton, 2002). The evaluator may introduce strategic and integrating questions to clarify some of the ambiguity that accompanies this organizational change. Formative context evaluation was also utilized to diagnose problems that must be solved to help stakeholders define the program and examine the delivery and implementation. This approach helped to fine-tune what is working and establish a baseline data for future decisions about the program's continuation, expansion or other major decisions (Gamble, 2008).

Context methodology. Five different data collection tools were used to assess contextual factors, capacity and resources. Principal interviews, pre and post teacher surveys, student experience observations, field notes, and technology staff interviews were used. In addition, the technology plans, school curriculum plans, school board minutes, budget and the New Hampshire Department of Education Profile documents were reviewed. In order to obtain information about the make-up of the school staff and students, I performed a document review of each school's NH Department of Education profile data as well as the respective technology plans. The 1:1 initiative approaches, including curriculum alignment and technology goals, were analyzed in the context of each school's technology plan, strategic plan, and curriculum policies. Logistics, budgets, funding, and infrastructure capabilities and reliability were evaluated through a combination of interviews of technology support staff, administrator interviews, and a pre-survey of participating teachers. The administrator interviews at both buildings enhanced the information pertaining to the goals of the programs and the future intent. Stated expectations and missions had an effect on both schools, therefore, a document review of the technology plan, school board minutes, technology committee minutes, and the budget lines for the 1:1 initiatives were performed and analyzed. The quality of teacher preparedness, evidenced by their ease with technology implementation as well as principals' perceptions of teachers' ability to utilize the technology, was examined. Principal interviews, technology support staff interviews, pre-survey of teachers, as well as a review of budget funds allocated to technology professional development (Appendices B, C, & E) also provided data. Each item on the data collection instrument is identified with the CIPP component being evaluated. The context evaluation provided information about the strengths and weaknesses of the program in order to assist in planning improvement-oriented objectives.

Input Evaluation

Stufflebeam (2007) explains that the main orientation of an input evaluation is to help a program to make needed changes. Input evaluation is a precursor to the success or failure and efficiency of a change effort. Data collection tools comprised of administrator interviews, pre and post teacher surveys, student experience observations, field notes, and technology staff interviews were used (Appendices A, B, C, & E). Again, I have identified which items collect information for each CIPP process on the instrument. A document review of technology help desk requests was also completed to determine if support was needed during implementation. Budgets were studied, and any impact on the program was evaluated through conversations and interviews with the technology support personnel and the principals. Improvements to both programs were supported by the information attained from a combination of the above named tools.

The input evaluation component of the CIPP model can help propose changes to a project to address the identified needs. Stufflebeam and Shinkfield (2007) assert that this component addresses the question "How should it be done?" and identifies procedural designs and educational strategies that will most likely achieve the desired results. Consequently, its main orientation is to identify and assess current system capabilities, to search out and critically examine potentially relevant approaches, and to recommend alternative project strategies.

Input methodology. The 1:1 implementation input evaluation research used six data collection tools that included student experience observation snapshot, administrator interviews, teacher focus groups, technology support staff interviews, and teacher pre and post surveys (Appendices A, B, C, D, and E). These data collection tools were used to gather data to determine whether the district resources were sufficient to support the 1:1 initiative. Resources evaluated consisted of training, technology, financial, infrastructure, and instructional programs. A content review was also performed on a number of district documents including budgets, schedules, technology policies and procedures, student handbooks, and help desk ticket reports. Student experience observations "snapshots" were used to determine how effective the professional development was in improving teachers' ability to use 1:1 computing strategies.

The input evaluation determines the effectiveness of the 1:1 project's plan. The success of a 1:1 initiative requires a good project plan that, if implemented correctly, will benefit both students and teachers (Bebell & O'Dwyer, 2010). The evaluation of the plans consisted of an assessment of the stated objectives as well as an appraisal of the extent to which these objectives have been interpreted into criteria and procedural strategies.

Process Evaluation

The process evaluation research reviewed the activities that are a part of the initiatives. According to Stufflebeam (2007), the process evaluation is an ongoing check on a plan's implementation and documentation of the process. The process evaluation periodically assessed the extent to which the participants accepted and conducted their roles. These activities included how and how often the technology was being used for lesson planning, classroom learning, collaboration, and communication. As indicated in the literature, Dede (2002) reminds us that the important issue in effectiveness for learning is not the sophistication of the technologies, but the ways in which their capabilities aid and motivate users. The mere existence of a particular technology does not dictate the manner in which it will be used. The process evaluation determined whether teachers were employing technology daily in the classroom, used a variety of tools to complete assignments, and created projects that show a deep understanding of content. Using the theories of constructivism, based on Piaget's and Vygotsky's theories, effective instruction is rooted in students creating their own knowledge. During the process evaluation, various tools provided information that indicated the presence of student centered instruction. In terms of instruction, the literature recommends that teachers should have basic technology skills and be able to support learning in a subject area, design technology-supported activities, and manage student-centered, technology-supported activities (Means, 2000).

Process methodology. For this evaluation, the process was examined by using seven tools that consisted of two teacher focus groups, pre and post teacher surveys, two student focus groups, ten student experience sampling sessions at each school, field notes, two principal interviews, two technology staff interviews, and a parent survey. The survey and interview questions appear in Appendix B, C, D, E, F, & G. The student experience sampling was performed at randomly selected times. For instance, the observations took place both in the morning and afternoon on various days of the week. This ensured that diverse classes and teachers were examined. Each student in a given class was asked to "freeze" and take a quick survey that provided a "snapshot" of their current experiences (See Appendix A for Experience Sampling Survey "snapshot" activity questions.). The snapshots were taken during quarter three of the school year and a minimum of ten random visits were made to each of the schools. Classroom visits were informal visits that were not prearranged by the evaluator. Teachers did not have prior knowledge that their classroom would be observed. This was to obtain an accurate representation of typical classroom practices. The number of classroom visits was chosen to provide a broad view of curriculum and provide more comprehensive data.

Product Evaluation

As explained earlier, the primary purpose of the CIPP evaluation was to generate relevant information useful to the decision makers; and a review of outcomes also assisted in this decision making process. The product evaluation research focused on the skills and knowledge the students developed in grade levels where 1:1 laptops are implemented. It also focused on the relationships between teacher and classroom outcomes and outcomes for students. The student outcomes included the development of 21^{st} century skills such as technology competencies, collaboration skills, and communication and presentation skills. The teacher outcomes included utilization of technology to provide more student-focused lessons that will ultimately increase student motivation. This evaluation was only a preliminary analysis of which objectives were met. Further investigation will be required to determine whether the technology caused demonstrable effects on specifically defined targets. The literature review outlined a number of additional outcomes that can be impacted by technology use such as test scores, absenteeism, motivation, and student grades. Accordingly, a long-term longitudinal study could to be designed to capture the summative outcomes.

Product methodology. The teacher pre and post survey, student experience sampling, teacher and student focus groups comprised the five data collection tools for the product evaluation (Appendices A, B, D and F). The teacher pre and post surveys collected information concerning the designing of curriculum and instruction pre and post laptop program. The questions also targeted the delivery of instruction and attempted to determine if the mode of delivery had changed since program implementation. The student experience sampling attempted to assess if the students were utilizing the laptops for collaboration and problem solving by analyzing the tasks they were performing at random points in their instruction. Both the teacher and student focus groups discussed the use of the laptops for teaching and learning, and investigated the amount and method of the laptop use in designing instruction, delivering instruction and student learning.

A parent survey (Appendix G) was also completed and collected information concerning the students' engagement with and use of the technology. Parents were asked if they feel the technology has changed the way their children learn. Their responses to the questions provided data for both the Process and Product analysis, and the results were examined and categorized to locate patterns and themes.

Data Collection and Analysis Plan

Data collection occurred during the spring of 2016. All data gathered from participant resources were collected with explicit permission from the participants and in full compliance with Institutional Review Board (IRB) guidelines. Data collection gathered information concerning the types of activities that were being performed using the laptops. This was an important element; as noted in the literature review, student centered learning is the most effective way to support active engagement with knowledge, therefore the data collections tools queried the types of projects, instruction, and collaboration that were being employed using the technology.

Analyzing the ultimate success of the laptop initiative long-term outcomes may require a multiple year evaluation, however, the realization of short term and intermediate objectives were analyzed in order to communicate progress and make improvements to the program. The evaluation informed funders and administration whether the laptops were being used in the early stage in a fashion that would lead to greater student learning and achievement in the future.

Stufflebeam (2007) states that a context evaluation's methodology may involve collecting a variety of information about members of the target population and their surrounding environment and conducting various types of analysis. A typical starting point is to ask the clients and stakeholders to help define the study's boundaries. First, background information for the 1:1 device programs at both schools was reviewed, establishing a context for the initiatives. Next, the scope of the evaluation was defined with regard to which school years and grade levels were included in the evaluation. After the scope of the evaluation was identified, the programmatic issues or concerns that the initiative was designed to address were identified. Teacher surveys, principal interviews, teacher focus groups, and technology staff interviews served to identify the goals for the programs and the target population. These stakeholders were also able to assess the requirements and the problems that underlie these needs. Most importantly, responses from these methods enabled the evaluator to judge whether the program goals were sufficiently responsive to the needs. Evidence of this was teachers' insights about student engagement, students' own feelings about the use of the technology, principals' perceptions of teaching and learning, and parents' observations of students' learning using the laptops.

Teacher Surveys

With the influx of Internet surveys flooding the web, Dillman and Bowker (2000) present the unique challenges of web surveys to provide ways to minimize error. The first is a sampling error that can be the result of surveying a sample of the population rather than the entire population. Since this was an internal evaluation, and I am principal of the Auburn Village School, the familiarity with the teachers enabled me to ensure that the majority of them responded to the questions. Participation in the surveys was not mandatory, but the majority of the 4-6 teachers in the laptop programs at each school agreed to participate. This eliminated sampling and coverage errors. All questions on the survey required an answer, thus preventing the respondents from closing out of the survey until all items had been completed. This reduced any nonresponse errors.

For the structured items, I used frequencies and percentages to report responses on each individual question. A significant result of certain questions would be over 50% and was investigated in depth in the teacher focus groups. Items on a Likert-scale from 1 to 5 were reported using means and percentages responding to each option on the item-by-item analysis. Results that have less or more than a three mean were investigated further in the teacher focus groups. I performed a content analysis of responses to open-ended items. I also documented some sample responses to illustrate the nature of the comments.

Using Google Forms for survey data collection and analysis allowed me to gather information with speed and efficiency. Survey data were used to guide the program development, while the post implementation or post survey data were used to gauge the program's success and make recommendations for change. The teacher surveys were designed to gather baseline data on teachers' prior knowledge and training in technology integration. A baseline-data survey was administered at the beginning of the research study. A second survey, administered toward the end of the study, recorded data on changes in teachers' incorporation of pedagogy learned during training, attitudes toward technology, and technology skills and competence. According to Fitzpatrick, Sanders & Worthen (2004), a survey only gathers information about the questions asked. In contrast, during a conversation, the interviewer can explore important subjects in depth, as they are uncovered. Thus, the results of the survey were incorporated into the principal and technology staff interviews as well as the focus group feedback sessions with teachers and students.

Open response questions were analyzed by establishing coding categories for the Context, Input, Process, and Product. Once I read the responses, I discerned certain patterns in the responses as well as topics the responses covered. I then recorded words and phrases to represent these patterns and topics. For instance, I looked for references to community culture and norms while examining the administrator interviews. This provided me with data that describes the Context of the laptop program. Once I categorized and coded data, I explained what was said about the subject or theme. I determined which categories were related, where trends and patterns could be identified, and if common themes emerged.

Parent Survey

The purpose of the parent survey was to understand the use of the laptops from the parent perspective. An email was sent to all the parents of the students participating in the 1:1 laptop program. The parents were asked to volunteer to participate in the survey. Because parents were asked to voluntarily participate, results from this survey may not be representative of the whole. Nevertheless, results from the teachers and students provided patterns that increased the validity of the findings. The majority of the questions provided data for the product evaluation and inquiries about observations they made as their child interacted with the laptop (process evaluation). The survey also analyzed the purported value of laptops and whether the technology resulted in added educational value to the learner.

Student Experience Sampling

In 1983, Larson R., & Csikszentmihalyi, M. developed student experience sampling as a research methodology that asks participants to stop at certain times and make notes of their experience in real time. This methodology was used in conjunction with observations or "snapshots" of classrooms to capture evidence about teachers' pedagogy and technology utilization (Larson & Csikszentmihalyi, 1983). These observations documented which types of learning activities occurred in the classroom, who was using technology, and how they were using it. Observations captured a range of teachers' and students' behaviors and technology use, classroom interactions, learning activities, and student engagement. The students were asked to complete a short Google Form and were not informed of the observation beforehand so they could not anticipate the event. Validity also came from repetition in information being collected, allowing the evaluator to scan for patterns.

This method was employed by Sam Sakai-Miller, Ed.D, in an internal evaluation done in 2014 for the St. Helena Unified School District in St. Helena, California. Email permission to use the experience form was received by S. Sakai-Miller in November 2015. This experience sampling provided data to address the product evaluation, assess outcomes, and determine the degree to which the 1:1 initiative has changed student learning, improved engagement, and increased 21st century skills. The questions also assessed satisfaction and usefulness of professional development related to technology-assisted pedagogy and technology use.

Focus Groups

The focus group data collection method was chosen because, unlike individual interviews, the focus group presents a more natural environment as participants appear to be influencing and influenced by others, just as they are in life (Locke, Spirduso, & Silverman, 2013). Focus groups are a special type of group used to gather information from members of a clearly defined target audience (Krueger & Casey, 2002). Focus groups played an important role in analyzing the process of the laptop program. The focus groups were used as an adjunct to the survey data collection tools for both teachers and students. The validity of the focus group results was tested by comparison to the survey results as well as content analysis. The first step in the analysis of the focus group data was ensuring that the group answered all the questions and collating those answers to each question. The answers were then organized into categories and labeled. The findings were used to answer the research questions. These findings were compared to the results of the data collection tools to discover if there were distinct themes emerging from the data. Responses to the surveys generated data that I discussed with focus groups of students and teachers. Bias remained an issue during the focus groups as I am in a position of authority at one of the schools. I attempted to reduce bias by keeping the focus groups informal and becoming more involved in the conversation. I encouraged participant elaboration but refrained from helpful responses to avoid imposing my views and biases on the area of interest (Seidman, 1991).

Krueger (2002) advocates for the systematic analysis of the focus group data that begins while still in the group. He suggests listening for inconsistent comments and probing for understanding. Krueger (2002) also proposes that the interviewer consider asking each participant a final preference question and offering a summary of key questions and asking for confirmation.

Teacher focus groups. This evaluation research ascertained information from the teachers in a focus group format. This allowed me to probe the responses from the survey questions and expand upon those answers by requesting examples or evidence. The emphasis of the teacher focus groups was to analyze student outcomes and determine the degree that the 1:1 initiative had changed student learning, improved engagement, and increased 21st Century skills. The questions also assessed satisfaction and usefulness of professional development related to technology-assisted pedagogy and technology use. The teachers were also allowed to voice other feedback about their experience with the 1:1 program. There were two groups, one from each school, that were made up of between four and five teachers. Each school had five teachers participating in the program and the majority of teachers agreed to participate. Each focus group lasted about 45 minutes. The focus groups were conducted at the end of the study at both schools and accommodated teacher schedules.

Student focus groups. The purpose of the focus group protocol was to gather data from students about their experiences with integration of 1:1 computing into their learning activities. The open-ended questions probed students' satisfaction with technology, their sense of its usefulness, changes in their classroom activities, and expectations for future work using technology. Student responses were coordinated with the teacher focus group responses and used as an opportunity to validate the data. The approximate timeframe of the focus group was about 45 minutes, and it was administered toward the end of the evaluation research study. The students were asked to volunteer for the group. The groups had five students per group per school to maintain informality and willingness to share. Of the students who volunteered, the five students were chosen purposefully and represented a cross section based upon academic achievement and socioeconomic standing. Initially, students were asked to volunteer to ensure that they would be open to speaking about their experiences. The final five students were purposefully chosen by socio-economic and achievement levels to provide data that was representative of the entire class and thus reduce the potential threat to validity.

Interviews

The interviews were used after results of more standardized measures such as the survey had been analyzed to gain insight into interesting or unexpected findings. The interview guide approach (Patton, 1999) is the type most used for qualitative interviewing. The interviewer has an outline of topics or issues to be covered, and the data is more comprehensive than the informal conversational interview. This type of interview was chosen for the evaluation research since it has the flexibility to probe for more in-depth responses on the topics that were identified through the survey process. This semi-structured approach enabled me to obtain information or insights that might not have been anticipated.

Interviews were recorded and transcribed using digital media and provided to the participants for review and member checking. Member checking is generally considered an important method for verifying and validating information observed and transcribed by the researcher (Stake, 1995), and is meant as a check and critique of the data. Member checking also provides material for further investigation and triangulation. Handwritten notes were taken during the interviews for the purposes of extending questions or as the researcher’s personal notes for further investigation. The interviews were conducted at each of the schools in accordance with the participants’ schedules.

Reducing bias during this interview process was problematic. Since I am an administrator in the school, responders were less apt to provide negative input. The interviews were semi-structured and friendly, and every effort was made to ease any judgement or opinion. Open-ended questions were used encourage information to flow freely and reveal honest responses on the topics. The data collected was triangulated through the use surveys and focus groups.

Technology staff interviews. The purpose of the technology staff interviews was to provide insight on the reliability of the hardware and infrastructure in each of the schools. Information about adequate training opportunities was also probed. Data about the ways in which the teachers’ and students’ use technology was collected through this interview process.

Principal interviews. Interviews with the two school principals documented changes they observed regarding teachers’ knowledge and skills, their technology integration, and their execution of high-quality instructional activities. They also provided insight into budgeting actions, policies, and procedures. Much of the context evaluation research was collected from these interviews.

School and District Data and Documents

Lincoln and Guba (1985) distinguish between documents and records based upon their different uses. Records are typically used for tracking, such as employment records or financial data. Documents require a qualitative method, such as a content analysis with keywords and themes. Documents such as policies, technology plans, curriculum, and procedural forms were used to gather information for context, input, and process evaluation research. Records such as budgets and help-desk ticket databases were used to evaluate the context and input evaluations. Northwest Evaluation Association (NWEA) test scores were analyzed in reading and math over a two-year period as evidence of any impact. It is interesting to note that a study conducted by Kim (2005) concluded that constructivist teaching is more effective in terms of academic achievement of students and that students have some preference for a constructivist teaching classroom environment. Items that are directly related to the initiative were used to provide insight on the effectiveness of the program and which changes should be implemented.

Reviewing existing documents helped me understand the history, philosophy, and operation of the program as well as the school in which it was being implemented. The review of the technology plan and school board minutes revealed no difference between formal statements of program purpose and the actual program implementation. After reviewing the existing documents, it was not necessary to alter questions for interviews, surveys, or focus groups based on a more solid understanding of the program or the school.

The final scope of this research study was to develop a feasible model for 1:1 laptop evaluation that is based upon American Evaluation Association (AEA) guiding principles of utility, feasibility, propriety, and accuracy. This study of two programs in different phases of implementation will contribute to the knowledge base for similar future schools that plan to institute this type of initiative. This factor facilitated the development of a more comprehensive feasible evaluation model that will provide other administrators the ability to measure the effectiveness of 1:1 programs within their schools. The premise of this tool is that evaluation is an important element in the design and implementation of effective 1:1 programs, and is a means of understanding the progress, product, and impact of these initiatives. Evaluation can help program staff ensure that their strategies are clear and realistic, and it can provide feedback on implementation effectiveness. This is very useful in readjusting approaches for efficient use of limited resources. Evaluation can also help program implementers target key outcomes and collect meaningful data on their program’s impact.

CHAPTER 4

RESULTS

Introduction

This chapter conveys the results of the two 1:1 laptop programs from the context, input, process, and product evaluation perspectives. The focus of the evaluation research was to assess the impact of the school's 1:1 devices on the students' learning experience. The evaluation is intended to determine the effectiveness of the 1:1 devices in improving learning and teaching based on both the student and the teacher experiences with respect to knowledge and instruction. The evaluation also determined which improvements should be made to the programs when the devices are rolled out to other grade levels within the schools. The final objective of the evaluation was to determine which elements of the CIPP evaluation model could be replicated to create a standardized evaluation model that could be utilized by administration and staff in other districts.

Context Evaluation

A review of the NH School Profiles, administrator and technology staff interviews, and teacher focus groups was conducted to determine the objectives and sustainability of the programs. A comparison of the make-up of the schools' staff and students was completed to determine if this had an impact on the programs. Both schools' demographic data are similar. The schools are located in the southern part of New Hampshire, with Auburn Village School's enrollment totaling 586 students and Candia Moore School's enrollment totaling 329. Information from the New Hampshire Department of Education's School Profile Reports (2015) indicates that both schools contain grades kindergarten through eighth grade and operate with similar administrative and support staffing levels. Both schools operate under the same school administrative unit and share the same superintendent, though they have independent school boards.

The context section imparts the results of a review of school information such as school size, enrollment, location, grade level configuration, personnel, administration team make-up, and demographics. This information was obtained by a review of data from the New Hampshire Department of Education School Profile Reports (2015) as well as the schools' most recent technology plans. The purpose of obtaining this information is to determine whether these context factors have an impact on the assessment of the programs. The following information summarizes the make-up of the school staff and students.

Table 4-1

Table Display of both Schools' Demographics

	Enrollment	Teachers	(Ratio T:S)	Administrators	Ratio (T:S)	Technology Staff	(Ratio T:S)	Specialists	% White	% Non-white	% Free and Reduced
Auburn Village School	586	41	1:14	2	1:293	1	1:586	13 1:45	87	13	11
Candia Moore School	329	30	1:11	2	1:165	1	1:329	9 1:37	92	7	15

Note. T Teachers, S Students

From the data above, both schools have similar organizations and are located within 3 miles of one another. Average class sizes at Auburn Village School range between 25 and 14 students as compared with Candia where they range between 20 and 14 students. Both schools are at or below the state average class size in all grade levels.

Data was collected from students, parents, teachers, administrators, and technology staff. Candia Moore School had 80 students participate at various times through the experience sampling tool while Auburn Village school had 73 students. Each student was surveyed at least once during the experience sampling period and, due to their participation in various classes; some were surveyed more than once. The parent survey was sent out via email to all 153 students' parents and guardians. Only 22 responses were received, comprising 14% of the total students. This was well below the response rate average of 52.7% that was found in Baruch and Holtom (2008) research regarding survey response rate levels and trends in organizational research. Non-response bias may have an impact on the survey results, and in the future, more consideration should be allotted to following up with those that do not respond or sending the surveys at different times of the day. Seven parents added optional thoughts to an open response question, providing supplementary insight into their opinions for future expansion or improvements to the program. Nine teachers in all content areas in both schools were asked to complete the pre and post surveys. All of the teachers completed the surveys and provided data that informed the evaluation. In addition, 100% of the teachers participated in the focus groups; this provided a broad base of data and validated much of the data collected by the other tools. One administrator and technology staff member from each school were interviewed. This provided full representation of the programs and provided statistically well-founded data collection.

Administrator interviews added to the context evaluation by providing data concerning the schools' goals for the 1:1 programs, the technology and curricular goals, the grade levels implementing the program, and the specifics of the programs. The assistant principal at Auburn Village School was interviewed to reduce bias because the principal of Auburn Village School is the author of this research. Auburn Village School is in its first year of implementation and focused on grade 6. The students do not take their laptops home overnight.

Auburn Village School's assistant principal explained that the 1:1 program was instituted as a response to teachers' repeated complaints regarding insufficient technology resources for their classroom needs. She explained, "In all honesty, the teachers complained that there was not enough technology to go around. At times, there was infighting and competition for the machines" (M. O'Rourke, Personal Communication, June 6, 2016). She noted she would have preferred that the intention of the program was for student learning or flattening the world, however, the decision was, in fact, attributable to the demand for additional technology resources by the teachers. She added, "Technology was very difficult to organize and plan due to availability. Teachers often did not plan for use of technology because of lack of equipment" (M. O'Rourke, Personal Communication, June 6, 2016). The teachers wanted the access to real time information, and putting a Chromebook in the hands of every student solved that problem. Candia Moore School's administrator shared that their goal was to increase student achievement. He stated that the objective was to see the Chromebooks become the learning tools that textbooks and notebooks had been in the past. The problem that the program aimed to solve, however, was to increase the access to technology with a limited budget. He stated, “We had piloted technology on carts, and the teachers reported an increase in student participation and motivation. This prompted the teachers to increasingly integrate technology in their lessons. Since we could not afford the more expensive machine, we looked to the Chromebooks to solve our problem both economically and for student learning” (R. St. Cyr, Personal Communication, December 12, 2015). Ultimately, both schools identified the need for more access to technology, and discovered an economic solution that would permit 1:1 coverage.

Both administrators shared that their biggest apprehension concerning the laptop program was the appropriate use of the computers by the students. The Auburn Village School assistant principal noted, “It is the responsibility, both in care and use. Students need to be taught appropriate usage and why. They need to learn the dangers and the good.” However, the Candia Moore School principal shared that his other second largest concern is the necessity to keep pace with technology innovation, a budget busting process. He reflected, “It is a major challenge to consistently make the right decisions regarding which equipment to choose to facilitate learning for our students. We do not want to hold them back by making the incorrect choice.” In fact, the Candia Moore technology director related, “It is really exciting to see a classroom full of kids using the devices and it really frees up the rest of the technology and allows us to distribute the rest of the machines to the classrooms that are not participating” (D. Roma, Personal Communication, June 3, 2016). He added, “One of our challenges is that we have so much technology in the building that it is tough to acquire more because we just have so much. Because of the amount of technology, it is difficult to justify to the school board that we need more devices because they are more technologically advanced."

The administrators of each school noted that funding and school resources have a major impact on the implementation and sustainability of the 1:1 computing initiative. At both schools, the school boards supported the technology programs and expressed interest in continuing the programs. The Candia Moore School principal shared, "Our ability to be successful in setting up the program has been due to the incredible support we had from the school board. They provided us the resources to acquire technology and improve infrastructure with full support of every school board member." Much of this commitment has to do with the affordability and durability of the Chromebooks. Infrastructure, however, is an ongoing challenge. The Candia Moore's student focus group raised Internet connectivity issues that occurred in many of the classrooms. Auburn Village School's student focus group (2016) did not indicate any connectivity issues, but did note the inability to access many of the websites due to the filter employed by the school. The three out of the five Auburn Village School teacher focus group (2016) members also conveyed the frustration of being restricted by banned websites. Technology staff at the Auburn Village School expressed the willingness to unblock sites when requested, however, teachers felt that the additional step of submitting the sites prior to lessons prevented the students from using websites creatively and with spontaneity. Candia Moore School teachers did not mention having similar issues; however, their students noted that the filter often slowed network connectivity (Candia Student Focus Group, Line 394, 2016).

The small size of both schools offered advantages in the implementation of the 1:1 program. First, the schools required fewer laptops to purchase leading to manageable upfront costs. Secondly, implementation of both initiatives was made easier due to the smaller groups of both staff members and students. Lastly, the challenge of transforming the culture into a 1:1 laptop school was less complicated because fewer staff needed to be trained and supported. The principals and technology leadership in both schools positively influenced the transformation by supporting the instructional changes and directing resources toward the 1:1 project. For instance, both the Auburn Village School assistant principal and the Candia Moore School principal noted that federal funds had been directed to purchase wireless adapters and additional laptops to reduce the impact on the general budget. Targeting grant money toward the technology initiative facilitated the realization of the program. In addition, both technology directors expressed their commitment to building sound technology infrastructure to support the equipment.

The goals of the programs were similar as well. Strain on the existing technology equipment and the demand for just-in-time use led to the urgency to acquire additional technology and move in the direction of one-to-one computing. Both schools expressed the need to streamline the use of computers. In fact, both schools' administrators, technology directors, and teachers explained that the lack of technology made using it more difficult due to having to schedule and plan for it. The ease of immediate accessibility to the equipment simplified the act of teaching. The teachers at both schools were receptive to the students using technology for various learning activities. Both environments were ripe to move forward with the initiative.

Input

The Input section shares the technology staff and administrator surveys as well as the student and teacher focus group results. The guiding Input component questions of this CIPP evaluation are "How satisfied are teachers and administrators with the type and amount of support provided?” and, “Are school/district resources sufficient for sustaining the 1:1 infrastructure?” The data collected from this section is highly reliable since 100% of the ten teachers participated in both the surveys and focus groups.

The interview and focus groups were coded and two specific sub-themes were identified more frequently than others. These were:

- professional development
- classroom implementation

The sub-theme of professional development was further broken down into useful activities and need areas for supplementary training.

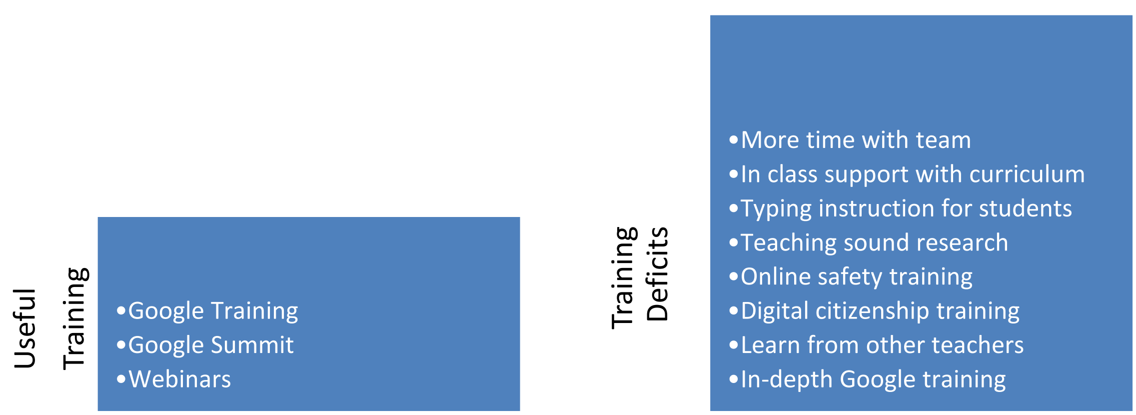

Figure 4-1. Teachers’ experiences of professional development.

Professional Development

An evaluation of the adequacy of teacher training prior to the program implementation was performed by assessing the professional development experiences provided to teachers regarding how to effectively implement 1:1 computing in the classroom. According to the Bill & Melinda Gates Foundation in their 2015 report, Teachers Know Best, a majority of teachers do believe that data and digital tools make them better teachers (Bill & Melinda Gates Foundation, 2015). The difficulty is that there are so many tools from which to choose, and they do not know which ones are effective. The study noted that most teachers choose products recommended by the people they trust most, with 56% of them relying on other teachers and 47 % relying on the principal or other school administrators, only 37% choosing products on their own (Bill & Melinda Gates Foundation, 2015). Results are from this national survey are in-line with much of the data collected in this evaluation.

Useful activities. A post teacher survey and focus group questions were used to evaluate what professional development activities were most useful. In the survey, open response questions indicated that teachers largely felt that the Google themed conferences and summits they attended were beneficial. Three out of the ten teachers cited that they were introduced to tools that they were not familiar with and taught how to use them. The Google trainings were skill-based and involved using Google docs, spreadsheets, and slideshows. The teachers also conveyed that they still needed additional training that was focused more on how to implement the technology rather than how to use it.

Need areas and supplementary training. More time with team members was identified as a need by three out of the ten teachers. One of the teachers stated, "I would like to share and learn from other teachers in the building. The technology conference was great, but I wish we had more time to unpack everything we learned as a team" (Teacher Post Survey, 2016). The teacher focus groups identified a desire for support throughout the school year. One of the teachers expressed a need to take some of the curriculum ideas and show how the laptops can make the activities more engaging for the students. She stated "The professional development activities that worked best were those that introduced us to the software, gave us time to work with the software for a month or two, and we then reported back with all of our successes/failures and used that momentum to drive further professional development" (Candia Teacher Focus Group, Line 176, 2016). Another teacher articulated, "I had some great ideas about what we could do for the Geography Fair, only to find out there were just too many steps to it. I thought about using Epals so they could communicate with a student from their country, but then I realized that our students do not have email accounts" (Auburn Teacher Focus Group, Line 235, 2016). Again, this evaluation data conveys that teachers require additional time to work through the infrastructure requirements and evaluate the effectiveness of the tool before employing them in the classroom.

In line with the Bill and Melinda Gates Foundation (2015) study, teachers felt they could have used additional time with colleagues to work on training and integration into curriculum areas. Although the teachers felt that the Google training was very beneficial, the sharing of resources and ideas with other teachers and leaders would have enhanced their knowledge. During the discussion about professional development, one of the teachers expressed the need for students to improve their typing skills. Another felt that she needed more training on how to teach digital citizenship to her students.

Overall, the data demonstrated that the teachers sought guidance from their colleagues and administration regarding choosing the right tools for classroom instruction. Interestingly, the Bill and Melinda Gates Foundation (2015) study also reported that when teachers look for digital tools on their own, they are significantly more likely to find those tools available and sufficient to meet their needs. Based on these findings, future professional development should be designed to provide the opportunity for teachers to learn about various digital tools and then work with their colleagues to determine if these tools or others might be beneficial in their individual classrooms.

Classroom Implementation

Classroom implementation was a recurring theme in both the teacher and student focus groups. Overall, both the teachers and students felt that the equipment was distributed without any issues, and the Chromebooks were suitable to accomplish the majority of required tasks that were required. Both the students and teachers agreed that the Chromebooks were easy to use, reliable, and quick to load. Concerns centered on the discipline for off-task behavior and stricter enforcement of proper digital behavior. One student mentioned, “Some people played games and ended up with high disciplinary action, but then they get it (Chromebook) back and just do it again.” Another student noted that, “these students used educational sites for non-educational reasons.” Off-task behavior was an issue that needed to be addressed and the teachers, students, and technology directors at both schools felt that increasing the consequences for inappropriate use and damage to the computers could curtail this activity.

Overall, both administration and staff acknowledge that the financial and technology support are adequate to sufficiently sustain the 1:1 initiatives. Both school boards are supportive and continue to fund the expansion of both programs. Both Auburn Village School and Candia Moore School technology staff have identified connectivity issues and have budgeted to increase the wireless coverage in both schools. The filter remains an issue at both schools; however, the technology staff cite The Children's Internet Protection Act (CIP), passed by Congress in 2000, which requires public schools that receive broadband access at a federally discounted rate to protect young people from online content that is obscene or otherwise "harmful to minors." They can manually unblock some sites, but agree that this additional step does impede the spontaneous needs that often occur in the classroom (Technology Staff Survey, 2016).

Overall, the Inputs at both schools were adequate to support the 1:1 initiatives; however, as the programs continue or expand, several matters must be addressed. The first is the professional development of teachers. Three out of the ten teachers expressed the need for more time to work with other teachers on ways to implement the technology into their instruction. A lead teacher or technology integrator could debrief with teachers on areas of technology need and then work with them on implementing new technology tools. From there, areas such as digital citizenship, research skills, and typing would be woven into their curriculum. Reflecting findings from the Henrico County, Virginia Public School's Laptop Initiative (Mann, 2008), Auburn and Candia students and teachers expressed difficulty in enforcing their school's acceptable use policy. Students, especially, were frustrated with others who did not adhere to suitable behavior when using the Chromebooks, and, many times, the devices were not utilized because of this behavior. Procedures for inappropriate behavior and consequences should be reviewed for adequacy and effectiveness. Disciplinary policies should reflect individual accountability and clearly state the consequences. Misuse of the hardware should be tracked, and if repeated, policies should be reviewed. Possible solutions include instituting an insurance fee for utilization or charging a replacement fee for the equipment if purposefully or carelessly broken or otherwise used irresponsibly. Interestingly, equipment damage was not cited as an issue; however, as the program expands to additional grade levels, it could become a problem. A proactive program that provides insurance coverage can protect the schools' investment and prevent them from incurring extra costs from damage or loss of the devices.

Process

In the Process evaluation research, frequency of laptop utilization in the classroom and the purpose for the use, such as collaboration, assessment, project-based learning, and web-based research was examined. This section also investigated the teachers' perceptions of their skills, and their actual implementation in the classroom as well as both students' and teachers' engagement in the learning activities.

Frequency of Use

Data was collected through teacher pre and post surveys, student experience sampling, observations, and student focus groups. Teacher pre surveys indicated that only 10% of the teachers used the technology in their classroom every day. That usage rose steeply to 60% after the 1:1 laptop program was introduced. The teacher post survey results showed that 60% of the teachers perceived that they asked their students to use their laptops every day in their class. Teachers that allowed students to use their laptops a couple times per week totaled 20% (Teacher Survey, 2016).

Student experience sampling (Appendix A) was performed when students were using the computers; however, to determine the frequency of technology use, a classroom observation of each teacher was conducted. Each observation lasted approximately 5 minutes. Field notes were used to collect the data regarding individual classroom use during the school visits. Ten visits were made to both the Candia Moore School and the Auburn Village School. Each visit was comprised of an observation of all classes and occurred during various stages of the class (i.e. beginning, middle, and end). At the Candia Moore School, only one visit demonstrated the computers being used in the math classroom. The lesson was targeted to the majority of the students, and the higher-level students were using the computers to complete more challenging material. At the Auburn Village School, computers were never observed being used in the math classroom. Out of 10 visits to five different classrooms at the Candia Moore School, for an aggregated 50 classroom visits, computer use was observed 20% of the time. At the Auburn Village School, which totaled 10 visits to 4 different classrooms totaling 40 separate classroom visits, computer usage was witnessed 50% of the time. The usage percentage was impacted by testing (computer-based), field trips, and culminating projects that transpired at the end of the school year. Auburn Village School had testing much of the time the observations were performed, directly affecting computer usage. During the observation, the non-computer use consisted of students watching videos or a novel being read aloud to the class. In math class, however, non-computer activity consisted of working through math problems from the textbook. None of these activities would have been enhanced by the use of a Chromebook.

Purpose of Computer Use

The purpose of the computer use in the process sections focused on data garnered from the student experience sampling (Appendix A), the teacher post survey (Appendix B), teacher focus group interviews (Appendix D) and the administrator interviews (Appendix C)**.** The student experience sampling generated a large amount of data regarding the use of the computers in the classroom. At a randomly selected time, each student in a given class was asked to “freeze” and take a quick survey that in essence provided a “snapshot” of their current experiences (Appendix A).

At the Auburn Village School, 75 sixth graders took the experience survey in various classes. Some students took the survey ten times depending on their class schedule. Students that were not using the computers were not asked to take the survey, and field notes were taken to note the classroom activity. Two hundred and twenty-five responses were obtained from students involved in activities using the computers.

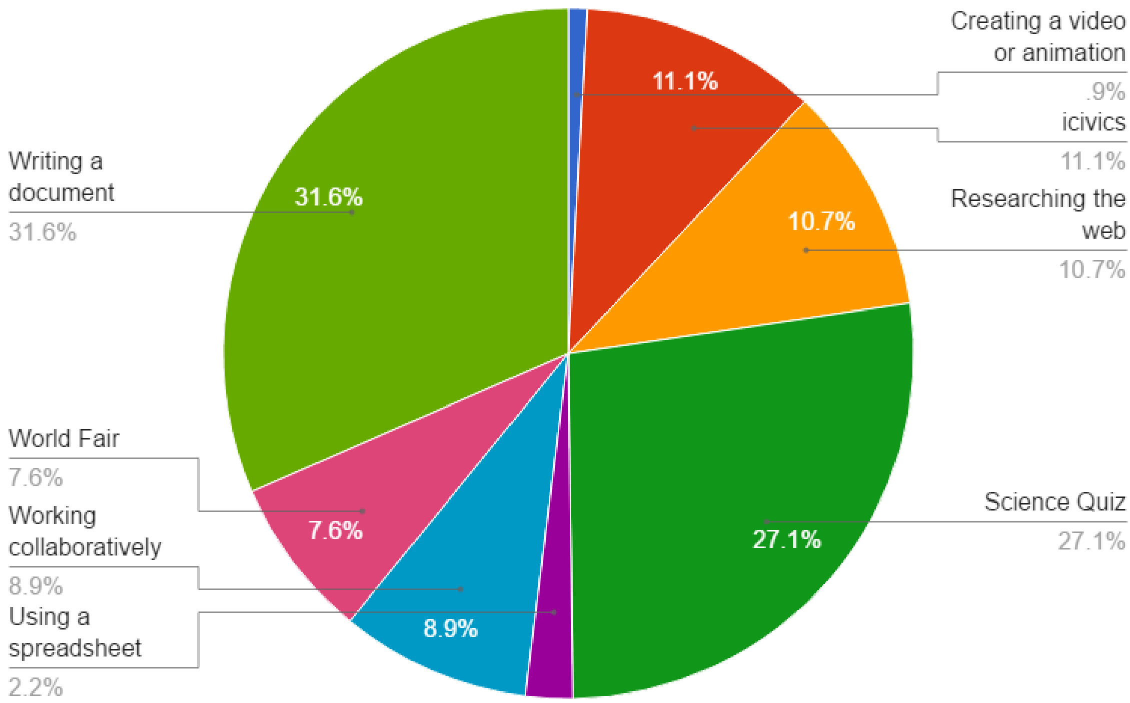

Figure 4-2. Auburn student experience survey results regarding how student is utilizing the technology at one point in time.

The most common activities students reported working on at the time of the "snapshot" were: writing a document (31.6%) and working collaboratively (8.9%). A science quiz accounted for another unusually high task rate at 27.1%. This quiz was created in Google Docs and students were able to use their notes to answer questions that were administered over 2 days. The ultimate use was as a word processor, causing the writing a document percentage to 58.7%. Researching the web and the World Fair were also closely linked. Field notes and observations proved that the students were researching and preparing a Google Presentation for a World Fair that was scheduled the next week. Many of the students were researching different countries and cultures, and reported that they were contemplating about what it would feel like if they lived in that particular country. One student reported, "I need to download my Google slides on my iPad so that I can display the super cool slideshow I have at the world fair.” Another student conveyed, “I was thinking about my wildlife of my country and how I was going to make the reader engaged about my country.” Sixteen students reported that they were creating and printing an image. Icivics, used by 11% of the students, is a web-based tool created by Chief Justice Sandra Day O’Connor to inspire students to be active participants in U.S. Democracy.

At the Candia Moore School, 80 seventh and eighth graders took the experience survey at 10 different intervals. Students that were not using the computers were not asked to take the survey, and field notes were taken to note the classroom activity. One hundred nine responses were obtained from students involved in activities using the computers.

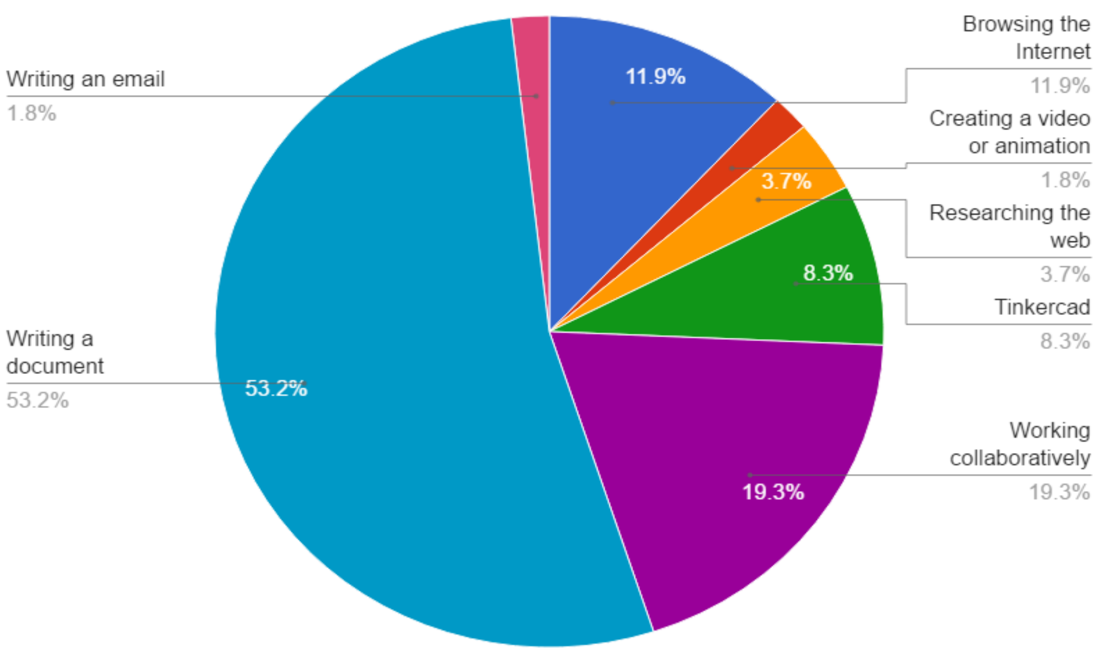

Figure 4-3. Candia student experience survey results regarding student technology utilization at a point in time.

The most common activities students reported working on at the time of the "snapshot" were: writing a document (53.2%), working collaboratively (19.3%), and researching and browsing the Internet (15.6%). Data from the field notes and observations indicated that 8.3% of the students reported using a website called Tinkercad. Tinkercad is a browser-based 3D design and modeling tool that allows users to imagine anything and then design a 3D model in minutes. When asked what they were thinking about during the activity, one of the students reported, "How big our earthquake resistant building is going to be and what materials we will need." Another student reported, "I was trying to think of a good supporting detail for my claim that competitive eating is dangerous."

Word processing was a highly utilized technology tool observed in classes at both schools. At Auburn Village School, Google Presentation was used consistently; however, this can be attributed to the timing of the classroom visits. One class that was involved in a month-long project used the presentation tool nearly every class period. At the Candia Moore School, the students used the web based 3D design program for a long-term project that caused the experience survey results to favor that category.

The third most highly used task was the working collaboratively category. Field observation notes shed light on the details of the "working collaboratively" category. At the Candia Moore School, in 8th grade social studies and language, students were working on a video project in groups. The project entailed creating a video representing a decade in American history. The students had to highlight the music, movies, and events of that decade and compare it to life in 2016. This assignment involved peer editing an essay as well as creating the script that supported the documentary. It is important to note that this activity aligns with recommendations in the

2016 National Education Technology Plan (U.S. Department of Education, 2016), builds upon research presented by Project Tomorrow (2015), and outlines the importance of using technology to enable students to personalize their learning through active and collaborative learning activities (ISTE, 2009). At Auburn Village School, however, students were given a choice in how they wanted to present their knowledge such as website, slideshow, or essay. Unlike Candia, they worked on the project individually, rather than working collaboratively. The NETP (U.S. Department of Education, 2016) elaborates by encouraging teachers to design instruction that supports student voice and choice in the design of learning activities and the means of demonstrating learning. Moving forward, teachers could gain insight from technology professional development to push their integration to the next level. They can learn to use technology in a more meaningful instructional way. By giving students an option to choose which technology to use, it encourages the teacher to examine the purpose of the activity. This builds upon Vygotsky's belief that when a student is at the Zone of Proximal Development for a particular task, providing the appropriate guidance or scaffolding will give the student enough of a boost to achieve the task (Vygotsky, 1978). Bruner (1996) created the word, scaffolding, to describe the type of assistance offered by a teacher or more competent peer to help a student master a concept that the student is initially unable to grasp independently. Eventually, students will begin to think about their use of technology and evaluate which tools best meet their needs and goals. Since they are aware their peers will see their work, they are more enthusiastic and motivated. The idea is to relocate the teacher from the traditional stage in the front of the classroom to beside the students who are constructing their own knowledge, engaging in long-term meaningful projects (Means et al., 1993). The strategies of collaboration and student choice used together are important approaches to advancing the technology integration to the next level.

During the experience survey observations, the content area which students used technology the most infrequently was math. In fact, after twenty visits to two different math classrooms, no students were observed using their laptops. In line with this trend, Auburn students, interviewed during the focus groups, reported that in math, the computers were not used as much, but if the teacher did use hers, “she was checking emails.” Students also reported that in general, they liked taking tests on the computer, however, “math tests are much easier with pencil and paper than with the computer” (Auburn Student Focus Group, 2016).

Possible reasons for the lack of computer use in math programs may be the strict adherence to a math program and textbook. I reached out to both teachers to clarify the reasons for the lack of technology use in math. One teacher conveyed that, although teachers want to use the technology, they struggle with how it fits into the program they are required to teach. “The textbook does not require a spreadsheet to teach any skills at my level, therefore I would not have time to use it. I do use Khan Academy to reinforce skills for certain students or extend the learning of the higher achieving students” (Teacher Focus Group, 2016).

Interestingly, the position of the National Council of Teachers of Mathematics (NCTM, 2015) concerning the role of technology in the teaching and learning of mathematics, is that it is essential that teachers and students have access to technology that advances mathematical sense making, reasoning, problem solving, and communication. The position statement describes the importance of programs in teacher education and professional development continually updating practitioners' knowledge of technology and its application to support learning. The NCTM (2015) reinforces the significance of teaching practitioners to develop mathematic lessons that integrate digital tools in daily instruction, and to understand the potential technology has to impact students' understanding and use of mathematics (Nelson, Christopher, & Mims, 2009; Pierce & Stacey, 2010).

Teacher Perception of Use

Ten teachers were asked to indicate how often they asked students to perform various activities using their computers. The activities were web research, online collaboration, student online discussions, adapting activities to individual needs, creating a test online, web-based simulations, and student-created audio or video recordings. The majority of teachers indicated that they asked students to conduct research using the Internet and online student collaboration a couple of times per week. Five out of the 10 teachers indicated that using the computer, they adapted an activity to a student's needs every day. The two math teachers were the only teachers that reported they never used the computers for online forums, simulations, or audio and video recording. Both language arts teachers and the two science teachers reported that they used the computers to adapt an activity to meet their students' needs. The social studies teachers were split between every day and a couple of times per week.

Table 4-2.

Teachers' perception of frequency of use

	Student RESEARCH using the Internet	Student COLLABORATION ONLINE to create a product	Student participation in online discussion	ADAPTING to students' individual needs	TEST or QUIZ for students	Student use of SIMULATIONS	Student creation VIDEO and/or AUDIO
Everyday	0	0	1	5	0	0	0
Couple times per week	8	6	2	2	2	3	2
Once a week	0	1	2	2	3	2	3
Occasionally	1	2	3	1	5	3	3
Never	1	1	2	0	0	2	2

Teachers' Perception of their Skills

The post teacher survey asked teachers to rate the following statement "It is challenging to integrate computer activities into my lessons." Three out of the ten teachers agreed with that statement, five disagreed with the statement and two strongly disagreed with the statement. The two math teachers and one social studies teacher agreed that it is challenging to integrate technology into their content areas. The remaining seven teachers, four from Candia and three from Auburn, did not perceive difficulty in technology integration in their subject matters.

The teacher focus group results were analyzed to determine how their teaching changed as a result of the laptop program. All teachers believed that their teaching had changed for the better because of the program. The majority of teachers cited the ability to personalize their instruction as the biggest transformation. The teachers are now able to offer reading passages based upon student Lexile levels. Helping students who struggle has become easier because of tools such as text to speech, and typing versus handwriting.

Legibility is no longer a hindrance, and student revisions are more prevalent than they were when students handwrote their assignments. One teacher stated, “Something that I always struggled with is differentiation, without making it obvious.” This teacher explained that the students realize who the high performing individuals are, especially in such a small school. Technology now allows her to differentiate and modify her assignments for her lower achievers without anyone else in the class realizing there is a difference in the assignments.

Four out of the ten teachers believed they were able to provide more immediate feedback on student assignments. The ability to comment on a Google document and chat with the student while they are working on the document was deemed helpful. Teachers mention they can be at home and chat with the students about their work while they are doing homework. One of the ten teachers, the Auburn language arts teacher, felt that her role moved from a teacher to more of a facilitator. She believes that her direct instruction has decreased, and her role as a *guide on the side* has grown (Auburn Teacher Focus Group, Line 200, 2016).

The Candia Moore School mathematics teacher noted, “Students have information at their fingertips. Students enjoy typing assignments and this allows them to do so without having to fight with other teachers (for the laptops). We are also able to easily create large projects for the students and break them down into small chunks as needed” (Candia Teacher Focus Group, Line 84, 2016). Further investigation clarifies that assignments are not given all at once, but broken down and given at intervals so as not to overwhelm or confuse the student. Math assignments are given in sections that build upon each other.

Looking more in depth at the focus groups results, the theme of making tasks and responsibilities easier became prevalent. Teachers made remarks to indicate that feedback frequency has improved. However underlying this statement, were comments such as “I can provide support from home if I am online.” There was no reference to the quality of the feedback they were able to provide; just that it was more effortless. Other teachers made comments that having the 1:1 laptop program made using the technology more straightforward as they did not need to plan ahead to use a shared cart. A few of the teachers felt that they could personalize their lessons more easily using Google classroom and assign appropriate reading passages without having to copy and distribute. Again, the theme of ease was more prevalent in the focus groups’ discussions than the theme of improvement in teaching strategies. However, as presented in the literature review, educational technology is a variety of modalities, tools, and strategies for learning (Tamin et al., 2011, Ross, Morrison & Lowther, 2010) and it depends on how well it helps teachers and students achieve their instructional goals. The fact that the technology is being implemented purely for easing existing minor struggles is evidence that these two 1:1 programs have fallen short on their impact on student instruction and must provide better support to teachers to enable them to more meaningfully integrate the technology.

The need for more professional development (determined in the Input Evaluation) is the solution for pushing the teachers to the next level of technology integration. To enact the vision of connected and creative learning with technology, the NETP (U.S. Department of Education, 2016) states, “we cannot expect individual educators to assume full responsibility for bringing technology-based learning experiences into schools. They need continuous, just-in-time support that includes professional development, mentors, and informal collaborations" (p. 25). The outcome of simplification of teaching responsibilities is not enough to support the cost and development of a major initiative such as a 1:1 laptop project. "Teachers no longer need to be content area specialists; however, by understanding how to assist students access online information, engage in simulations of real-world events, and use technology to document their world, educators can help their students examine problems and think deeply about their learning" (U.S. Department of Education, 2016, p. 28).

Student Engagement in the Learning Activities

The Process evaluation explored the question of student engagement in a lesson that used technology. In a recent paper titled "Unleashing the Future: Educators speak up about the use of emerging technologies for learning" (Project Tomorrow, 2015), teachers report that technology increases factors of student engagement, both academic and social. The reported outcomes of increased access to technology in classrooms improves aspects of student engagement, such as taking initiative and responsibility for learning, using resources wisely, time on task, having interest and desire to pursue information, and learning in and beyond classrooms. In the experience sampling survey at the Auburn Village School, 84.4% of the students reported that they were engaged or somewhat engaged in the activity they were conducting. At the Candia Moore School, 73.5% of the students reported that they were engaged or somewhat engaged in the computer activity they were performing. Sixty percent of the students at the Candia Moore School reported that they enjoyed or somewhat enjoyed the activity they were working on, while 72.8% of the students at the Auburn Village School reported that they enjoyed or somewhat enjoyed the activity they were working on. These results mirrored the student focus group interviews that conveyed that students were happier and more interested when they were able to use their laptops for an assignment. During these interviews, students expressed that they enjoyed using the Google Apps tools such as Docs and Slideshows. One student declared that taking open notebook tests were much “easier” on their Chromebook than on paper. In general, all students felt as though they were engaged with the technology, and using it made their classwork easier, especially when taking tests. However, in contrast, students preferred to take a math test with pencil and paper rather than on a computer.

Results were lower for the students’ opinion on whether the computer task was challenging and meaningful. Both schools had results lower than 35% when asked if the technologically enhanced task was challenging. This could be the result of the computer making it easier for the students to get the work done, or it could reflect that the higher engagement in the task causes the student to feel that it is easier. When questioned on whether the task was meaningful, 41.3% and 55.8% at Candia and Auburn, respectively, felt as though it was important to them. Respondents could have interpreted meaningful in a number of different ways, whether it was meaningful to them or meaningful in terms of their grade. However, of the Candia Moore responses denoting a personal choice in their activity, all but one response indicated that it was meaningful. The Auburn Village School responses indicating a choice in activity revealed a 56% response that the activity was meaningful. This data may be indicative that the actual activity has more meaning than the technology use and supports the literature review research that advocates that student engagement is more about the instructional design than the tools used to accomplish it. Project Tomorrow’s (2015) survey results characterize present day students as deeply interested in learning that is socially based and collaborative, and is untethered from the traditional constraints or limitations of education institutions, and learning that is digitally rich in context and relevancy (p.16). These findings uphold the premise that both schools must provide further training in the area of instructional design using technology.

Higher results were obtained when the students were asked if they were concentrating while involved in the specific task. Table 4-3 illustrates that the majority of students in Auburn and Candia felt as though they were concentrating throughout the task. The students' level of engagement seems to correspond with the level of concentration used in accomplishing the task. A majority of students also conveyed that they felt skilled in their charge and were not intimidated by the technology required to complete the task.

Table 4-3.

Experience Survey Sampling

	Candia	Auburn
Did you enjoy the activity? Extremely and somewhat enjoyable	60%	72.8%
How engaged were you in the activity? Extremely and somewhat engaged	73.5%	84.4%
How challenging was the class activity? Extremely and somewhat challenging	32.1%	25.4%
How skilled were you at the class activity? Extremely or somewhat skilled	67.9%	76.9%
Was the activity meaningful to you? Extremely or somewhat meaningful	41.3%	55.8%
How much were you concentrating? Very hard or somewhat hard	69.7%	83.6%

The theme of ease and convenience emerged again in the experience survey results. Students reported that because the technology was readily available, they were able to access the most up-to-date information quicker and easier than before. This may be why they reported that the activities were not as challenging. Layering technology over traditional assignments may be producing less challenging tasks, underscoring the need to design 21st century lessons (U.S. Department of Education, 2016). Since the technology breaks the traditional passive learning mold, the classroom teacher must move toward becoming the encourager, advisor, or coach. As reported in the NETP (U.S. Department of Education, 2016), "Technology can help organize learning around real-world challenges and project-based learning using a wide variety of digital learning devices and resources to show competency with complex concepts and content (p.11).” The plan cites a traditional research report read by only the teacher and a small group of classmates, to publishing the findings so that feedback is received from members of communities of practice around the country. Students become more responsible. The technology helps students take more control over their own learning. They learn how to make their own decisions and think for themselves.

In general, the majority of students reported that they were engaged, concentrating, and skilled in the assignment using technology. The lower percentage of students that found that the lesson was meaningful and challenging could be the result of traditional instruction layered on top of the technology making the activity even easier. Further research should be done focusing on the types of tasks the students were required to perform to determine if the assignment was sufficiently rigorous and connected to make it more challenging and meaningful to the student. Additional questioning could determine whether the technology was the primary factor keeping the students engaged and able to enjoy their lesson or if the task they were engaged with was the driving force.

Table 4-4.

Teacher perceptions of student use of technology.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
S: interact with each other more.	12.5%	75%	12.5%	0%	0%
S: meet learning objectives	37.5%	50%	12.5%	0%	0%
S: actively involved in their own learning.	62.5%	37.5%	0%	0%	0%
More open communication between S and T.	37.5%	50%	12.5%	0%	0%
S: more productive.	12.5%	87.5%	0%	0%	0%
S: better able to understand content.	12.5%	87.5%	0%	0%	0%
S: more initiative outside of class	12.5%	37.5%	37.5%	12.5%	0%
S: writing quality is better.	37.5%	37.5%	25%	0%	0%
S: in-depth research.	0%	62.5%	37.5%	0%	0%
T: work harder at their assignments.	0%	62.5%	37.5%	0%	0%
S: students revise their work more.	14.2%	42.9%	42.9%	0%	0%
T: individualize instruction.	50%	50%	0%	0%	0%
S: quality of students' work increases.	37.5%	50%	12.5%	0%	0%
S: more organized	25%	75%	0%	0%	0%
S: more engaged.	62.5%	37.5%	0%	0%	0%

Notes. S Students, T Teachers, table able represents the teachers' perceptions of the impact of the 1:1 device on students.

Overall, the evidence reveals that the teachers' perceptions of the students' use of technology was overwhelmingly positive. In the teacher post survey, only one of the teachers disagreed with the student performance statements. The majority of teachers felt as though the students interacted with each other; were better able to meet learning objectives; and were actively involved in their own learning. The bulk of teachers also noted the students were more productive, more organized, more actively engaged, and were better able to understand content when using their laptops. Teachers believed their instruction was enhanced by the ability to facilitate more open communication and individualize their instruction. The teacher focus group substantiated this result with one of the teachers claiming, “Instruction is easier to differentiate as I can readily find reading material suitable to the wants and Lexile needs of my students. I’m able to quickly generate higher order thinking questions on documents, as well as model/scaffold instruction.” Another teacher stated, “It is a quicker means to providing feedback to students (it was actually more difficult for quite some time, but now that I’m familiar with the process I can move at a much quicker speed).” Sixty-two percent of teachers agreed that the students worked harder on their assignments and did more in-depth research; however, 37.5% neither agreed nor disagreed with these statements. Half of the teachers perceived the students did not take more initiative outside of class time when using the computers. When writing quality and revision of work was surveyed, 87.5% of the teachers felt that the students demonstrated a higher quality of writing; however, 57.2% felt as though they revised the work more. In general, 87.5% of the teachers believed that the students’ work was of higher quality when using the Chromebooks.

The results of the student focus group and experience survey indicate that the students view technology as more ubiquitous than the teachers do. They did not indicate that the work they were doing was extremely challenging. Further research should analyze whether or not the increased engagement that the students perceived caused them to feel as though the assignment was easier and less challenging. The teachers, on the other hand, also noted that the students were more engaged while using technology, but questioned if the students worked harder and produced work of higher quality. From the teachers' perspective, the 1:1 program appears to be an overall success in terms of student outcomes. They experience more student engagement, improved student organization, increased communication, higher quality writing, and in-depth research. Students also report that their experience in the 1:1 program is considerably positive, aside from their work being somewhat less challenging.

Product

The product section addressed the first guiding evaluation question: What is the effectiveness of the 1:1 devices in improving the student and teacher experience with respect to learning and instruction? The product element examined the degree to which the participation in the 1:1 classrooms changed or influenced students' technology skills, their development of 21st century skills, and their ability to engage in deeper and more meaningful learning. The primary focus was to determine which activities the students accomplished using the computers, and consider whether these activities were centered on problem solving, collaboration, and creativity rather than traditional methods. This section also concentrated on determining the change or influence the 1:1 devices had on teachers' instruction and pedagogy. The final part of the product section focused on the sustainability of the project, and examined whether the program should continue and, if so, which improvements are needed when the devices are rolled out to other grade levels. Data for this section was collected using teacher focus groups (Appendix D), teacher post survey (Appendix B), student experience sampling (Appendix A), and student focus groups (Appendix F).

Student Technology Skills

Student technology skills were evaluated via the students' own reflections in the experience survey (Appendix A) and focus groups (Appendix F) as well as teachers' perceptions in the post survey (Appendix D). When asked if they were skilled at the class activity using the Chromebooks, 77.1% of the students at Auburn Village School felt they were extremely or somewhat skilled at the task at hand while 71.9% of the Candia Moore students felt skilled. Field notes during the classroom observations showed that the majority of students were either researching information on the web, typing an essay, or answering open response questions in a content area. During one science class at Auburn, the class watched a video and then answered follow-up questions on a Google Doc. During science at the Candia Moore School, the students were using a 3-D online software tool to design different structures such as rooftop gardens, skateboard parks, and buildings to determine if they could withstand an earthquake. Digging deeper into the data, students who responded to the experience survey during that activity all responded that they were somewhat skilled in what they were doing.

The Auburn Village School student focus group validated that the students felt confident conducting research using the Internet. The students also indicated their word processing skills had improved, as one student reported, "I was very bad, but now I am a lot better. I got a lot better." The Candia Moore students concurred that the skills that have improved were largely word processing and Internet research, as well as web page design. One Candia student remarked,

> Word processing? We really never had to type, the work we did we didn't type-I wrote really bad and was bad at typing and now I am much better at typing faster, I don't have to work as hard. We are much better now at typing than we were before, we don’t type correctly, but we type fast. We don’t seem to have to work as hard with the Chromebooks (Candia Moore School, Student Focus Group, 2016).

The Candia Moore School has a specific course called Media that offers a web design component. Students at both schools reported that they very rarely use spreadsheets in their classes. The Auburn Village School students stated that they have also improved their skills in developing slide presentations while the Candia Moore students related that slide presentations were not a part of any of their classes. The Auburn Village Students noted that many times they take pictures of the notes in their Science class and insert and crop them into a document. Only one student at Auburn Village School noted that they used any kind of photo or video editing tools. None of the Candia Moore School students reported that they used any editing tools at all. One student at Auburn Village School chose to do a web page for one of their projects and she learned to do it on her own.

The teacher post survey and focus groups revealed that the teachers overall felt that students would benefit from more typing instruction. They identified that the lack of typing skills caused projects to take longer than planned. Teachers also noted that students needed to be taught sound research techniques. One teacher reflected, “Students do not go deep enough when doing research. They search and report the first result they see.” Other teachers identified the need for digital citizenship training for students. They need to learn appropriate behavior online and understand that some people may misrepresent themselves online (Auburn Teacher Focus Group, Line 234, 2016).

In general, when asked if students' skills had improved with the implementation of the laptop program, four out of the eight teachers referred to the improvement of organization and editing skills. One of the teachers remarked, "When they are typing they are expanding more because the handwriting was also a big problem and because the editing was such a struggle, this [the computer] has made it easier for the students." Another teacher added, "And knowing that they know that we can go back and see what changes were made with the revision history is a plus."

Student 21st Century Skills

The 2016 National Education Technology Plan (NETP) states that to remain globally competitive and develop engaged citizens, our schools should weave 21st century competencies and expertise throughout the learning experience. The NET Plan (2016) defines this skill as the development of critical thinking, complex problem solving, collaboration, and adding multimedia communication through the teaching of traditional academic subjects. The Experience Survey (Appendix A) provided information about 21st century skills which was taken directly from the students' responses regarding the tasks they were engaged in during the classroom visit. The student and teacher focus groups provided some anecdotal information, which also aligned with the Experience Survey Data.

Table 4-5.

Experience Survey: Student tasks

	Auburn Village School	Candia Moore School
Browsing the internet	0%	11.9%
Creating a video or animation	.9%	1.8%
Creating an image	0%	0%
Researching the web	10.7%	3.7%
Using a spreadsheet	2.2%	.9%
Working collaboratively	8.9%	19.3%
Writing an email	0	1.8%
Writing a document	31.6%	50.5%
iCivics	11.1%	0%
Science Quiz	27.1%	0%
TinkerCad	0%	8.3%
World Fair	7.6%	0%
Organization Project	0%	2.7%
Music Writing Project	1.8%	0%

Critical thinking and complex problem solving. Students were not asked directly if they were using critical thinking skills while using the laptops, however, an overview of the projects gave some indication that, in some cases, the tasks involved higher order thinking skills. Many of the smaller categories demonstrated varied uses of the computers. About 27.1% of Auburn students were taking a quiz in science class about weathering and erosion. The quiz was on a Google Doc and did not require collaboration or inquiry type tasks. Another 7.6% of Auburn students reported that they were doing internet research and designing a physical poster board for a World Fair that was scheduled the next week. This task involved finding cultural information about a country and presenting that information in the form of a physical poster and a virtual tour via slide show or website. Again, restating the facts involved in this assignment does not support critical thinking. Another 11.1% of Auburn students were using iCivics which teaches students how government operates by having them experience it directly. The student takes on a role such as a judge, a member of Congress, a community activist fighting for local change, or the President of the United States. The student experiences many civic roles, and are given the opportunity to address real-world issues. The use of iCivics, which requires higher thinking skills, was the only task at Auburn Village School observed to require these skills.

Candia Moore students were engaged in a small amount of tasks outside of creating a document, Internet research, and working collaboratively. A small amount of students, 1.8%, were writing an email to their teacher for clarification of an assignment. About 2.7% of the students were using Google Docs to organize, schedule and write the sequential steps for a first grader to complete a science fair project. This required a high level of organization and problem solving and appeared to be challenging for many of the students. Lastly, 8.3% of the students were using the Tinkercad web-based 3D design tool. Again, this program required problem-solving skills to design a building that would withstand an earthquake.

Surprisingly, approximately 11% of students at each of the two schools were working on projects that entailed some component of problem solving and higher order thinking skills.

Collaboration. Collaboration is increasingly mentioned as an important educational outcome, and most models of 21st century education include collaboration as a key skill (U.S. Department of Education, 2016). While group work was observed at various times at both schools, the survey focused on the use of technology to work in collaboration. The main tools used in collaboration were the Google Apps for education where students could simultaneously work on a document. At the Auburn Village School, 8.9% of the students reported that they were working collaboratively while 19.3% of the Candia Moore Students reported working collaboratively. The data did not reveal whether or not the collaboration was in small groups, pairs, or whether the groups were student driven or teacher developed.

Multimedia communication. In order for students to be prepared for a more complex life and work environment, a 21st century classroom must promote creativity, critical thinking, communication, and collaboration (U.S. Department of Education, 2016). Technology tools that allow students to create with audio, text, and images provide an opportunity to build higher-order thinking skills. When students develop knowledge that is media-rich, they better connect to learning if they explore content while authoring a media-rich project. During the evaluation research, the Experience Survey identified only .9% and 1.8% of students at the Auburn Village School and the Candia Moore School, respectively, engaged in tasks using multimedia. It is evident from the observation field notes that students do not regularly access their content by using these tools. Further research is needed to determine the cause of the lack of multimedia use in the classrooms.

Student engagement and meaningful learning. Student engagement and motivation was a topic that was prevalent in the teacher and student focus groups, the experience survey, parent survey, and the administrator interviews. In the focus groups, one of the teachers shared that they believed that this program is critical for all students. She stated, “it provides development in technology for all students, increases engagement, and provides an opportunity for students to be responsible with school equipment.” Another teacher expressed “student learning has changed. I think it has been a positive thing. The program has been positive and student engagement has increased. Some of the students have actually produced an essay, which they had never accomplished before. Their writing has gotten better, and I have seen a lot of growth.” A Candia Moore teacher explained that her teaching has changed because the “students are more engaged when technology is used as a tool” (Candia Teacher Focus Group, Line 78, 2016). When asked to explain how her teaching had changed she commented, “I have students do more independent research and less lecture/notes than in years past. We also do more interactive activities as practice, rather than textbook practice. Most reflections and summaries come to me through Google Docs” (Candia Teacher Focus Group, Line 508, 2016). Teachers express that they are doing less lecturing and more facilitation.

The student focus groups did not reveal an increase in engagement, but did disclose that they like to do their assignments on the computer because it made their work easier. The student experience sampling did validate that the majority of students were engaged and enjoyed the activities that were presented to them using the Chromebooks.

According to Table 4-3, 84.4% of Auburn students reported that they were engaged or somewhat engaged in the activity. At the Candia Moore School, 73.5% of students reported that they were engaged or somewhat engaged in the assignment. The students also stated that they enjoyed undertaking the task on the Chromebook, with 72% and 60% of the Auburn and Candia students, respectively, disclosing that they extremely enjoyed and somewhat enjoyed the work in which they were involved.

As stated earlier, the low response rate for the survey is an issue with this data tool. Only 14% or 22 parents completed the parent survey, nonetheless, they overwhelming revealed that their children were more interested in doing their schoolwork when they used a computer. Overall, 77.3% agreed that their children showed more interest in doing their work, and 72.7% reported that the computer made it easier for their children to do their assignments. One parent stated, “I can see homework/schoolwork is much easier to do on a computer and faster.”

21st Century learning. Research and practice have lent support to schools in determining what students need to learn to enable them to compete in today’s globally competitive world. In order to remain competitive, 21st century competences such as critical thinking, complex problem solving, collaboration, and multimedia communication must be added into the teaching of traditional academic subjects (U.S. Department of Education, 2016). Through the student experience sampling, many of these experiences were documented, however, they were observed in isolation. For instance, Candia Moore School’s capstone project involved creating a multimedia presentation on a historical decade, however, students were observed working in traditional classroom groups all huddled around one device. In a Candia Moore School science class, students, working in partners, were using a 3-D program to design a house that was earthquake resistant. The lesson contained many critical thinking components; however, students were again in traditional teams hovering over one device. At the Auburn Village School, the activities and lessons that were observed were traditional lessons being done using technology. For instance, students were researching chosen countries and were charged with developing an argumentative essay and Google presentation to market that specific country. Other instances of technology use observed were taking notes, doing an online quiz, and writing an essay. These tasks are traditional activities, with the use of technology layered on top.

Teacher Instruction and Pedagogy

The 2016 NETP urges teachers to create compelling learning activities that improve learning and teaching, assessment, and instructional practices. It recommends using technology that facilitates development of skills such as inquiry, teamwork, and creativity. Teachers need to develop digital skills associated with implementing project-based learning with digital media and technology. The student and teacher focus groups, teacher surveys, and parent surveys provided data in the product category of teacher instruction and pedagogy.

Students were asked, “What has been the most helpful use of technology by the teachers since the laptops were introduced?” Students at Candia Moore School agreed that it was the connection with teachers that was enriched. One of them summarized the primary advantage as the ability to share using Google Apps: “It is a lot easier to get feedback from the teachers. We really like the sharing piece of Google. Google classroom is good for sharing the links, but it is not as good for getting feedback as

Google Apps." All the students at the Auburn Village School concurred that their teachers' instruction has improved because of the two-way communication that is supported by the use of Google Apps. All Auburn focus group students agreed that the ability to share a Google Doc and receive feedback was the biggest improvement in their classroom instruction.

When asked if their teaching changed with the addition of the laptop program, all teachers agreed that it had changed. The Auburn Village School teachers explained that they were able to easily and discretely differentiate their instruction using the laptops. One teacher elaborated, "You can poll the class in a matter of seconds to see who got it and who didn't. Something that I always struggled with is differentiation without making it obvious because the kids know who the high achievers are and who are not. You can create differentiation more subtly." One of the Candia Moore School teachers reported that their turnaround time for assessment of writing assignments "has been cut in half." Another teacher felt that he was able to give faster and more detailed feedback on student assignments. A third teacher stated that his students were able to do "more spur of the moment online research, simulations, use of design programs such as Tinkercad, and also use far less paper"(Teacher Focus Group, 2016).

Teacher surveys showed that the increase in the availability of resources adds value to their instruction. Many teachers felt that there was no need for hard cover or even online texts and more time sensitive material was used for instruction. One Auburn teacher stated, "Our time is much more effective. I cannot believe how much we are able to cover with the use of Google Classroom. I also strongly believe that students' work quality has greatly increased" (Teacher Post Survey, 2016). Increased availability of resources was a constant theme with the Candia Moore teachers as well. One teacher indicated, “Students will have greater access to information and activities so my role will become more of a mentor than the provider of information.” Another teacher commented that the multimedia resources added depth to the subject matter. While the abundance of resources that are there to supplement knowledge for students, there still lacks a change in the way students are learning.

It is important to note that the teachers’ positive attitudes toward technology were based primarily on their feelings that their instruction had improved. All of the teachers shared the perspective that the technology made their tasks easier. They cited the ability differentiate more easily by finding material that is suitable to the reading levels of their students (Teacher Focus Group, 2016). Other teachers stated that feedback could be disseminated more quickly using Google Docs. One teacher declared that at times she would be online in the evening watching students work on their documents. She could then offer feedback in the moment to consult on any misconceptions. These beliefs are substantiated by the results of the Teacher Post Survey (2016) which demonstrated that all of the teachers felt that they could better individualize instruction because of the accessibility to the Chromebooks. Students also reported that personal feedback from teachers increased because of the ability to share using Google Apps (Student Focus Group, 2016). The data reveals that, in general, the greatest improvement in classroom instruction was the ability to provide real time feedback. The increase and timeliness of the feedback to students is a direct result of being able to quickly scroll through essays using a commenting feature rather than wrestle though piles of paper to handwrite in margins. This also raises questions about the extended amount of time teachers are spending during evenings and weekends in order to utilize the capacities of the Chromebooks. A study to examine the difference in amount of out of school time for teachers with and without the Chromebooks would shed light on the usefulness of the program.

Parents were asked, “What is the most noticeable change you have seen in your child's teacher since the beginning of the computer pilot program?” Four major benefits emerged from this open-ended question. The first was improved, timelier communication. One parent commented, “Better communication, more engaged and timely with posting info to their own teacher’s web site.” Another remarked, “Some really have embraced it and opened new ideas and ways of learning and communication.” A third parent felt, “Emails are great when received since my daughter often misfires in communicating with me” (Parent Survey, 2016).

Organization is the second major advantage that emerged from the parent survey. Parents commented that teacher websites and Google Classroom kept the information in one place. One parent stated, “There is a thought that my child is communicating information to me because she is in the 6th grade. My child is still working on keeping herself organized so often misplaces information, inconsistently brings papers home that I need to see, and often does not share information until the day before, when I cannot ‘make it happen’ at that time.” Another parent expressed that while technology is beneficial, ” I think technology can be helpful but needs to be more streamlined with fewer ‘places’ to have to go look for information” (Parent Survey, 2016).

The third advantage was less paper coming home, but that was not always a plus. One parent remarked, “One noticeable change is that there is much less paper coming home, which can be good for trees but it does leave me without a lot of examples of the work that she has done" (Parent Survey, 2016).

The fourth benefit is that the students seem to like to work on the laptops. One parent expressed, "The teachers have assigned easier homework, but work that still challenges their growing minds." Another parent conveyed, "My child will now gravitate to the laptop to complete assignments independently" (Parent Survey, 2016).

Overall, the comments were positive; however, some parents reported that they had not seen a change in instruction since the laptops were introduced. The most negative theme that emerged was the frustration with finding information in a number of places. The suggestion to streamline or reduce the "information overload" arose.

Sustainability and Improvement

As part of the product section of the CIPP evaluation, an analysis of the improvements and the potential sustainability was performed. The student and teacher focus groups, parent survey, administrator interviews, and teacher surveys all posed questions that elicited information concerning the continuation of the program as well as the enhancements that need to be implemented to improve the initiative.

Improvements. Resulting from student focus groups, inappropriate use of the laptops emerged as a common theme at both schools. The Auburn Village School students felt as though the program should continue, but with more discipline. One student commented, "If you do something bad you should have something done not just [the computer] taken away. You should have a consequence". Candia Moore students responded similarly, "We think the school should be stricter with discipline when kids are not doing what they are supposed to do". When asked if they all feel the same way, they agreed. One student added, “I think that just because one person does something you shouldn’t punish everyone. That is what happens. They took the wallpaper away from all of us because one person misused the wallpaper.” Another student said, “Yes, they do have it taken away and you get some slow old laptop to use. Or they lock you out of all your websites except for Google Classroom” (Student Focus Group, 2016).

Auburn Village School students felt as though they should be able to take the computers home. One student elaborated, “It would be a good idea because I leave tabs open-but it could be a bad thing because people lose them-but it there a lot of things that could happen to them. But it would help people that don’t have computers at home and for the responsible kids. If people did take it home the kids could put their own USB in and unlock all the websites.” Candia Moore students liked taking their computers home, saying, “We can bring them home and there is no fighting with our siblings-easier to manage your work, you can do it anytime and on your own time. It is more convenient to work at home with them. You get tired of writing, but you can also work on them in the car and edit the papers” (Student Focus Group, 2016).

Teacher focus groups had two themes for improvement of the program. The first was establishing greater consequences for those students that use computers inappropriately. The second was additional time spent planning with other teachers on the best way to integrate the computers in their lessons.

Sustainability. Teachers were asked for their recommendations for the next school year. Of the ten teachers that responded, 60% felt that the program should be expanded to grades 6 through 8 and 40% felt as though the program should go schoolwide. Parents expressed the support for the program at the middle school. One parent explained, “I think the entire middle school should be on Chromebooks! I hope you continue expanding the use of technology in the classroom but I like that all the students are using the same technology vs Bring Your Own Device (BYOD) to school program.” The administrators both agreed that it appeared that the school boards were open to continuing the program, and both schools’ technology plans outlined the devices being financially supported for the next three years.

Conclusion

One of Stufflebeam’s (1971) key questions when it comes to CIPP Evaluation is *Did it Work*? On the surface, both 1:1 initiatives appear very successful, evidenced by the teachers’ perceptions of their change in teaching as well as their perceptions of student motivation and engagement. Evidence presented by the students in terms of their engagement also demonstrates the success of the program. In fact, a cursory review of the pilot would merely produce the need for general improvements such as wireless infrastructures, a change in discipline protocol, and more common time for teachers to share their methods of technology integration.

The CIPP evaluation uncovered that, aside from making their instruction more efficient; teachers’ actual pedagogy had not changed. The technology provided students an easier method of accessing resources and made it less cumbersome to type and revise papers. It provided teachers an effortless way to offer feedback and provide leveled reading material. The stakeholders were taking what the technology offered them, but not pushing the technology to drive the learning process. Stakeholders were happier because they could get to the end faster, but did not force the technology to bring the learning to a higher level. The data revealed that the majority of students were not challenged and felt the assignments were not meaningful, this may be due to the fact that the learning tasks were not rigorous. Additional research in this area is warranted.

Results from the full CIPP evaluation indicated at both schools that logistically, the 1:1 initiatives were successful and could be expanded to other grade levels given the financial support offered by both school boards. However, in order to develop teachers' skills in designing instruction for students to use technology in meaningful ways that allowed for creativity, collaboration, and reflection, the schools need assistance. There is a need for a program that goes beyond traditional professional development such as teaching of computer skills. Instead, the need is for a program that is aligned with teachers' professional practice and current textbooks and, in addition to providing teachers with specific input, should include opportunities to enact certain 21st century instructional strategies and to reflect, individually and collectively, on their experiences.

CHAPTER 5

CONCLUSIONS

This chapter begins with a brief overview of each aspect of the Auburn and Candia full CIPP-based evaluation followed by an analysis of the data tools that provided the greatest amount of information to generate an effective evaluation. The analysis of the data generated from these particular tools produced indispensable knowledge regarding how the technology procedures and process can best be designed or improved to meet schools' learning goals. The chapter concludes with a recommendation for an embedded evaluation framework that can be utilized for school-based evaluations of technology initiatives. This newly created evaluation is meant to provide schools with continuous technology improvement knowledge without unnecessarily burdening school principals.

The full evaluation was framed around the CIPP model with Stufflebeam's (1971) stages and guided by the following research questions:

1. What is the effectiveness of 1:1 devices in improving learning and teaching based on:
    a. Student experience with respect to learning and instruction?
    b. Teacher experience with respect to learning and instruction?
2. What improvements should be made when 1:1 devices are rolled out to other grade levels?
3. What elements of this evaluation can be adapted to create a feasible evaluation model that can be utilized by other districts?

Table 5-1.

CIPP model summary

CIPP Component	Laptop Evaluation Component/Research Question
Context	Description of the laptop programs as well as assessing needs, problems, assets, and opportunities within the educational technology area of the Auburn and Candia School Districts.
Input	What is percentage of budget, policies procedures and classroom configuration supporting the use of the 1:1 initiative? What is effective professional development for implementing technology integration to engage students?
Process	How did the use of the computers influence the learning activities? What were the teacher perceptions of the students' skills and engagement when using the laptops for learning activities? What were the students' perception of their own engagement and challenge when using the technology?
Product	Impact: In what ways does the use of the laptops lead to technology integration in the classroom? Effectiveness: In what ways does teacher instruction change using technology in the classroom? In what ways does technology support or promote students' critical thinking and problem solving skills? What future changes need to be employed to sustain the program for the future?

CIPP Overview and Tool Analysis

Context

The Auburn and Candia School Districts evaluated their laptop programs in order to assess the effects of the devices on technology integration in the classroom and on student engagement. Despite a large financial investment in the devices, to date, neither district had formally evaluated the effects of the technology on teachers or students. The CIPP evaluation gives teachers and administrators data and a sense of the impact of these devices on teaching and learning. Furthermore, the evaluation provided information to validate the initiative and deliver feedback to strengthen the future development.

Much of the information obtained for the Context evaluation was found either by administrator interviews, technology staff interviews, separate budget documents, or data from the N.H. Department of Education. This is a time consuming step for any school administrator to undertake. While most schools have a static technology plan in place that spans a three to five year period, few use these plans to hold themselves accountable in terms of both spending and implementation. There are many potential reasons for the lack of updates; by defunding the Enhancing Education through Technology (EETT) program in 2011, the U.S. Department of Education eliminated the largest federal incentive for district and school-level education technology planning. The E-rate program also recently dropped its requirement that schools produce a plan in order to apply for funding (Wilhelm, 2014). In fact, only 19 states have planned for technology past 2012, New Hampshire not being one of them. This is a key reason why schools have not seen the value of maintaining an organized approach to making technological progress. A school technology committee can be the vehicle for much of the context evaluation if implemented meaningfully. Had either of these schools had a robust technology committee in charge of a living technology plan based upon data, the context evaluation would have been complete. This embedded evaluation, one that connects instruction and technology procurement, is an essential part of program improvement.

Questions contained in the both the administrator and technology staff interviews can be addressed within the technology committee and answered in an adaptive technology plan that continually reviews and updates the technology goals and outcomes.

The make-up of the committee also lends insight to the success and needs of the program by including stakeholders such as parents, teachers, staff, school board members, and administration. Actually, much of the parent feedback can be obtained from having them as part of this committee.

By means of a technology plan, a school can create specific goal statements that relate back to aspects of its overall mission and vision. The goals can be focused on specific areas of teaching and learning that the technology committee has determined should be changed or improved in order to foster increased student achievement and success. For evaluation purposes, the established goals should be reasonable and measurable. A robust technology committee would meet quarterly and the plan should be revised as progress is made or outcomes are produce that are different from originally planned.

A high functioning technology committee and plan can reduce the need for a principal to undertake a Context evaluation. If the plan is comprehensive enough to encompass information such as vision, goals, impact, success, needs, and budget, the formal the Context evaluation could be eliminated. The evaluation then becomes embedded in the school’s learning environment and is accomplished by the committee as a whole, and not just the principal’s responsibility.

Input and Process

In the full CIPP evaluation, the Input and Process evaluations were undertaken separately, but in reality, could have been intertwined and still produced adequate information. After completing both the Input and Process evaluations, it was clear that they could be simplified by reducing the number of data tools and combined to alleviate complexity. The combining of these two evaluations can streamline the analysis and save time for a principal. The Input section evaluated the budget, policies and procedures, and building infrastructure of both schools. This is a major charge of a technology committee. If the appropriate stakeholders are part of a constructive technology committee, feedback on the budget, policy, procedures, and infrastructure will have already been accomplished.

As part of the full Input evaluation, the amount and type of professional development was compiled and reviewed. This provided important information for future planning purposes. Information concerning the amount of training and its effectiveness was essential to the evaluation and was collected primarily from the teacher survey (Appendix B). Teachers' perceptions of the impact of the professional development on their own skills and student engagement of the information were also reviewed. This section also evaluated teacher satisfaction with the content and quality of the professional development opportunities provided, as well as teacher perception of their readiness for the 1:1 initiative. This data was collected from teacher pre and post surveys, teacher focus groups, and student experience samplings (Appendices A, B, D, & F). The student experience sampling and student focus groups provided data concerning the students' perceptions of their interest and their engagement in the learning activity.

Overall, the full evaluation data collection tools for the input and process provided powerful information, yet there were some tools that yielded redundant information or not enough information to make them worthwhile. A busy principal does not have time to spend analyzing unproductive data. Therefore condensing the number of collection tools can reduce the time involved, but still produce informative data. For instance, the pre and post teacher survey data was not as pertinent as it did not provide any evidence of transformation in any of the criteria. This could be due to the short timeframe that the surveys were given. A single survey would be sufficient to gather pertinent information and could be directed through the technology committee twice a year. This would provide a longer timeframe between surveys and data from each period could be compared. It is advisable to maintain all of the questions originally proposed in the teacher survey as they provided information that was useful in examining frequency of use, teaching impact, and infrastructure. The teacher survey questions also shed light on the teachers' perceptions of student learning with the laptops, professional development, and overall strengths, and needs for the program. The survey was administered through an online form that accrued all responses and produced results in graph form. This did not require a great deal of time from the principal. The teacher focus groups did not add any new or different information than the teacher survey. In fact, the answers to the open response questions on the survey were more detailed and genuine than that of the focus groups responses. This may because the principal was taking notes and may have deterred the more open and honest responses found in the survey. Accordingly, the teacher focus groups did not add any value or insight that was not delivered by the teacher survey. To simplify the process, it is recommended to eliminate the teacher focus groups from the evaluation and rely on feedback from teacher members of the technology committee.

Professional development data collected from the post teacher survey and focus group questions demonstrated that teachers felt that the Google themed conferences and summits they attended were beneficial. The skills taught in the Google trainings concentrated on using Google docs, spreadsheets, and slides. A common concern from 30% of the teachers was that they could benefit from more time with other teachers. Generally, teachers felt they could have used additional time with colleagues to work on training and integration into curriculum areas. This evidence supports the premise that teachers need training on the pedagogy to decide on how to best use the technology to transform the learning in the classroom. All of this data was gathered from the teacher surveys.

The understanding of teachers' concerns about the lack of team planning time and professional development that focused on the use of the technology in lessons was relevant and important information to be produced from the Input and Process analysis. Teachers were able to use the open-ended questions provided in the survey to elaborate on what skills and training they lacked. A highly functioning technology committee in conjunction with a technology plan that has embedded teacher feedback surveys administered twice a year can support an intertwined Input and Process evaluation.

The Input and Process portion of the evaluation was also enhanced by the student focus groups. A short time probing with students regarding the successes and barriers of the program proved extremely useful. This important piece produced information relative to policies and procedures that were not collected from other sources. These discussions initiated a more thorough investigation of the management of infractions involving the Chromebooks. In the end, a further conversation with teachers at a staff meeting identified a need for more streamlined discipline guidelines along with more clear communication with students. The student input became an important piece of the improvement of the process.

Product

Data collected in the full CIPP evaluation demonstrated clearly that the products fell short of ISTE Standards for Students (ISTE, 2009). The Chromebooks were being used as electronic typewriters to create independent compositions. The technology appeared to be an add-on to the traditional classroom. Outside of school, students were using their phones, tablets, and game consoles to interact with people on a global level, yet there was clear disconnect between how they are absorbing information recreationally and socially, and how they were learning in school.

The full CIPP Product evaluation utilized teacher pre and post surveys, teacher focus groups, student focus groups as well as the student experience sampling (Appendices B, D, A, F). The student experience sampling was crucial in providing insight into the student learning activities that were actually being implemented in the classrooms. Field notes and observations provided additional understanding to the student assignments as well as the contextual use of the technology. The analysis of the data from these tools showed that teachers' perceptions of student learning in the classroom did not match what was actually happening in terms of student tasks. Furthermore, the teacher survey (Appendix, B) data revealed that the Chromebooks were used least often in the math classroom as compared with other content areas. This data was also confirmed by the student experience sampling results. The full CIPP evaluation observed five different content area classrooms at ten intervals. Some of these intervals were a week apart while others were a few days apart. Many times the classroom visits observed the same lesson that was sequenced out over a number of days. The most successful visits were the ones that were done on a weekly basis to give teachers time to advance to another topic. By the third interval, it was evident that the technology was never used in the math classroom. The student experience survey along with field notes and observations aligned with the findings that technology was used the least amount in the math classes.

To simplify this process for a more concise and time efficient evaluation, the recommendation is to do three interval visits over three weeks, twice a year. At both schools, it was evident by the third week of observations that the technology was primarily used for low-level technology integration. This modification will allow the evaluator to potentially view nine diverse student tasks spread out over three weeks. Visiting a classroom only once per week decreases the odds that the same lesson is still being carried out. These classroom observations, along with the field notes and the student experience survey, reveal a clear understanding of the technology use in the classroom.

In the full CIPP evaluation, both the Auburn and Candia experience surveys were enhanced by the field notes and observations. Without these added data tools, a full understanding of the use of collaborative tools would not have been discovered. At the time of the snapshot experience survey, the most common activities students reported working on were writing documents, researching the web, and working collaboratively. Field observations about what the students described as working collaboratively were documented as a student working on one document (Google Docs) with other peers within that classroom. In fact, most of the learning activities using technology were observed as being done independently or with peers within the same physical classroom.

Thus, even though the students considered their work a collaborative effort, the actual work could have been accomplished with pencil and paper with students sitting next to one another. In the end, the teacher surveys, three weeks of student experience surveys with field notes and observations produced a clear understanding of the technology integration in the classroom.

Important Data Tools for Program Improvement

Three areas of program improvement were identified using the full CIPP model (Stufflebeam, 1971) were identified. These three areas were teacher professional development, student learning, and discipline procedures and policies. These areas were identified as needs by three main data collections tools; teacher survey, student experience sampling and observations, and student focus groups. However, the full evaluation took over two months to complete at each school and involved hours of interviews, observations and surveys, while these three needs were identified very early in the process. Though the full CIPP (Stufflebeam, 1971) evaluation uncovered many essential areas for improvement, the process was very time and labor intensive. With the present-day demands on school principals, a full evaluation such as CIPP (Stufflebeam, 1971) is impractical. There is a convincing need for an evaluation model that is based on a proven research framework that will take less time and manpower, but focuses on improving the circumstances of learning, and on determining how technology can help make that happen.

Advantages for School Embedded Evaluation

Building an evaluation into an educational technology initiative can have strong implications for the long-term success of the project. Including evaluation in a technology project offers key benefits. First, any technology program introduced into a multifaceted system, like a school, is going to encounter obstacles, and uncover unexpected opportunities. An evaluation can help to identify and understand both of these possibilities and, often, the evaluation can provide guidance. With this evaluation, the stakeholders have a chance to discuss and shape the evaluation design to meet their individual goals and vision. Many times the evaluation allows for deeper exploration and can act as a facilitator for change within the larger system. Nevertheless, the time and effort involved in this undertaking prevents many school principals from realizing this very important charge.

The U.S. Department of Education recommends that school administrators adopt an evidence-based process to determine the effectiveness of educational technology acquisitions. They acknowledge that the traditional research approaches do not meet the needs of quickly changing educational technology because they take too long and serve a different purpose than most school leaders need. By the time a traditional research project is complete, new technology can make the research outdated before it is even published (U.S. Department of Education, 2017). In order to support school and district leaders, the U.S. Department of Education has provided an evaluation tool that determines the effectiveness of the technology.

This new tool, called the Ed Tech Rapid Cycle Evaluation (RCE) Coach, walks educators through how to construct a research question, set up data, create a match comparison group, and analyze the results. The RCE Coach has five phases beginning with requiring the educator, now evaluator, to create their research question. This step also necessitates the evaluator to choose the type of technology, as well as the outcome impacted by the implementation. The system offers a choice of student academic achievement, student non-academic achievement, teacher performance, parent engagement, other, and not sure. The following step is to identify the groups who will directly engage in the technology. This might not be the same group for which you are trying to improve outcomes.

The second part of the RCE Coach helps to determine the most appropriate design to evaluate the technology. One drawback in this model is the limited choice of evaluation designs. The only choice is to perform an experimental evaluation that compares a group using the technology (the treatment group) to a similar group not using the technology (the comparison group). The evaluation does not acknowledge the political context of a school. Particularly, in a small school, it is impossible to perform that type of evaluation without upsetting parents and other stakeholders. A small group of students not chosen to use the technology may feel isolated and left out from a social perspective. By not engaging stakeholders and just evaluating the tool, the program may miss a serious opportunity for stakeholders to be champions and supporters. In addition, in a small school there are not enough students to gather robust sampling data.

Depending on the outcome that was chosen to be analyzed, the model requires the school to choose a measure that will test whether there was an effect. Examples of this can include a midyear math assessment, student attendance or another benchmark that the district uses. The unit of measurement that demonstrates academic achievement also needs to be determined. This could be points on a test if the goal is trying to improve math achievement or days absent if the goal is to improve school attendance. The final stage of the RCE Coach allows administrators to upload the assessment data and determine if the technology intervention had a positive impact on the student outcome. The data analysis consists of only one measure. To illuminate what has actually changed in a classroom, the evaluator needs to move beyond a single outcome measure. Other sources of evidence, that can inform a bigger picture, include: class observations, interviews, self-reports (journals, on-line discussions), student products, surveys, and electronic records of activities.

Although the Office of Ed Tech (U.S. Department of Education, 2017) will feature two additional research designs in the near future, the current model is dedicated to evaluating one specific technology rather than an entire systematic implementation. A particular challenge with this model is the incredible number and variety of internet-based apps and resources that are available to support learning and instruction, as well as many significant differences among learners and instructors. It is difficult to isolate the exact influence on the student achievement or attendance. The wealth of resources now available, along with the variety of learning tasks, and learners and levels of learning, make the task of evaluating a specific technology application very challenging.

The goal of the RCE Coach is to help educators determine whether the technology currently used or planning to be used in the future achieves its goals. It is intended to help educators approach evaluations in schools more like a researcher and to help implement some of the methods and approaches researchers use. It lacks the involvement of the stakeholders from the beginning in the program planning and evaluation design. Although it is has been developed to be used by internal evaluators, its limited focus does not allow for ongoing evaluation. The evaluation serves as more of a summative evaluation rather than an evaluation that promotes continuous improvement that provides ongoing input and suggestions during the effort. In addition, this approach has no bearing on programs, policies, and practices involved in the educational technology effort. Most importantly, the approach does not include stakeholders in order to evaluate the context, resources (input) or implementation (process) of the technology effort. Choosing not to engage stakeholders can have serious implications for the integrity of an evaluation.

Essential Embedded Evaluation Model

As noted, a full CIPP (Stufflebeam, 1971) evaluation, or even a rapid-cycle evaluation, as suggested by the U.S. Department of Education is time and labor intensive and not feasible for many principals. An ideal evaluation can be effective without unnecessarily burdening school administrators. It can also utilized by other schools or districts interested in piloting a new educational technology. This newly developed evaluation, based on the CIPP (Stufflebeam, 1971) approach, can help schools identify needs, set objectives and determine important criteria for successful implementation. This Essential Embedded Evaluation Model (EEEM) can provide comprehensive information essential to a district's continuous program improvement plan, but reduce the burden that a full CIPP (Stufflebeam, 1971) evaluation can have. Embedding the evaluation into a school's technology plan and making it a part of the responsibility of the technology committee will distribute the accountability and generate more buy-in from stakeholders.

Context Evaluation. The first step in the Essential Embedded Model Evaluation is to assemble an effective technology committee. They should represent and can speak for the interests of the end-user community, and should include administration, board members, teachers, staff and parents. This implies that they have some engagement with the school and are well respected by others in the end-user community. The members should have enough vision to appreciate how technology may help the school achieve its strategic goals and understand that technology only works within the cultural confines set by the school. These members should know that simply adding new technology for the sake of adding technology does not result in worthwhile change. A study from the Academy of Management (Gallupe, Dennis, Cooper, Valacich, Bastianutti, & Nunamaker, 1992) found that large groups (up to 12 people) did the best job of brainstorming.

The leader of the technology committee does not need to be the technology director. It should be someone who is an effective communicator and can work with people to develop a shared vision. The committee should establish their chair. It is not necessary for the chair to be the foremost technical experts; it is more important that they accomplish necessary tasks through their membership.

Once the technology committee has been established, their work begins by evaluating how a school vision relates to technology before thinking about what hardware to purchase. The technology vision and goal setting should align with the overall school vision and should be communicated with all stakeholders. Every decision made going forward is back-fed through the vision statement to guarantee alignment and provide guidance for program improvement.

The technology plan should be a dynamic document that is implemented over a specific time period. It can and should be revised quarterly as progress is made and actions that produce outcomes different than originally planned should be revised and replaced with new actions as opportunities arise. In order for successful results to occur, a plan must be driven by the examination and analysis of data relative to all areas. Context evaluation components include vision, goals, school demographics, budget, policies, procedures, current network infrastructure, current device allocation, current software/app use, successes, needs, and instructional impact.

Context. Much of the full Context evaluation was completed through teacher surveys and administrator and technology staff interviews, and can be done more efficiently through the school technology committee. The first step is to clearly outline the objectives for the implementation. Administration, technology personnel, and teachers should be a part of setting the goals for the program. Much of this context evaluation should be a part of the technology plan that ought to routinely be reviewed in schools. A technology committee that meets at least four times a year, consisting of administration, teachers, parents, school board, and technology personnel, should drive this plan. Objectives such as student engagement, student academic achievement, or teacher performance are some of the objectives that could be identified. If the technology has not been purchased, a needs assessment should be conducted to determine what technology fits the schools' needs , and should be part of the technology plan. This Context Evaluation, an essential part of the technology plan, can be complemented by the teacher survey (Appendix H) and input from school administrators and technology personnel. Furthermore, making the evaluation part of the school technology plan is fundamental to ensuring that infrastructure, budgeting, policies, and professional development support the vision of the program.

Input and Process. As learned in the full CIPP evaluation, the Input and Process evaluations can be combined to simplify and expedite the process. The main data collection tools for input and process are the teacher survey, student experience sampling and student focus group. The timing of all three of these data collections tools should be scheduled and documented in the technology plan. The recommended frequency is twice a year after first and third quarters. The results should be reported to the technology committee during the second and fourth quarters. This allows changes to be made on any of the context components. For example, changes to the professional development needs can be planned for the spring and summer after a fall evaluation. The scheduled reporting feature holds those involved in the evaluation accountable.

The teacher survey can be administered online through any online survey tool. The link to the survey should be sent out by the technology committee as it is a collaborative evaluation. The survey should be anonymous and this should be communicated to the staff. The surveys should be compared with one another so that improvement can be documented.

The Student Experience Sampling, developed by Sharon “Sam” Sakai-Miller, also found in Appendix H, provides some of the most telling facts concerning the actual use of technology in the classrooms. This survey requires students to stop what they are doing in order to take a short survey. Taking brief field notes in addition to this survey provides related information that is integral in determining the success of the program. This information can be collected using a Google Form, and the results can be aggregated in minutes. The drawback to the Student Experience Sampling is that it does require administrators to do a quick walk though of at least three classrooms over a three week period. This activity should be done at least twice annually to enable the evaluator to note improvement in the type of tasks being asked of students. This may appear extensive, but is necessary to obtain an all-encompassing appraisal of classroom instruction. This activity could be combined with regularly scheduled formal classroom observations to save time. This is the responsibility of the principal, however, compared to the obligations involved in the full CIPP evaluation; it is much more efficient and timesaving.

Because students are important stakeholders, data should be collected from them through open-ended questioning. Student focus groups offer important information concerning the success or needs of a program. Again, logistics and time can be a barrier to accomplish this charge. A quick stop by the principal at a lunch table might be another way to elicit feedback from students, ensuring that their comments are documented. Appendix H outlines the questions that should be covered in discussions with students. It is key to maintain consistency in questions in order to evaluate improvement from year to year.

Product. The last evaluation section provides information about student engagement using the technology, tools they have found useful and opinions on whether their teachers' instruction had changed. The data collection tools are the same as those used in the Input/Process sections. A comparison of the results of the student sampling with that of the teacher survey results to determine if there is a misconception about the level of technology integration expected of the teachers. Again, much of this data can be collected through technology committee meetings and team or professional learning meetings. Student experience sampling and observations can also be completed during formal principal observations.

By using the technology planning committee, team or professional learning meetings, informal student gatherings, and prescheduled formal observations, an administrator can efficiently evaluate technology initiatives. With more schools increasing the number of devices in their buildings, it is important to create an evidence-based process to determine the effectiveness of technology used in the classroom.

Using the results. A embedded tech evaluation that uses only the essential data collection tools can assist school leaders in making evidence-based decisions regarding educational technology programs. There are various opportunities that exist for data gathering without setting aside formal groups. The technology committee is the place to start. Regularly scheduling the data collection intervals and well as the data review times allows the committee to be accountable and use the results for continuous improvement. This concise and efficient tool, based up a proven research approach, allows principals to use various stakeholders' input to prioritize and focus their school's core educational objectives. Undertaking the full CIPP evaluation allowed me to identify the right questions to ask and then realize the point in which the data was providing the same information. The full CIPP evaluation provided clear direction regarding what tools provided the enough data to ensure valid results.

Traditional research approaches do not meet the needs of evaluating rapidly changing education technology. They take too long, and if using an outside evaluator, can cost too much. Many times these evaluations serve a different purpose than most school leaders need. By the time a traditional research project is complete, new technology has replaced the former, and the written evaluation has not even been published. School leaders must be accountable for the decisions that they make. Therefore, it is important that they determine and document the effectiveness of the tools they choose.

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Appendix A (Data Collection Tool 1)

Student Experience Sampling Survey

All students were asked to "freeze" their activities when using the Chromebooks and to take a quick Google Form "snapshot" of their current experience. Students will be asked:
1. **(Product)** What are you working on right now?
- Browsing the Internet
- Researching the web
- Writing an email
- Writing a document
- Using a spreadsheet
- Creating an image
- Creating a video or animation
- Working collaboratively
- Other

2. **(Product)** What are you thinking about?

In addition, students were then asked to score the 10 questions below using a five-point Likert scale.

Questions:

3. **(Product)** How engaged were you in the activity?
Rate your engagement on a scale of 1 to 5 (5 = extremely engaged, 1= not engaged at all).
4. **(Process/Product)** Did you enjoy the activity?
Rate your enjoyment on a scale of 1 to 5 (5 = extremely enjoyed, 1= did not enjoy at all).
5. **(Product)** How challenging was the class activity?
Rate the level of challenge on a scale of 1 to 5 (5 = extremely challenging, 1= not challenging at all).
6. **(Process)** How skilled were you at the class activity?
Rate your ability to do the activity on a scale of 1 to 5 (5 = extremely skilled, 1= not skilled at all).
7. **(Process)** Was the activity meaningful to you?
Rate the level of meaningfulness on a scale of 1 to 5 (5 = extremely meaningful, 1= not meaningful at all).
8. **(Product)** How much were you concentrating?
Rate your level of concentration on a scale of 1 to 5 (5 = extremely high, 1= not concentrating at all).
9. **(Product)** Were you learning anything or getting better at something?
Yes or no
10. **(Product)** Did you feel nervous?
Rate your level of nervousness on a scale of 1 to 5 (5 = extremely nervous, 1= not nervous at all).
11. **(Product)** Did you have a choice in picking this activity?
Yes or no

Appendix B (Data Collection Tool 2)

Teacher Surveys

Pre-Survey-Teacher

1. **(Context)** What do you feel is the prime objective for the establishment of the 1:1 program?
2. **(Context)** How often did you use technology in your classroom before the 1:1 program?
    a. Once a week
    b. Twice a week
    c. More than three times a week
    d. Everyday
    e. Never
3. **(Context)** When you think of a school that provides a computer for every student what comes to mind?
    a. Open response
4. **(Input)** What is your biggest concern about students having their own laptop?
    a. Open response
5. **(Process/Product)** How did you think your teaching will change as a result of the laptop program?
    a. Open Response
6. **(Process/Input)** What concerns/barriers did you think might limit the success of the 1:1 project?
    a. Lack of keyboard skills
    b. Not enough instruction on use of a laptop
    c. Poor technology support from the school
    d. The district blocks (firewalls) limit internet searches
    e. Not able to keep laptop charged
    f. Student breakage
    g. Student losing laptop

	Never	Occasionally	Once a week	A couple of times a week	Everyday
a. **(Product)** DELIVERY of instruction and/or assignments					
b. **(Product)** Student RESEARCH using the Internet					
c. **(Product)** Student cooperation and/or COLLABORATION ONLINE to create a product					
d. **(Product)** Student participation in online FORUMS (or other vehicles for online discussion)					
e. **(Product)** ADAPTING an activity to students' individual needs					
f. **(Product)** Creating and using a TEST or QUIZ for					

students					
g. **(Product)** Student exploration of models and/or SIMULATIONS					
h. **(Product)** Student VIDEO and/or AUDIO recording and sharing					

Teacher Post Survey (Data Collection Tool 3)

Dear 1:1 Laptop Team

Please complete the following survey regarding the 1:1 laptop program. The information from this survey will be used as one tool to make this program even better and to help inform the school regarding future work with laptop programs.

1. **(Context)** What is the primary content area you teach?

Math
Science
Language Arts
Social studies

2. **(Product)** How often have you allowed/asked students to use their personal laptops in your class?

Never
Occasionally
Once a week
Couple of times a week
Everyday

3. **(Product)** How often do you perform the following through the use of computers?

	Never	Occasionally	Once a week	A couple of times a week	Everyday
a. **(Product)** DELIVERY of instruction and/or assignments					
b. **(Product)** Student RESEARCH using the Internet					
c. **(Product)** Student cooperation and/or COLLABORATION ONLINE to create a product					
d. **(Product)** Student participation in online FORUMS (or other vehicles for online discussion)					
e. **(Product)** ADAPTING an activity to students' individual needs					
f. **(Product)** Creating and using a TEST or QUIZ for students					

g. **(Product)** Student exploration of models and/or SIMULATIONS					
h. **(Product)** Student VIDEO and/or AUDIO recording and sharing					

4. **(Product)** Please indicate your degree of agreement with the following statements about TEACHING with students' laptops in class.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	N/A
a. **(Product)** My TEACHING BENEFITS from students' personal laptop use.						
b. **(Product)** I am better able to INDIVIDUALIZE my curriculum to fit student needs.						
c. **(Product)** Students having personal laptops helps in accessing more UP-TO-DATE INFORMATION.						
d. **(Product)** When students are using personal laptops there is less CLASSROOM MANAGEMENT that needs to take place.						
e. **(Product)** Using the personal laptops has increased my WORK LOAD.						
f. **(Product)** I am better able to access DIVERSE TEACHING materials and resources for my students.						
g. **(Product)** Having personal laptops in the classroom has increased my EXPECTATIONS for students' work.						
h. **(Product)** The presence of personal laptops in my classroom is DISRUPTIVE to my teaching.						
i. **(Product)** I am able to COVER MORE material in class.						
j. **(Process)** I would like to have access to more "just in time" TECHNICAL SUPPORT in my classroom.						
k. **(Product)** Use of the personal laptops helps me create INSTRUCTIONAL MATERIALS which better meet the curriculum.						
l. **(Product)** Having personal laptops has reduced the amount of PAPER- BASED supplies that I need (Ex: notebooks, textbooks).						

m. **(Process)** Given laptop problems, it is necessary to create BACKUP LESSON PLANS.						
n. **(Product)** I am able to explore topics in GREATER DEPTH with my students.						
o. **(Product)** It is difficult for me to MONITOR inappropriate INTERNET use in my classroom with personal laptops.						

5. Please indicate your degree of agreement with the following statements about LEARNING with students' LAPTOPS in class.

	Never	Occasionally	Once a week	A couple times a week	Everyday
a. **(Product)** Students INTERACT with each other more.					
b. **(Product)** My students are better able to MEET LEARNING OBJECTIVES.					
c. **(Product)** Students in my classroom are more ACTIVELY INVOLVED in their own learning.					
d. **(Product)** Use of the 1:1 laptops facilitates more OPEN COMMUNICATION between my students and I.					
e. **(Product)** Students in my classroom are more PRODUCTIVE.					
f. **(Product)** My students are better able to UNDERSTAND CONTENT.					
g. **(Product)** Students take MORE INITIATIVE outside of class time.					
h. **(Product)** Students' WRITING QUALITY is better.					
i. **(Product)** Students get more involved with IN-DEPTH RESEARCH.					
j. **(Product)** Students WORK HARDER at their assignments.					

k. **(Product)** Students REVISE their work more.					
l. **(Product)** I am better able to INDIVIDUALIZE instruction.					
m. **(Product)** The QUALITY of my students' work increases.					
n. **(Product)** My students are MORE ORGANIZED when they use their own laptops.					
o. **(Product)** My students are MORE ENGAGED.					

6. Please indicate your degree of agreement with the following statements regarding adoption of the 1:1 laptop model:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a. **(Process/input)** Frequent technical problems hinder learning.					
b. **(Process)** Students would benefit more from their laptops if they had more typing instruction.					
c. **(Process/input)** It is challenging to integrate computer activities into my lessons.					
d. **(Process)**There are too many classroom management problems.					

7. **(Process)** Based on your current experiences with our 1:1 Laptop Pilot please choose one of the following recommendations for the NEXT SCHOOL YEAR:
    - I recommend we go 1:1 school wide
    - I recommend we go 1:1 grades 6 to 8
    - I recommend we stay at 1:1 for the current grade levels.
    - I recommend that we discontinue 1:1.
8. **(Process/input)** What do you see as the strengths and/or need for improvement on the 1:1 laptop program?
9. **(Process/input)** What types of professional development practices for 1:1 laptop use do you think are the most effective and why?

Appendix C (Data Collection Tool 3)

Administrator Interview

1. **(Context)** What do you feel is the prime objective for the establishment of the 1:1 program?
2. **(Context)** What problem did this program expect to solve?
3. **(Context)** What is your vision for your school's laptop program?
4. **(Context)** How often did you think that teachers used technology in your classroom before the 1:1 program?
5. **(Context)** When you think of a school that provides a computer for every student what comes to mind?
6. **(Context)** What is your biggest concern about students having their own laptop?
7. **(Context)** How did you think the teaching would change because of the laptop program?
8. **(Context)** What concerns/barriers did you think might limit the success of the 1:1 project?
9. **(Product)** What kind of impact has the laptop program had on student learning?
10. **(Context)** How has the laptop program affected your school policies?
11. **(Process)** What is your overall assessment of the laptop program at this point in time?
12. **(Process)** Please describe the two factors that contributed the most to the successful or unsuccessful implementation of the laptops.
13. **(Product)** What student outcomes do you feel are most positively affected by the laptop program (e.g. attendance, behavior, motivation. learning)?

Appendix D (Data Collection Tool 4)

Teacher Focus Group Questions

1. **(Context)** What problem did this program expect to solve?
2. **(Process)** Has your teaching changed with the addition of the laptop program? How?
3. **(Product)** Do you feel you are better able to meet the needs of students with varying needs (e.g. struggling students and gifted students)? How?
4. **(Process)** Do you rely on different instructional resources than you did prior to the laptop program (e.g. textbooks, worksheets)?
5. **(Process/Product)** What is the biggest advantage of the laptop program?
6. **(Process/Product)** What is the biggest disadvantage of the laptop program?
7. **(Product)** Has your communication with parents improved since the laptop program? If so, how?
8. **(Process)** Overall, how important do you believe the laptop program is for students?
9. **(Process)** What issues create barriers to your use of educational technology?
10. **(Process)** In the past 3 years, what types participated in any formal (classroom) or informal (video based, computer based, etc.) professional development activities that focused on uses of computers for instruction?
    Was this professional development helpful in the integration of the laptop program? What types of professional development have you had concerning the utilization of the technology? How was it provided? District provided? On your own? What is your general feeling about the amount of professional development that was offered to you?
11. **(Input)** How effective has the combination of your personal learning, professional development, and the integration of the Chromebooks been on the teaching and learning in your classroom?
12. **(Input)** What is the most important thing you learned in the technology-related professional development?
13. **(Input)** What other kinds of professional development do you think will be helpful?
14. **(Process)** How supportive was your administration in terms of your participation in the laptop program (e.g. vision, collaborative planning, funding, professional development)?
15. **(Product)** How do you feel your students' learning has changed as a result of the laptop program?

Appendix E (Data Collection Tool 5)

Technology Staff Interview Questions

1. **(Process)** How do you feel about the distribution of the Chromebooks?
2. **(Input/process)** What do you feel are the barriers to the Chromebook initiative?
3. **(Input/process)** What do you feel are the advantages of the Chromebook initiative?
4. **(Process)** What do you think should be changed about the program?

Appendix F (Data Collection Tool 6)

Student Focus Group Questions

1. **(Product)** The year BEFORE you received your own laptop, how often did YOU use technology in school?

	Never	Every few months	About once a month	About once a week	Nearly everyday
In the classroom					
In the computer lab					
In the technology/computer class					
In the library					

2. **(Product)** The year before you received your own laptop, how often did YOUR TEACHER use technology in school?

	Never	Every few months	About once a month	About once a week	Nearly everyday
In LA					
In science					
In the Social Studies					
In math					
In specials					

3. **(Process)** Now that you have your own laptop, do you enjoy using computer technology? Yes No

Why

4. **(Process/Product)** Before you received your laptop, how skilled were you with the following technology tasks?

	I never tried this	Not very good	Pretty Good	Very good
Internet Search				

Word processing				
Spreadsheets				
Slide Shows				
Editing Photos				
Editing/creating Music				
Editing/creating Videos				
Designing Web Pages				

5. **(Product)** Do you think that these skills have improved since you have received your laptop? Which ones?
6. **(Product)** What has been the most helpful use of technology by teachers since the laptop program?
7. **(Product)** What technology project or assignments have you been most proud of?
8. **(Process/Input)** How helpful was the school's introduction to using your laptop computer? Could it be better? How?
9. **(Process)** Do you prefer taking tests on paper or the computer?

Appendix G (Data Collection Tool 7)

Parent Survey Questions

1. **(Process)** Do you believe that the one-to-one laptop program at your child's school has changed your understanding of technology? How?
2. **(Context)** Do you believe the one-to-one laptop program at your school has changed your perception of your child's school?
    a. How?
3. **(Product)** Do you agree with the following statements?
    a. Computers make schoolwork more interesting for my child.
    b. Computers make schoolwork easier to do for my child.
    c. Computers make schoolwork harder to do for my child.
    d. Computers have improved the quality of my child's schoolwork.
    e. Computers have improved my child grades.
4. **(Product)** My child is more interested in doing schoolwork when they use a computer.
5. **(Product)** What is the most noticeable change you have seen in your child's teacher since the beginning of the computer pilot program?
6. **(Process/Input)** How valuable do you think the one-to-one computer program was this year for teachers and students?
    a. Not Valuable
    b. Somewhat valuable
    c. Valuable
    d. Extremely Valuable

Appendix H

Appendix H

Essential Embedded Evaluation Model

☐ Assemble or realign school technology committee	A group totaling 12 people with necessary members: ☐ Principal ☐ Technology director ☐ Librarian ☐ Special educator ☐ School board representative ☐ Technology integrator ☐ Teachers (3) ☐ Parents (3)	• Members: o Well respected by others in the end-user community o Understand that technology only works within the cultural confines set by the school
☐ Appoint a chair of the committee	☐ This does not need to be the technology director. It should be someone who is an effective communicator and can work with people to develop a shared vision.	• Set meeting schedule o Quarterly meetings o Data review 2nd and 4th quarters
☐ Develop a vision for the educational technology	☐ Align with school vision ☐ Communicate with stakeholders o School board meetings o Website o Newsletters o Social media	
☐ Determine expected outcomes from the technology implementation	☐ How is success measured? o Determine specific, measurable, goals	
☐Execute technology evaluation		
☐ Context	☐ Technology plan includes o Vision o Goals	• At quarterly technology committee meetings, technology principals should be reviewed and updated o Vision

	- School demographics - Budget - Policies - Procedures - Current network infrastructure - Current device allocation - Current software/app use - Successes - Needs - Instructional impact - Professional development	- Goals - School demographics - Budget - Policies - Procedures - Current network infrastructure - Current device allocation - Current software/app use - Successes - Needs - Instructional impact
☐ Input and Process	◻ <u>Teacher survey</u> administered by committee ◻ <u>Student experience survey</u> with observation administered by principal ◻ <u>Student focus groups</u> administered by principal ◻ Teacher input collected in technology committee	• Administered during first and third quarters • Reported to tech committee second and fourth quarters
☐ Product	◻ <u>Teacher survey</u> administered by committee ◻ <u>Student experience survey</u> with observation administered by principal ◻ <u>Student focus groups</u> administered by principal ◻ Teacher input collected in technology committee ◻ Parent input collected in technology committee	• Administered during first and third quarters • Reported to tech committee second and fourth quarters
☐Results	◻ Quarter 2 and 4 technology committee analyzes results ◻ Changes are made in technology plan because of data analysis	• Data reviews and analyzed as part of technology committee meetings • Technology committee communicates results to school board and discusses budget impact

Teacher Survey (To be emailed to entire staff)

Hello Staff:

Thank you so much for taking time out of your busy day to help your technology committee complete this technology survey. We have a goal to get 100% staff input and we need your help. This survey will address three areas: (1) personal technology skills, (2) technology usage, and (3) technology integration.

Our goal is to discover areas in which our staff desires technology training or professional development, identify issues inhibiting technology integration, and generate ideas for how the technology committee can provide technology assistance to staff. The survey is anonymous - answer freely and honestly. Again, thank you!

Technology Committee

1. **(Context)** What is the primary content area you teach?
   - Math
   - Science
   - Language Arts
   - Social studies
2. **(Product)** How often have you allowed/asked students to use their personal laptops in your class?
   - Never
   - Occasionally
   - Once a week
   - Couple times a week
   - Everyday

3. How often do you perform the following through the use of computers?

	Never	Occasionally	Once a week	A couple of times a week	Everyday
i. **(Product)** DELIVERY of instruction and/or assignments					
j. **(Product)** Student RESEARCH using the Internet					
k. **(Product)** Student cooperation and/or COLLABORATION ONLINE to create a product					
l. **(Product)** Student participation in online FORUMS (or other vehicles for online discussion)					
m. **(Product)** ADAPTING an activity to students' individual needs					
n. **(Product)** Creating and using a TEST or QUIZ for students					
o. **(Product)** Student exploration of models and/or SIMULATIONS					
p. **(Product)** Student VIDEO and/or AUDIO recording and sharing					

4. Please indicate your degree of agreement with the following statements about TEACHING with students' laptops in class.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	N/A
p. **(Product)** My TEACHING BENEFITS from students' personal laptop use.						
q. **(Product)** I am better able to INDIVIDUALIZE my curriculum to fit student needs.						
r. **(Product)** Students having personal laptops helps in accessing more UP-TO-DATE INFORMATION.						
s. **(Product)** When students are using personal laptops there is less CLASSROOM MANAGEMENT that needs to take place.						
t. **(Product)** Using the personal laptops has increased my WORK LOAD.						
u. **(Product)** I am better able to access DIVERSE TEACHING materials and resources for my students.						
v. **(Product)** Having personal laptops in the classroom has increased my EXPECTATIONS for students' work.						
w. **(Product)** The presence of personal laptops in my classroom is DISRUPTIVE to my teaching.						
x. **(Product)** I am able to COVER MORE material in class.						
y. **(Process)** I would like to have access to more "just in time" TECHNICAL SUPPORT in my classroom.						
z. **(Product)** Use of the personal laptops helps me create INSTRUCTIONAL MATERIALS which better meet the curriculum.						
aa. **(Product)** Having personal laptops has reduced the amount of PAPER- BASED supplies that I need (Ex: notebooks, textbooks).						
bb. **(Process)** Given laptop problems, it is necessary to create BACKUP LESSON PLANS.						
cc. **(Product)** I am able to explore topics in GREATER DEPTH with my students.						
dd. **(Product)** It is difficult for me to MONITOR inappropriate INTERNET use in my classroom with personal laptops.						

5. Please indicate your degree of agreement with the following statements about LEARNING with students' DEVICES in class.

	Never	Occasionally	Once a week	A couple times a week	Everyday
p. **(Product)** Students INTERACT with each other more.					
q. **(Product)** My students are better able to MEET LEARNING OBJECTIVES.					
r. **(Product)** Students in my classroom are more ACTIVELY INVOLVED in their own learning.					
s. **(Product)** Use of the 1:1 laptops facilitates more OPEN COMMUNICATION between my students and I.					
t. **(Product)** Students in my classroom are more PRODUCTIVE.					
u. **(Product)** My students are better able to UNDERSTAND CONTENT.					
v. **(Product)** Students take MORE INITIATIVE outside of class time.					
w. **(Product)** Students' WRITING QUALITY is better.					
x. **(Product)** Students get more involved with IN-DEPTH RESEARCH.					
y. **(Product)** Students WORK HARDER at their assignments.					
z. **(Product)** Students REVISE their work more.					
aa. **(Product)** I am better able to INDIVIDUALIZE instruction.					
bb. **(Product)** The QUALITY of my students' work increases.					
cc. **(Product)** My students are MORE ORGANIZED when they use their own laptops.					
dd. **(Product)** My students are MORE ENGAGED.					

6. Please indicate your degree of agreement with the following statements regarding adoption of the 1:1 laptop model:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
e. **(Process/input)** Frequent technical problems hinder learning.					
f. **(Process)** Students would benefit more from their laptops if they had more typing instruction.					
g. **(Process/input)** It is challenging to integrate computer activities into my lessons.					
h. **(Process)**There are too many classroom management problems.					

7. **(Process/input)** What do you see as the strengths and/or need for improvement on the 1:1 laptop program?
8. **(Process/input)** What types of professional development practices for 1:1 laptop use do you think are the most effective and why?

Student Focus Group: Can be asked in informal settings such as lunch or study periods.

1. **(Process)** Do you think that these skills have improved since you have received your laptop? Which ones?
2. **(Product)** What has been the most helpful use of technology by teachers since the laptop program?
3. **(Product)** What technology project or assignments have you been most proud of?
4. **(Process/Input)** How helpful was the school's introduction to using your laptop computer? Could it be better? How?
5. **(Process)** Do you prefer taking tests on paper or the computer?

Student Experience Survey: 3 weeks of classroom visits twice annually

All students were asked to “freeze” their activities when using the Chromebooks and to take a quick Google Form “snapshot” of their current experience. Students should be asked:

1. **(Product)** What are you working on right now?

- Browsing the Internet
- Researching the web
- Writing an email
- Writing a document
- Using a spreadsheet
- Creating an image
- Creating a video or animation
- Working collaboratively
- Other

2. **(Product)** What are you thinking about? (Open-ended Question)

In addition, students were then asked to score the 10 questions below using a five-point Likert scale.

Questions:

3. **(Product)** How engaged were you in the activity?

Rate your engagement on a scale of 1 to 5 (5 = extremely engaged, 1= not engaged at all).

4. **(Process/Product)** Did you enjoy the activity?

Rate your enjoyment on a scale of 1 to 5 (5 = extremely enjoyed, 1= did not enjoy at all).

5. **(Product)** How challenging was the class activity?

Rate the level of challenge on a scale of 1 to 5 (5 = extremely challenging, 1= not challenging at all).

6. **(Process)** How skilled were you at the class activity?

Rate your ability to do the activity on a scale of 1 to 5 (5 = extremely skilled, 1= not skilled at all).

7. **(Process)** Was the activity meaningful to you?

Rate the level of meaningfulness on a scale of 1 to 5 (5 = extremely meaningful, 1= not meaningful at all).

8. **(Product)** How much were you concentrating?

Rate your level of concentration on a scale of 1 to 5 (5 = extremely high, 1= not concentrating at all).

9. **(Product)** Were you learning anything or getting better at something?

Yes or no

10. **(Product)** Did you feel nervous?

Rate your level of nervousness on a scale of 1 to 5 (5 = extremely nervous, 1= not nervous at all).

11. **(Product)** Did you have a choice in picking this activity?

Yes or no