

TALBOT COUNTY PUBLIC SCHOOLS

ONE TO ONE LAPTOP INITIATIVE
2005 – 2010

Successful Implementation through Systemic Change

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THE ILLITERATE OF THE 21ST CENTURY
WILL NOT BE THOSE WHO CANNOT READ AND WRITE,
BUT THOSE WHO CANNOT LEARN, UNLEARN, AND RELEARN.

~Alvin Toffler

INTRODUCTION

Technology is pervasive in the lives of each and every American. Both access to technology as well as technology use has increased dramatically in just the last decade. According to 2009 U.S. Census Bureau data, U.S. household computer ownership increased from a mere 8.2 % in 1984 to over 60 % in 2003. It is now estimated that close to 90 % of all households in the U.S. have at least one computer at home and over 80 % of Americans report using the Internet (USC Annenberg, 2010). Likewise, just 18 % of U.S. households in 1997 reported having access to the Internet at home; by 2009 this had almost quadrupled to 68.7 % (U.S. Census Bureau, 2010).

As progeny of technology users, our children are growing up plugged in and online. Research conducted in 2010 by AVG (one of the leading Internet security firms in the United States) found that 82 % of the children in an international study had an online presence by the age of two (Milian, 2010). Furthermore, as of 2009, close to two-thirds (61.6%) of U.S. children ages 3 through 17 had access to the Internet from some location, and over three-quarters (76.6%) lived in a household with Internet access (U.S. Census Bureau, 2010). Current survey data reveal that the average American spends 19 hours per week online (USC Annenberg, 2010).

Students today learn in both formal and informal learning environments. Gee (2008) states; "Many elementary school children are gamers and emerging tech-savvy digital natives. They crave engaging experiences with new technologies and

want to learn socially and collaboratively, using digital tools that allow them to participate in learning communities and to produce media and knowledge.” Our students today not only crave technology-rich instruction, they require this instruction along with other 21st century skills to be competitive.

Twenty-first century skills go beyond the traditional 3 R’s to include: Learning and innovation skills (e.g., creativity, critical thinking/problem-solving, and communication/collaboration); Information, media, and technology skills; Life and career skills (e.g., flexibility, adaptability, initiative, self-direction, productivity, and leadership); and the core subjects coupled with 21st century themes (e.g., finances, civics, health, and economic literacy) (Partnership for 21st Century Skills, 2009).

There is no doubt that our students must be prepared for the realities they will face when they exit school and enter the professional world, including the reality that technology is intricately weaved into not only most aspects of our daily lives, but also the current workforce. In a 2003 survey conducted by the U.S. Department of Labor, 61.8 % of all employed workers in the nation reported using computers at work and 45.1 % reported that their jobs required the use of the Internet (U.S. Department of Labor, 2003). That figure has since risen. Furthermore, “globalization is changing demands of the workplace. American workers are now facing competition from skilled workers in many low-cost countries... To stay ahead and sustain our standard of living, we must prepare our students for the 21st century with new skills—they must be capable, creative, innovative problem-solvers—along with the traditional core skills” (Gee, 2008, p. 6).

The need for an increasingly skilled workforce and the focus on 21st century skills is not new; the Secretary’s Commission for Achieving Necessary Skills (SCANS) published their findings on the skills necessary to succeed in the workplace in 1991 (U.S. Department of Labor, 1991). These “workplace readiness skills” have resided in the background for years but have recently become a high priority as they’ve been placed in the national spotlight. The draft National

Educational Technology Plan, released in the spring of 2010 and echoed by legislation such as the America COMPETES Act, calls for all schools in the nation to meet the challenge of adopting a “21st century model of learning powered by technology” (U.S. Department of Education, 2010). At its core, this plan urges educational leaders to focus on (a) providing engaging and empowering learning experiences, (b) using assessment data in a process of continuous improvement, (c) inspiring more effective teaching through the use of technology, and (d) creating a robust technology infrastructure to support technology integration at all levels (state, district, and school).

To achieve the goal of ensuring that our students receive the education they need to be viable competitors in the rapidly changing global economy, educational leaders must face the challenge of championing systemic change and sustaining support for the transformation of the current educational system; a system that, in many schools across the U.S., does not look dissimilar to the system that existed 50 years ago.

One to One computing initiatives are being implemented by states, districts, and schools across the nation as one strategy to achieve systemic change in order to meet the demands of 21st century learners and address the call for technology integration. In 2008, 27 % of school districts in the U.S. reported having a One to One program in some form (i.e., providing each participating student access to a wireless laptop on a continuous basis in at least one full grade in at least one school) (Lento, 2008). In 2005, Talbot County Public Schools (TCPS) joined the ranks of U.S. school districts implementing a One to One laptop initiative.

This report, based upon a 5-year program evaluation conducted by the Johns Hopkins University Center for Technology in Education (CTE), documents the implementation of the Talbot County One to One Laptop Initiative (2005 – 2010) and examines the alignment of the initiative to characteristics of successful One to One laptop initiatives as well as best practices in achieving systemic change.

Overview of the Talbot County Laptop Initiative

Shortly after her appointment in 2003 as Superintendent of Public Schools in Talbot County, Dr. Karen Salmon began the One to One Laptop Initiative with the goal of providing Talbot County high school teachers and students a “competitive advantage by furnishing laptop computers to all students and teachers.” The 2005 – 2008 Talbot County Public School Technology Plan, a strategic K – 12 proposal that included the incorporation of the Laptop Initiative, was presented to the Maryland State Department of Education in 2005. The underlying intent of the Laptop Initiative was to utilize technology to transform the learning environment. The Initiative was envisioned as a means to facilitate each student’s ability to function and to compete in the 21st century world with its rigorous demands for information, knowledge, communication, and technology.

The Laptop Initiative, launched in both TCPS high schools, had a staggered implementation plan. In the first year of the initiative (2005), a new laptop was assigned to each incoming ninth grade student. The students retained these laptops as they progressed through high school for the next four years. During the first three years of the initiative, the rate of laptop adoption increased each year by approximately 25 %, as new 9th graders were assigned laptop computers upon enrollment.

Similar to the staggered implementation at the student level, the teaching staff was assigned laptop computers and provided professional development in preparation for the 2005 9th grade cohort entering their classes. Those who taught the 2005 9th grade cohort were trained first. As the 2005 9th graders progressed to 10th grade in 2006, those who taught 10th grade were trained, and so on. The fourth year of implementation (2008-09 school year), was the first year with a school-wide implementation where every high school student in Talbot County Public Schools had his/her own laptop computer, every teacher was trained to integrate technology, and every student fully participated in the One to One Laptop Initiative.

Decreasing the Digital Divide

The Digital Divide, defined as the difference in ownership of, access to, and use of technology based on characteristics such as socioeconomic status, gender, and ethnicity, continues to be a challenge faced across the nation. While computer ownership and access to the Internet is at an all-time high, significant differences continue to exist within subgroup populations. For example, according to U.S. Census Bureau data from 2009, while 73.5 % of the total population of individuals 3 years and older reported living in a household with Internet access, only 60 % of black individuals and 57.4 % of Hispanics reported living in households with access to the Internet.

At its inception, the Talbot County One to One Laptop Initiative intended to address the digital divide. While Talbot County is one of the most affluent communities in Maryland, one-third of its students qualify for Free and Reduced Meal plans. In these low income areas, technology is sparse to non-existent. TCPS worked with community partners to provide free home Internet access to any student who qualified for Free and Reduced Meals. For many of these children, the Laptop Initiative provided the only computer in their households and provided some of their first experiences with ubiquitous access to the Internet. This access helped to level the playing field and provide the technology opportunities consistent with their more affluent peers.

CHARACTERISTICS OF SUCCESSFUL LAPTOP INITIATIVES:

A COMPARATIVE ANALYSIS

Recent research has outlined the characteristics of successful laptop initiatives (Bonifaz & Zucker, 2004; Cisco, 2006; Gulek & Demirtas, 2005; Lento, 2008; Livingston, 2009; Penuel, 2006; Zucker, 2005). In an effort to support states, districts, and schools in implementation efforts, the Northeast and the Islands Regional Technology in Education Consortium (NEIRTEC) created a compendium of

“lessons learned.” This meta-analytic report yielded four main categories of lessons: Planning, training and professional development, managing change, and monitoring and evaluation (Bonifaz & Zucker, 2004). In addition, the report outlines the following characteristics essential to laptop program success:

- Alignment of the laptop program to well-defined goals
- A strong leadership team at all levels
- Long-term funding commitments
- Ongoing stakeholder involvement and partnerships
- Systemic integration of technology in curriculum and instruction
- High-quality professional development
- A well-maintained infrastructure and network architecture
- Careful planning of all logistics
- Strong and ongoing technical support at all levels
- Monitoring and evaluation

From its inception, the Talbot County Laptop Initiative comprehensively addressed the majority of the characteristics for success. The next section of this report will systematically review each characteristic with respect to the literature as well as summarize the efforts (over the past five years) made in TCPS to address each characteristic.

Alignment to Well-defined Goals

In their summary of lessons learned, Bonifaz and Zucker of NEIRTEC (2004) found that well-defined and well-articulated goals were crucial to the success of any laptop program. Without a defined target, it stands to reason that it would be difficult to ensure that all initiative participants move in the same direction to achieve success. Moreover, the authors found the greatest programmatic success was associated with the establishment and adherence to goals on student learning.

Talbot County district leadership articulated a vision for One to One computing in the TCPS Technology Plan: 2005 – 2008. This plan clearly documented all steps and stages for the roll-out of the Laptop Initiative. With the mission of preparing students so that each student can “learn, grow, and succeed,”

the vision was expressed as the following: “Talbot County Public School students and staff will continuously develop technology skills as an integral part of their life-long learning. Through the use of technology, students and staff will access information efficiently and effectively, evaluate information critically and competently, and communicate information effectively and creatively” (Talbot County Public Schools, 2005).

To achieve the vision, TCPS outlined both student and teacher goals for technology integration. Specific to the Laptop Initiative, TCPS outlined four main goals—with the overarching objective of decreasing the digital divide. The four goals of the Initiative were: (a) increasing student achievement, (b) effectively using technology for instruction, (c) increasing student engagement in the learning process, and (d) improving educational access for and participation by high-risk students (i.e., students with poor attendance, students with disabilities, students who qualify for free and reduced meals, and students with limited English proficiency). *(Note: The impact of the Talbot County Laptop Initiative on each of these four goals can be found in the annual evaluation reports completed by the Johns Hopkins University Center for Technology in Education.)*

Throughout the past five years, the TCPS Laptop Initiative goals have provided the foundation for all efforts and activities associated with the initiative as well as the basis for the annual evaluation. Status toward the achievement of each goal was regularly measured and programmatic changes were put into effect to address barriers to goal attainment.

Strong Leadership at All Levels

Leadership is crucial to the success of any intervention and particularly important in the implementation of a laptop program. As the literature suggests, “Even the staff most committed to one to one computing will turn against the program if administrative leaders do not follow through on their promises of material

and political support” (Center for Digital Education, 2008). The research goes a step further to suggest that leadership at the top is not enough to ensure success. In addition, leadership must not only exist at all levels (state, district, school), but leadership must also include administrators, curriculum specialists, department heads, technology coordinators, IT specialists, and teacher leaders who are implementing the initiative at each level to increase the likelihood of achieving programmatic goals. Furthermore, researchers point out that the leadership must also communicate and collaborate often to address challenges and overcome obstacles (Bonifaz & Zucker, 2004; Zucker, 2005).

District Leadership Team

In Talbot County, the District Leadership Team articulated a clear vision at all levels. The Leadership Team is comprised of the Superintendent, the Assistant Superintendent of Curriculum and Instruction, the Staff Development Specialist, high school principals and assistant principals, and all curriculum specialists responsible for instructional programming at the secondary schools. In addition, the District Leadership Team built and maintained support for the program’s mission and work among school-based administrators, teachers, students, parents, members of the TCPS Board of Education, and other stakeholders through ongoing communication and involvement. Guided by the leadership of the Superintendent, the laptop initiative was implemented following a strategic, well-defined plan of operation characterized by high-quality professional development, shared leadership, and resources with substantial technical assistance.

The TCPS District Leadership Team followed the distributed leadership model in creating a comprehensive system of leaders at all levels by facilitating the involvement of school-based administrators and school leadership teams, the Staff Development Specialist, the Technology Coach, the IT staff, and teachers who were strong and early adopters of technology in the planning and implementation process. The leadership team allocated adequate resources, training, and support for

implementation as well as provided opportunities for job-embedded coaching to support “just-in-time” learning. The team engaged in careful planning to maximize the time teachers had for training in relation to school schedules, district calendars, association agreements, and other policy requirements.

Staff Development Specialist/One to One Coordinator

From the beginning of the TCPS Laptop Initiative, the District Leadership Team selected an administrator to serve as the Staff Development Specialist, whose role was to manage and coordinate the day-to-day administration of the multi-faceted Laptop Initiative across both Talbot County high schools. As more and more teachers developed improved competencies in using laptops and various technology tools in their classes, the Staff Development Specialist encouraged individual and collaborative experimentation, practice, and reflection. During the first two years of the Laptop Initiative, teachers kept journals in which they captured reflections, ideas, questions, frustrations, and new understandings related to their implementation efforts that were reviewed by the Staff Development Specialist and used to customize and improve training and professional development. This practice of journal reflection provided the district leadership with up-to-date, authentic information on teachers’ attitudes toward their progress in using various tools, integrating technology into the curriculum, and changing their instructional delivery models as well as their attitudes toward technology’s effect on student learning.

As the Staff Development Specialist’s role evolved over time, the focus was less about daily operations and more about exploring new and innovative methods and tools to help teachers use technology for regular instructional tasks. The Specialist focused on supporting teachers in the use of technology to assist them in more efficiently accomplishing their routine tasks. Most recently, the Staff Development Specialist has moved toward the investigation and acquisition of technology tools (such as Interwrite boards, flip cameras, student response systems, and probeware for science) to facilitate increased technology integration. The

success of these efforts is evident in the adoption of technology by teachers for administrative tasks in addition to instructional purposes.

Vanguard Team

The Vanguard Team, a collegial learning community established by the Leadership Team, emerged as a particularly successful professional development component in Talbot County. This group of tech-savvy teachers emerged in Year One (2005-06) of the Initiative and has since played an active role in providing peer-to-peer leadership as well as peer coaching and mentoring. During the first year of implementation, the Vanguard Team met on a regular basis to discuss current issues facing participating teachers as they delivered instruction within a technology-rich environment. Possible solutions were proposed and communicated to their peers.

Over time, the Vanguard Team has grown from six participants to 14 and has evolved from a team of “peer experts” and mentors to a team that develops, coordinates, and provides all of the technology training for existing and new staff at both Talbot County High Schools. In addition, the Vanguard Team members continue to provide peer-to-peer, just-in-time support to their colleagues. Most recently, the Vanguard Team planned and facilitated support meetings at both high schools to share best practices, solve problems, and showcase new technology tools and applications. Currently, the team is piloting the use of virtual meetings via video-conferencing technology to provide greater efficiency and flexibility to maximize teacher participation.

Technology Coach

In response to the need and demand for additional instructional supports and technical assistance, TCPS created a Technology Coach position to augment the just-in-time professional development and coaching provided through the Vanguard Team. The Coach, an original member of the Vanguard Team, became the “on the

ground” facilitator for the use of instructional technologies at both high schools in Talbot County. This position was responsible for creating linkages between the Leadership Team, the IT team, and the teaching staff and focused on differentiating instruction and understanding the needs of all content areas to best support technology integration. The Coach could step into a classroom with a teacher and model technology integration to foster skill development even as staggered implementation required new teachers each year to join the Initiative.

The differentiated leadership structure in Talbot County created a highly-diversified, distributed model of leadership that fostered a constructivist approach to technology implementation at all levels and supported the development and sustainability of a robust professional learning community.

Long-term Funding Commitments

Another lesson learned from research is the need for a long-term funding source, and preferably multiple sources. Bonifaz and Zucker (2004) found that successful programs tended to secure both internal and external funding sources to ensure consistent financial support. The most successful programs combined a mixture of federal, state, and local funds as well as private (i.e., funding from private organizations) to sponsor their programs.

Financial support for the Talbot County Laptop Initiative has historically been provided through capital improvement funds. The budget goes before the Talbot County Council for approval each year. During the second year of implementation, the budget approved by Talbot County Council did not include public funding for the Laptop Initiative. Due to strong community support, private resources provided funding for laptops for the graduating class of 2011 for the 2007-08 school year. This funding also ensured that the graduating classes of 2009 and 2010 continued to have laptops available during that time. A record number of parents attended public hearings to voice their unwavering support for the Laptop Initiative during Year 2. In

addition, when the continuation of the Laptop Initiative was threatened, numerous parents wrote letters to the editor (in the *Star Democrat*) in support of the Laptop Initiative.. Since the second year of the Initiative, the County Council has fully funded the Talbot County Laptop Initiative.

Stakeholder Involvement and Partnerships

The development of partnerships provides a solid foundation for any technology integration project. TCPS was a champion of community involvement and partnership development. One immediate partnership Talbot County Public Schools created was with the external evaluator: the Johns Hopkins University Center for Technology in Education (CTE). Utilizing an Empowerment Evaluation model, CTE acted as a “critical friend” in assisting the District Leadership in the collection and analysis of both formative and summative data to make programmatic decisions in a process of continuous improvement.

TCPS has a history of including parents and community members in the planning and implementation of the One to One Laptop Initiative. Parent participation in training events in Talbot County is near 100% and over time has allowed for consistent and shared expectations for laptop care and use. In addition, TCPS District Leadership has partnered with the Talbot County Chamber of Commerce, local businesses, individuals in the community, foundations, and other organizations to garner support for the Initiative and allow for community awareness and participation. Many of these engaged community members stepped forward to donate money to fill the funding shortfall during the second year of the Laptop Program (2006-07).

Systemic Integration of Technology in Curriculum and Instruction

Successful laptop programs provide support for the seamless integration of technology into curriculum and instruction. “Researchers find that extracting full learning from a technology investment requires much more than the mere

introduction of technology with software and web resources aligned with the curriculum. It requires the triangulation of content, sound principles of learning, and high-quality teaching..." (Cisco Systems, 2006). The District Leadership team recognized the importance of the contextualized support of technology integration from the Initiative's inception. And, as the technology infrastructure has improved, the adoption of online textbooks has become more pervasive. Online textbooks have been utilized successfully in several classes and are preferred to the traditional text.

In addition to efforts provided through the comprehensive system of teacher professional development, TCPS leadership consistently sought innovative, research-based technology tools to support technology integration. In some cases, technology integration and innovative use came from teachers and students who creatively applied technology solutions to required courses. What materialized over the years was not only a "top down" (district/school leadership) but a "bottom up" (teacher/student) approach that resulted in inventive instructional strategies and in some cases new course offerings that expanded opportunities for all students in TCPS. The examples that follow provide a glimpse at a few of the innovative strategies employed during the duration of the Laptop Initiative.

Study Wiz

Beginning in Year Two (2006-07), Laptop Initiative teachers utilized a new approach to facilitate communication with students. *Study Wiz*, a software program, allowed teachers to post assignments and provided students a means to submit homework with greater reliability. *Study Wiz* offered a vehicle for secure communication between students and teachers. Using *Study Wiz*, students were able to access information about class assignments and submit completed assignments. In addition, *Study Wiz* allowed instructors to create chat rooms for all students in the class to participate in an "online" discussion about a particular topic.

During focus group sessions led by the Evaluation Team, this functionality was said to lead to increased student engagement in classroom discussions.

Cognitive Tutor

The District Leadership Team, and particularly the Vanguard Team members, have consistently been interested in providing teachers with software tools to assist with content delivery. *Cognitive Tutor*, a research-based mathematics software package, was introduced during Year One (2005-06). *Cognitive Tutor* combines curricular content with individualized lessons for Geometry and Algebra 1. Classes with laptops had access to this software, which provides students opportunities to engage in problem solving, communication, and abstract reasoning while making connections to math concepts and processes. In addition, students who use *Cognitive Tutor* received individualized instruction, practice, immediate feedback, “just-in-time” help, and positive reinforcement. Research on the effectiveness of *Cognitive Tutor* shows its promise for improving student performance and achievement through scaffolded practice and technology-supported guidance toward knowledge acquisition and skill development (Ritter, Anderson, Koedinger, & Corbet, 2007).

Communication and Multi-media Career Pathway

The *Communication and Multi-Media Career Pathway* is one example of systemic change that occurred due to the combination of teacher initiative and technology availability. This interactive multi-media program came into being following the efforts of one teacher at Easton high school to leverage the power of technology in her classroom. In the early years of the Laptop Initiative, a computer-related course was developed and delivered that addressed the technology education curriculum using the latest software. The success of this course led to its expansion and the creation of a career pathway. Currently, four related courses have been designed and offered to students utilizing the latest version of the Adobe

Creative Suite. Students who successfully complete all four of the multi-media courses in sequence are eligible for Adobe Certification—earned by taking certification exams through a third party to become certified Adobe experts. In addition, Talbot County Public Schools has developed an articulation agreement with Chesapeake College so that students who pass all four courses can bypass foundation courses at the college level. Interview data during Year 4 revealed that students who passed this Certification had been hired directly out of high school into desktop publishing and graphic design jobs (typically not accomplished without some post-high school training).

Apple iPhone Application Course

Similar to the *Communication and Multi-Media Career Pathway*, software programming courses were developed and offered due to student interest and teacher initiative. Students currently have the opportunity to develop applications using the Apple Software Development Kit for the iTouch, iPhone, and iPad. This stand-alone course offers students the opportunity to learn to program using Objective C (a programming language). After course completion, students can develop applications that they can independently disseminate to other Apple users through the iTunes and other Apple applications networks.

Auto Tech

The final example is the exemplary use of technology in the auto tech courses. Led by teacher interest and fed by student enthusiasm, technology has been thoroughly infused into the auto tech curriculum. An electronic “notebook” was created by the instructor to support students as they progress through the course material. Classroom observations revealed the seamless transition between the use of high and low tech technologies. For example, during one observation, students used their laptops to access class activities while participating in the activity using a circuit board and wiring. The auto tech instructor has meticulously aligned his

courses to the National Automotive Technicians Education Foundation standards and guidelines providing TCPS students with an advantage going into certification exams directly out of high school.

All of these examples demonstrate the creative use of technology to create an environment and culture of systemic change that has affected not only teacher knowledge, skills, and subsequent instructional strategies but has directly impacted student outcomes. Successful technology integration requires far more than just placing computers in the hands of students and teachers—it involves transforming instruction and calls for the dramatic reorganization of classroom routines, grouping structures, and instruction.

High Quality Professional Development

The type of instructional transformation described above did not happen overnight, nor did it happen without support—it required significant efforts to offer and provide high quality professional development to support technology integration. Research indicates that technology integration is most effective within the context of inquiry-based instruction, particularly when it comes to promoting higher-level thinking skills (Windschitl & Sahl, 2002). Inquiry-based instruction facilitates learning through exploration and investigation (Piaget, 1969; Vygotsky, 1978) and fosters competency development in researching, organizing, analyzing, and presenting new knowledge and information, as well as in engaging in productive teamwork—all skills necessary for success in the 21st century workplace. Although technology integration and inquiry-based instruction are a powerful combination, many teachers encounter difficulties learning new technologies while they are shifting toward a more team-based and inquiry-oriented teaching approach.

One of the basic pillars of successful laptop initiatives is high-quality professional development for teachers (Bonifaz & Zucker, 2004; Edmonds & Matzen, 2003; Lento, 2008; Livingston, 2009; Penuel, 2006; Silvernail & Buffington,

2009). Evidence suggests that it is vital to a laptop initiative's success to provide teachers with high-quality, iterative, ongoing professional development that is content-specific and demonstrates concrete examples or methods for technology integration. Penuel, 2006, reports that the more teachers perceived the professional development to be aligned with the content they were expected to teach, the more likely they were to integrate technology. In addition to the quality of professional development, it has also been shown that specific characteristics of professional development are associated with successful initiatives. These characteristics include a variety of professional development offerings (i.e., formal and informal, online and face-to-face) as well as peer coaching and mentoring to support and augment the professional development itself (Maine Education Policy Research Institute, 2009).

Recent research has found a statistically significant relationship between the quality of professional development and teachers' levels of implementation (Drayton, Falk, Stroud, Hobbs, and Hammerman, 2010; Shapley, Sheehan, Maloney, and Caranikas-Walker, 2010). "Giving every child a computer will only improve student learning to the extent that teachers integrate the technology into classroom practice, and change that practice to leverage the features of ubiquitous computing environments" (Center for Digital Education, 2008). Substantial changes in instructional practices require significant professional development and ongoing teacher support.

Technology integration, not just technology use, is another key to the success of a laptop program. Technology integration is established through content-specific professional development that focuses on student-centered, project-based, collaborative learning opportunities. Not surprisingly, laptop initiatives in the early stages of implementation do not show a high degree of technology integration as teacher and students are focused on learning the new technology. However, in order for a program to be sustainable and show impact in areas like student

engagement, technology must move past the stage of simply being implemented to truly being integrated in instruction.

Not surprisingly, incorporating laptop computers into daily and weekly instruction calls for changes in instructional delivery approaches. The Talbot County One to One Laptop Initiative includes robust professional development as part of a system of supports to help teachers transform instruction in order to maximize impact on student achievement. From its inception, the Laptop Initiative encompassed a strong professional development component designed to seamlessly infuse technology into instruction and to optimize learning opportunities for students. Efforts were continually in place to enhance and update professional development to reflect new instructional technologies, teaching strategies, and programs. Throughout the duration of the Laptop Initiative, the professional development process had been intensive, ongoing, multi-faceted, and well-paced with training utilizing teacher collaboration, peer observation, and coaching.

In the beginning of the TCPS Laptop Initiative, professional development focused on knowledge acquisition and skill development regarding the use of technology tools. For example, during Year One (2005-06), staff development personnel conducted 10 days of teacher training. Teachers were taught to use the *iSuite* of applications, including *iPhoto* and *iMovie*. Over time, other tools related to lesson planning and Internet research were introduced and practiced in a hands-on environment. Collaborative lesson planning and co-teaching (with the teachers and the Apple trainer) allowed teachers to observe high-quality integration of technology into instruction as well as the reactions of their students to the modified lessons. In the early stages of the Initiative, professional development was formal and focused on technology use.

Following best practices from the literature, the professional learning community (supported by leadership at all levels) had at its foundation the belief that knowledge and skill improvement is best accomplished within the context within which it is

applied and through “critical reflection with others who share the same experience” (Vescio, Ross, & Adams, 2008). Over the last five years, the professional development in Talbot County has been transformed from conference sessions to after-school support meetings and Continuing Professional Development courses developed by members of the teaching staff. Professional development has changed from a top-down approach to a grassroots, just-in-time, peer developed and delivered system of support. Both formal and informal, virtual and face-to-face training and technical support opportunities are common at TCPS high schools and offered with frequency.

During Year Four (2008-09) of the Laptop Initiative, the Vanguard Team and Staff Development Specialist developed and delivered two, two-day technology conferences that featured over 44 sessions taught by members of the teaching staff. Teachers attending the technology conferences could choose the level of instruction (from basic to advanced technology proficiency) and the topics for instruction to ensure they received differentiated, targeted professional development that best supported their own needs, skills, and competencies related to the integration of technology in the classroom.

Infrastructure and Network Architecture

Planning and development of a solid and adaptable technology infrastructure and network architecture are crucial for the success of any large-scale technology initiative. Strategic planning for the provision of all digital resources involves details such as the purchase or rental of equipment, rapid assignment and deployment of digital tools to teachers and students, purchase or licensing of software and hardware to support technology integration, development of network security systems, as well as the network infrastructure to accommodate bandwidth needs for implementation. In 2005, both public high schools in Talbot County shared two T1 lines (approximately 3 MB of bandwidth). In subsequent years, a dedicated pipeline was provided (approximately 8 MB of bandwidth) to improve Internet connectivity

and speed. In partnership with the local utility company and utilizing ARRA funds, the sixth year of implementation sees the development of plans for a fiber optic network that will serve both high schools and significantly improve network performance.

Careful Planning of Logistics

Bonifaz and Zucker (2006) found that the careful and strategic planning of all program logistics to be one of the most important differences between programs that succeeded and those that floundered. Without strategic and meticulous planning, unexpected barriers or a lack of digital resources necessary for successful implementation can derail an initiative. In Talbot County, District leaders consulted with other programs and visited successful implementation sites to learn best practices and benefit from others “lessons learned.” Significant planning went into the preparation for the beginning of the initiative and was documented in the TCPS Technology Plan submitted to the Maryland State Department of Education in 2004.

Equipment

The Information Technology (IT) team was integrally involved in all aspects of the operation of the Initiative. For example, while the District Leadership team made decisions with input from the IT Department regarding the specific equipment for the TCPS Initiative, the IT team played an essential support role in equipment deployment for the One to One Laptop Initiative. Coordinating with members of the leadership teams and school personnel, the department efficiently deployed 435 laptops for students and 45 laptops for teachers, administrators, and curriculum specialists during the first year (2005-06) of the Laptop Initiative.

From the beginning, the IT Department has been committed to supporting the teachers’ instruction of students through a focus on customer service and customer satisfaction. Technicians have acquired skills and certifications to increase their internal capacity to serve the Initiative’s participants. Over time the technicians’

reliance on outside support for equipment repair has diminished substantially. By the end of the fifth year (2009-10), the majority of repairs could be completed in-house.

File Storage and Management

Over the course of the Initiative, the IT technical staff established and maintained the program infrastructure, including the network and user directory systems necessary to support the large number of computers and files. After the first year (2005-06), the District Leadership Team licensed the use of *Study Wiz* to support the integration of technology and provide a dynamic online learning environment. Through the use of *Study Wiz*, teachers and students can access course materials, assessments, and supplementary resources at any time. In addition, *Study Wiz* can be used for: assignment distribution and collection; the creation of online interactive, collaborative learning spaces; and assessments. Utilizing this program allowed teachers and students additional access to file storage and management of materials and resources.

Laptop Service and Repair

TCPS IT Department managed and staffed Help Desks at both high schools. Processes and procedures were developed and integrated into the use policies to govern how laptops were submitted for repair, repaired, and returned to students. The IT staff took pride in timely turn-around of repaired computers or delivery of loaner computers in the event a computer had to be shipped out to a service center. Data were collected on an ongoing basis by IT management to analyze repair issues and create training programs for staff and students to mitigate damage and repair needs. Data were also used to target common problems and to order sufficient supplies to have on-hand to facilitate timely repairs. Program evaluation data revealed that both students and staff were pleased with the service and support provided by the district IT staff.

Student Responsibility for Equipment

During the early years of the initiative, cracked or broken screens were the most common problems reported by students. The second most frequently mentioned repair issue was a malfunctioning disk drive. A number of student responses indicated laptops had been dropped. In reaction to these issues, school and district leadership increased efforts to ensure that students understood the essentials of laptop care. In addition, efforts were made to clearly detail those actions that constitute “mistreatment” and communicate the consequences for mistreating laptops. Currently, all incoming 9th grade students must attend an information session that outlines all critical issues with regard to laptop care and use.

As the laptop initiative matured, teachers commented (during Year 4 focus group sessions) on changes they observed in student responsibility with regard to the laptops. Although some teachers felt a few students needed to be more responsible in caring for their computers, other teachers observed greater responsibility by most students—“more responsible across the board”—and some were impressed with the lack of vandalism and the good care students were taking of the computers.

Network Safety and Security

Another important aspect of any Laptop program is the network security and safety measures implemented. The TCPS IT department has stayed on the cutting edge of advancements in network security. In the early days of the Initiative, IT staff installed network filters and managed firewalls and other security procedures. During the fourth year of Implementation (2008-09), LanSchool was introduced to transform the environment from one of control/restriction to one of consistent monitoring. LanSchool serves several purposes, but at its core it’s a network monitoring application. Through the use of this tool, teachers can blank screens, limit the use of applications, and limit web browsing on student computers. IT

personnel can also access LanSchool and monitor an entire class or the entire school. By simply scrolling down a screen, the IT administrator can scan students and the websites they're currently accessing. If a teacher or administrator sees a student on an inappropriate site (i.e., Facebook), the staff person can send the student a message or can simply close the browser on the student's computer. Students know that they could be monitored at any time. Inappropriate use is stipulated and enforced through an Acceptable Use Policy. Students who abuse their laptop privileges stand to lose access to technology.

In addition to its access-monitoring capabilities, LanSchool can be used to monitor student activity and assist teachers in providing just-in-time support or fast reinforcement for a job well done. LanSchool also has a polling feature that allows teachers to quickly assess student understanding and make instructional decisions on the fly. Individual students who are struggling can be monitored and customized assistance or differentiated instruction can be provided.

Monitoring and Evaluation

Successful laptop initiatives use formative data collection strategies as a method for making programmatic modifications to improve implementation practices. In addition, successful programs have consistent, robust, and ongoing program monitoring and evaluation. This ongoing monitoring allows programs to identify challenges and barriers and target solutions along the way to avoid the pitfalls that can destroy an initiative.

From the initial planning stages of the One to One Laptop Initiative, TCPS prioritized the need for external evaluation to measure the impact of the Laptop Initiative and to determine the degree to which the goals of the Laptop Initiative were met. The school district contracted with the Johns Hopkins University Center for Technology in Education (CTE) to conduct annual evaluations of the Laptop Initiative. A mixed-methods approach was used to evaluate both quantitative and

qualitative data and included sources such as aggregate state standardized test scores and final course grades, for students in *all* grades. Consistent across all years of the Laptop Program evaluation was the collection of data through surveys, focus groups, and interviews. Across the 5-year evaluation period, all key stakeholder groups and laptop initiative participants (e.g., district and school-based administrators, leadership team members, teachers, students, IT staff, parents, and Talbot County high school graduates who had transitioned to college) contributed data to the evaluation efforts. The objective of the evaluation was to provide a status report as to the progress of the One to One Laptop Initiative toward meeting its four primary goals. Evaluation reports were produced and disseminated mid-year and end-of-year for Year One (2005-06) and then annually thereafter.

STAGES OF SYSTEMIC CHANGE

If one thinks of the characteristics of effective laptop initiatives as the ingredients for success, then following best practices in affecting systemic change is the recipe for success. As anyone who has followed a complex recipe knows, the process and sequence are as important (if not more important) than the ingredients themselves. Similar to this analogy, One to One initiatives take more than simply having the proper components in place, but require following a structured sequence of activities over time to achieve success (Center for Digital Education, 2008). In addition, sufficient time for change must be provided to allow teachers to adjust to and become comfortable with technology tools prior to being expected to tackle integration (Bonifaz & Zucker, 2004).

Several models have emerged in an effort to document the stages (or evolution) of change with regard to technology implementation. Two specific models were used with the Talbot County Laptop Initiative: the Concerns Based Adoption Model (CBAM) and the Apple Classrooms of Tomorrow (ACOT) model. The CBAM is a well-research adoption model that defines how individuals progress through the stages of a developmental learning process to embrace innovation. The process

begins with a basic awareness level at Stage 1 and progresses through stages of increasing mastery. At the higher stages, the learner is concerned with the application of the innovation and the use of it in novel ways to achieve the greatest impact (Christensen & Knezek, 1999; Knezek & Christensen, 2004). Similarly, the ACOT model documents stages of instructional evolution identified by the Apple Classrooms of Tomorrow program. See the table below for the stages for each of the models.

Comparison of the Concerns Based Adoption Model and the Apple Classrooms of Tomorrow Stages of Technology Adoption

Stage	CBAM	ACOT
1	Awareness: Aware of technology but haven't yet used it	
2	Learning the process: Learning the basics of technology use, but with a lack of confidence and a tendency to get frustrated	Entry: Learning the basics of using new technology
3	Understanding and application of the process: Beginning to understand how to use technology and can think of specific tasks in which it might be useful in traditional instruction	Adoption: Use technology to support traditional instruction
4	Familiarity and confidence: Gaining a sense of confidence in using technology for specific tasks	Adaption: Integrate new technology into traditional classroom practice (often with a focus on the use of word processing programs, spreadsheets, and/or graphics tools)
5	Adaptation to other contexts: Using technology with confidence—can use it in different contexts and as an instructional aide	Appropriation: Focus on cooperative, project-based and interdisciplinary work incorporating the technology as needed
6	Creative application to new contexts: Integrating technology into the curriculum and using technology as a tool. Independently learning new technology applications and creatively using technology to accomplish instructional goals.	

(Trinidad et. al., 2006)

From the inception of the Laptop Initiative, evaluation data were collected to measure the progress of the teachers through the stages of adoption. During Year 1, 19 teachers completed a survey that asked them to rate their level of adoption. During the initial year of implementation, 72 % of the teachers indicated that they were at Stage 5 or 6 of the CBAM. During Year 2, 33 teachers completed the survey and 79 % indicated they were at stages 5 or 6. In addition to collecting data via end-of-year surveys, TCPS collected formative data through classroom observations, teacher journals, and collaborative just-in-time professional development sessions to inform strategic changes which would assist in moving more teachers through the stages of adoption. By the end of Year Five (2009-10), the majority of the teaching staff implementing the Laptop Initiative indicated or demonstrated that they had reached a Stage 6 level of adoption. Interview and focus group data revealed a consistent and strong theme that is characterized by comments such as:

“We don’t call it an initiative anymore, it’s been institutionalized.”

“We have evolved in the past 5 years... using laptops is not viewed as taking a risk at all. Most teachers have moved beyond the “laptop mentality and are asking for things such as flip cameras, clickers, document cameras, Web 2.0 technologies and applications, etc. to improve instruction.”

“We are well past the “initiative” point... it’s now business as usual.”

In order to facilitate movement from beginning stages of adoption to later stages of adoption, district leadership allocated sufficient time for change and made requirements for technology adoption and integration gradual. The staggered implementation approach also assisted in allowing for gradual change as full implementation was achieved over a four year time span. The gradual implementation allowed for TCPS to address challenges and respond to needs on an ongoing basis. Over the 5-year evaluation period, positions were created in response to demand for more just-in-time support and increased speed for

equipment maintenance. Infrastructure, hardware, and software limitations were addressed and improved upon. Formative evaluation data were used to modify professional development and training approaches and to target specific areas of improvement. For example, in response to data indicating that entering 9th grade students did not have the basic keyboarding and software skills necessary to effectively use the laptops, TCPS instituted training classes at the middle school level to ensure that students had the skills necessary for success when they entered high school.

The future is now the focus of the Talbot County District Leadership Team. As was described, plans are underway to expand the network infrastructure to allow for increased use of streaming audio and video, online textbooks, as well as to speed up and make the current network more reliable. Leaders at all levels are investigating new technologies and considering ways that tool differentiation might be employed in the future. The laptops have become a vehicle for technology integration as new mobile devices (i.e., the iTouch, iPod, flip cameras, and student response systems) are employed in creative ways to augment instructional delivery strategies.

THE IMPACT OF THE LAPTOP PROGRAM

The impact of the Laptop Initiative is not only documented in the evidence of systemic change and technology integration but most notably in the effect on student outcomes. Over the 5 years that the Johns Hopkins University conducted annual evaluations, significant impact was documented in the areas of student achievement, effective use of technology for instruction, student engagement, and improved educational access for and participation by high-risk students.

The analysis of four years of aggregate student achievement data found a statistically significant increase in student achievement for students who used laptops in the classroom compared to students whose teachers used more conventional classroom instruction. Data analyses compared the performance of

students who participated in the Laptop Initiative with students who attended Talbot County high schools prior to the start of the initiative. The analyses used student scores on the Maryland statewide High School Assessment (HSA) tests and end-of-course grades in core subject areas. This analysis showed that students using laptops in the classroom made clear gains on the HSA standardized tests with regard to both pass rates and mean score. The results of analyses of student grades in core subject areas show favorable trends in mathematics and social studies for students who used laptops.

Over the course of the past 5 years of evaluation data, teacher perceptions have consistently affirmed the impact of laptops on student learning and have suggested that using laptops benefitted students most notably in the areas of:

- collaborative learning with peers,
- acquisition of complex concepts,
- enthusiasm for school and learning,
- the application of acquired knowledge, and
- self-directed learning.

Moreover, teachers have consistently agreed that the laptop program has assisted them in the improvement of their instructional strategies and the effective use of technology to deliver content. They report providing a more student-centered and discovery-based learning environment that leverages the use of technology tools to increase student engagement in the learning process. More than 75% of the teachers who completed the Year 4 questionnaire indicated that they felt the use of the laptops increased student interest and engagement in school. Students were similarly enthusiastic, with 73% indicating that the initiative increased their interest in learning. In addition, they felt that the initiative had an overall positive effect on the effort they exerted in the classroom. Parents voiced the same opinions. One parent stated:

“Wow! The laptop program is the best opportunity these kids have to get a jump start in life. The laptops keep my daughter and her friends interested in school and that can be a really difficult thing to accomplish with 14 and 15 year olds.”

The most significant impact, as measured by survey results, focus group data, and interviews has been on students who are at risk (students with disabilities, students from lower socio-economic backgrounds, and students with limited English proficiency). More than 90% of teachers reported that the initiative was important to students at risk. As in previous evaluations of the TCPS One to One Laptop Initiative, teachers indicated that instructional technologies were particularly beneficial for students with disabilities, largely due to the capabilities allowed by technology to differentiate instruction and to customize assignments to accommodate individual learning styles. Ninety-two percent of teachers reported that interventions and accommodations using instructional software allowed students with disabilities to experience success. Parent, student, and teacher comments in surveys, focus groups, and interviews consistently voiced the following sentiments:

“We have increased our ability to differentiate education much better.”

“Now kids get to show their knowledge acquisition in a variety of ways.”

“It’s now easier to do tiered assignments in classes of mixed ability. We can challenge students who need challenge[s] and also help students who need additional support, often without other students knowing.”

“It [the technology] makes such a huge difference for students who are physically challenged. It makes such a big difference in their writing.”

“My child is not a native English speaker. The computer has been an invaluable tool in helping her to both better understand assignments and to communicate what she has learned.”

SUMMARY AND CONCLUSION

Talbot County Public Schools has succeeded in achieving full technology integration by way of affecting systemic change while consistently and systematically addressing the characteristics of successful One to One laptop initiatives. What started over 5 years ago as an effort to decrease the digital divide has expanded to provide the best opportunity for all students to compete in the 21st century world of work. As the quote by Alvin Toffler says, “The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.” In the workplace that these students will enter, it will not be enough to be functionally literate—success will require the agility to meet multiple demands and shifting priorities while continually acquiring knowledge and utilizing that knowledge to meet ever-changing needs.

The Talbot County School System has achieved genuine systemic change through the combination of many factors known to be associated with successful technology integration and adoption initiatives such as: the alignment of the laptop program to well-defined goals, a strong leadership team at all levels, long-term funding commitments, ongoing stakeholder involvement and partnerships, systemic integration of technology in curriculum and instruction, high-quality professional development, a well-maintained infrastructure and network architecture, careful planning of all logistics, strong and ongoing technical support at all levels, and ongoing monitoring and evaluation.

The evolution of the laptop initiative in Talbot County was driven by the leadership, but has been embraced by teachers, students, and community members. As was stated during the focus groups, the Initiative is now regarded as “business as usual.” However, while technology integration has occurred in Talbot County through the consistent efforts of all involved stakeholders, the Leadership Team recognizes that they must continue to focus on all of the components of

successful technology integration efforts. One administrator was quoted as saying “We need to continue to stay on the cutting edge. We have to continue our work... good enough is not good enough.” And, indeed, technology integration initiatives require enormous efforts and resources to remain effective—efforts that TCPS is poised and capable of achieving for the continued success of their students.

The Talbot County Laptop program is a highly successful technology integration project, and an exemplary example of systemic change, that is providing opportunities for their students to not only compete but succeed in the 21st century.

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