Advance 21st Century Innovation in Schools Through Smart, Informed State Policy

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Cisco Systems is an international company actively engaged in the work of transforming education to meet the needs of 21st century learners, educators, and organizations. For more information see: www.cisco.com.

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About the Report

The intent of this policy brief is to provide state education agencies with a model for using public policy informed by research to launch educational technology innovations in local schools. The model features research on collaborative learning.

In this year of 2009, the American Reinvestment and Recovery Act (ARRA) provides a tremendous opportunity for transforming schools into 21st Century Learning systems. This brief provides six principles for moving state policy to practice; a logic model that translates the principles into action; a practical example of the logic model in action (using the findings from a companion publication on research related to collaborative learning to inform policy and practice); and three examples of how other states have successfully modeled this approach.

While the logic model was developed to inform policy work in educational technology, it could be used in other areas of state policy as a model for scaling sound research from policy to practice.

> *"Reforming public education is not just a moral obligation. It is an absolute and economic imperative. It is the foundation for a strong future and a strong society. Education is the civil rights issue of our generation."*
>
> Arne Duncan, Secretary of Education, 2009

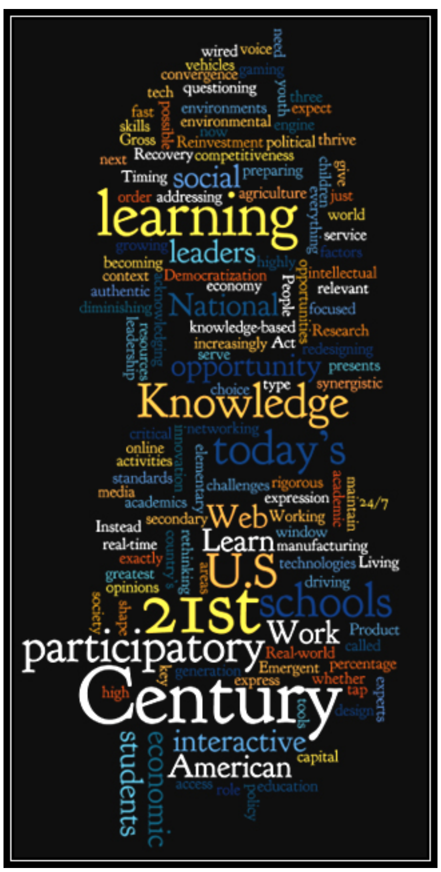
Technology in Schools: A 2009 Window of Opportunity for Innovation

Timing is everything. 21st Century learning is the innovation that can, in the long term, help address the current economic crisis and reaffirm the economic competitiveness of the U.S. internationally.

In the midst of today's economic crisis, U.S. policy leaders are collectively acknowledging the critical importance of elementary and secondary education to this country's economic competitiveness. Simultaneously, Web 2.0 technologies are emerging as the communication and cognitive tools needed to support deep, relevant, participatory learning required for 21st Century success. Our children are growing up wired 24/7 to real-time social networking, interactive gaming, media, and experts, with opportunities to explore, learn, express their opinions, and shape their world. They expect online choice, opportunity for expression, interactive communication, and access to knowledge.

At the same time, U.S. leaders are expecting more of students. Calling this moment in time, "A rare inflection point in history," President Obama delivered a highly controversial address to the Notre Dame class of 2009. Amid protests for his support of abortion rights and embryonic stem-cell research, he asked, "As citizens of a vibrant and varied democracy, how do we engage in vigorous debate? How does each of us remain firm in our principles, and fight for what we consider right, without demonizing those with just as strongly held convictions on the other side?" It is exactly for these reasons students need the critical thinking, collaboration, and cultural awareness embodied in 21st Century Learning.

Asserting that today's major global threats do not discriminate across borders or cultures, he advised the graduates that greater cooperation and open discussions of controversial issues will be necessary in order to find common ground despite deeply held, seemingly irreconcilable beliefs.



The President's eloquent challenge to these graduates comes at a time when U.S. elementary and secondary schools are under fire for not preparing students to take on the challenges of today's high tech, global society. The American Recovery and Reinvestment Act presents a window of opportunity for the rethinking and redesigning of today's schools into 21st Century Learning environments. In 2009 alone the federal government will direct nearly $1 billion for technology in schools. In order to maintain its leadership role internationally, the U.S. will need to tap its greatest national resources, the intellectual capital of youth.

Emergent technologies provide students a voice in addressing economic, environmental, political, and social challenges of the times as they learn academics and 21st Century Skills through authentic, interactive, participatory activities.

This policy brief provides a model for bringing 21st Century Learning innovations into America schools through powerful, insightful state-level policy. One of the unique features of this model is the use of research to inform innovations in 21st Century Learning.

The Role of the State Education Agency

In acknowledgment of the critical role of technology in today's society, the U.S. federal government will release nearly $1 billion this year in monies targeted specifically for effective uses of technology in elementary and secondary schools.

Individually, school districts may also opt to invest funds from other federal or state programs for technology-enhanced resources, services, and products. It is imperative that these funds be invested innovatively.

Six Principles for Moving State Policy to Practice

The stimulus bill, aka the American Recovery and Reinvestment Act (ARRA), represents a $100 billion, once-in-a-lifetime opportunity for the redesign of American schools. The challenge for State Education Agency leaders is how to position the ARRA funds in ways that ensure smart, innovative thinking and action by school districts on effective practices in the short term, which will also be transformative and sustainable over time. Within the overall $100 billion ARRA budget for education, $650 million has been targeted for the What Works and Innovation fund, offering competitive grant opportunities for districts and non-profit groups with a strong track record of results.

The following six principles are presented here as a starting point for the design of innovative programs that will carry the intent of the stimulus package into schools and classrooms.

Principle **1**

A 21st Century Vision

The single most critical principle for education innovation is the collective vision for the future that is held by stakeholders across the diverse sectors of the education community. Today's vision must be fueled by innovation, guided by principled leaders, and accelerated by emergent technologies. In this knowledge economy, a country's greatest natural resource is the intellectual capital and entrepreneurial spirit of its citizens.

Education has a unique opportunity in 2009. The education of American children and youth is seen as a critical, high profile element of this country's economic, political, and social viability in today's global economy. That translates into a charge, from the nation's policy leaders to educational leaders, to redesign educational systems in ways that ensure Americans can compete in the 21st Century.

In 2009, over $100 billion in federal funds will be invested in American schools, with nearly $1 billion targeted specifically for technology in elementary and secondary schools.

Vision matters. The redesign of American schools must be guided by a vision for learning that addresses the crises in American schools, such as high dropout rates, mediocre literacy rates at the secondary levels, low comparisons in math, science, and problem solving, and achievement gaps across minority populations and socioeconomic groups.

The difference is that these issues, in the short and long term, must be addressed, not by stopgap measures, but through a new vision for learning that:

- Taps into the key 21st Century Skills of critical thinking, collaboration and teaming, self-direction, multimodal literacy, and global and cultural awareness;
- Aligns to and leverages emerging technologies (e.g., computers, smart phones, and Web 2.0 tools);
- Embraces the collaborative, participatory learning made possible through Web 2.0;
- Is informed by emergent research on how people best learn;
- Maintains high rigor, but in the context of relevant, real-world, authentic learning and 21st Century Skills;
- Is designed to be student-centered, giving the student and his/her family a strong voice in their own learning.

Principle 2

Research

The public investment in elementary and secondary schools must be informed by the emerging body of research from the learning sciences as well as innovative pilots in 21st Century Learning.

Today's vision must be fueled by innovation, guided by principled leaders, and accelerated by emergent technologies.

Educators must be knowledgeable about the growing body of evidence-based practices, while, at the same time, maintaining openness to innovative pilots that build on strong theoretical knowledge. Take for example the opportunities afforded through Web 2.0 for online collaboration. While few research studies have been conducted on the use of collaboration using Web 2.0 tools, the concept should be seriously considered, given the strong theoretical research base for collaboration in other venues.

While it seems self-evident that educators must become informed consumers of trustworthy research, the challenges in doing so are many. It will require that educators have transparent access to unbiased reviews of research; clear definitions of what constitutes trustworthy evidence; professional development to advance educators' expertise on the use of research for informed decision making; and school cultures where evidence-based practices are the norm.

At the same time, educators need to be cognizant of emerging Web 2.0 tools that could serve to accelerate the spread of effective practices or perhaps provide vehicles through which much larger numbers of students and teachers could engage in learning strategies that research has found to be effective.

Principle 3

Scaling Up[1]

One of the strategies many state programs adopt to ensure the wise investment of public funds is that of "scaling up." This entails the transference of effective programs from schools where the approach has proven to work, into other schools that are seeking to achieve similar goals. Too often educators try the cookie cutter approach, insisting that every detail of the successful program be replicated in the new school. This usually doesn't work, because it is rare for one program to perfectly fit another school's circumstances. Effective "scaling up" happens when the new school adopts the core elements of the successful program, but is able to modify and adapt other aspects of that program to fit their school's circumstances.

Key to successful transference, or "scaling up," is the provision of choice for the district. This would entail identifying which effective programs or strategies are worthy of consideration for transference; and then carefully building the capacity of the district to understand fully the research basis (both theoretical and empirical) upon which the program was designed. With the acquisition of such knowledge comes insightful instruction and learning.

> *"Only innovations with strong mechanisms that foster resilience and evolution can survive the complex process of change involved in moving to scale."*
>
> Chris Dede, James Honan, and Laurence Peters, Scaling Up (2005) p. 228

Principle 4

Community of Practice

Change is enhanced through communities of practice (CoP). School districts that are expected to redesign teaching and learning need opportunities to work with colleagues tackling similar challenges.

The benefits can be tremendous if the community of practice is established in ways that enable districts to work together formally and informally to exchange ideas, share lessons learned, provide feedback to state funders, and establish a support system for the change processes.

This type of community also enables the state to stay attuned to school districts' discussions on the challenges they face in transferring research to practice. It enables the state officials to identify barriers and common problems early on so they can be addressed before they seriously interfere with the implementation of the school district programs. In this way, state officials can systemically address issues rather than expecting individual districts to do so one by one.

At the same time, CoP establish formal linkages among school districts that are on similar paths, creating the springboard for informal liaisons that can serve as critical, safe, informal support structures for educators in the throes of change.

Principle 5

Smart, Informed Innovation

One of the most important shifts in American schools needs to be in its openness to new ideas and to change. Just as business and industry must continuously adapt to the rapid shifts in this 21st Century, so must education. That calls for a culture of innovation informed by data, research, and critical and creative thinking. Schools should not only adapt to societal innovations, they must embrace the entrepreneurial spirit and become centers of innovation.

Schools need to establish data and information cultures that are continuously gathering, analyzing, and reviewing data, research, and societal trends in ways that inform continuous improvements.

There are a variety of ways in which the state education agency can scaling up innovative, effective practices. As statewide programs are launched, state officials can facilitate the strategic use of such knowledge to inform iterative improvements in quality, fidelity, and efficiency of programs. This can happen in part by establishing a state framework for evaluation metrics. In cases where the state has established a statewide program and invited districts to participate, the evaluation process could be streamlined by the SEA's commissioning of a program-wide evaluator. The evaluator would design the evaluation, establish the indicators of success, measures, measurement instruments, data collection procedures, timeline, and processes for analysis and reporting.

In other cases, where the school districts are designing unique programs for implementation, the metrics could take the form of an evaluation framework with certain requirements that local evaluators for each school district project would be required to meet. In the latter, the state can increase the quality of local evaluations tremendously, and the ability to aggregate across programs, by establishing a community of interest with all the local evaluators and points of contact. Similarly, this is an opportunity for aggregation of buying power in establishing state broadband networks and low-cost "last mile" access for schools.

School districts that are expected to redesign teaching and learning need opportunities to work with colleagues tackling similar challenges.

Another important way in which the state education agency can advance innovation is by supporting a state culture of innovation and learning inside the agency and among district leaders. There are a myriad of opportunities available to do so. For example, a state might proactively convene a group of practitioners, researchers, and business and industry representatives to provide advice on how specific programs could be reinvented to better serve students. While it is difficult for a state education agency alone to make change to funding streams and parameters of existing programs, innovations in the program become possible when the changes are collaboratively investigated and recommended by collaborative groups.

Another critical area is in establishing a culture of innovation and change within the agency itself. The perfect opportunity to do so in 2009 is in the development of proposals to the federal government in response to the competitive grant programs in the What Works and Innovation Funds.

Principle **6**

Sustainability

Sustainability of an educational program depends, to a large extent, on the commitment of the staff to the program, their perceptions of the value of the program, the degree to which the program fits into the culture of the school, and their analysis of the total cost of ownership (TCO). Much of the success of sustainability depends on the fidelity of the implementation based on associated research.

Fidelity means ensuring high-quality implementation that adheres to essential elements of effectiveness. To effectively scale up requires extensive capacity building through professional development, leadership training, facilitation of work sessions, and responsiveness to district inquiries, needs, and requests for technical assistance. In addition, it requires sufficient time (often 2–5 years) of support in order for the program to become integrated fully into the culture of the school.

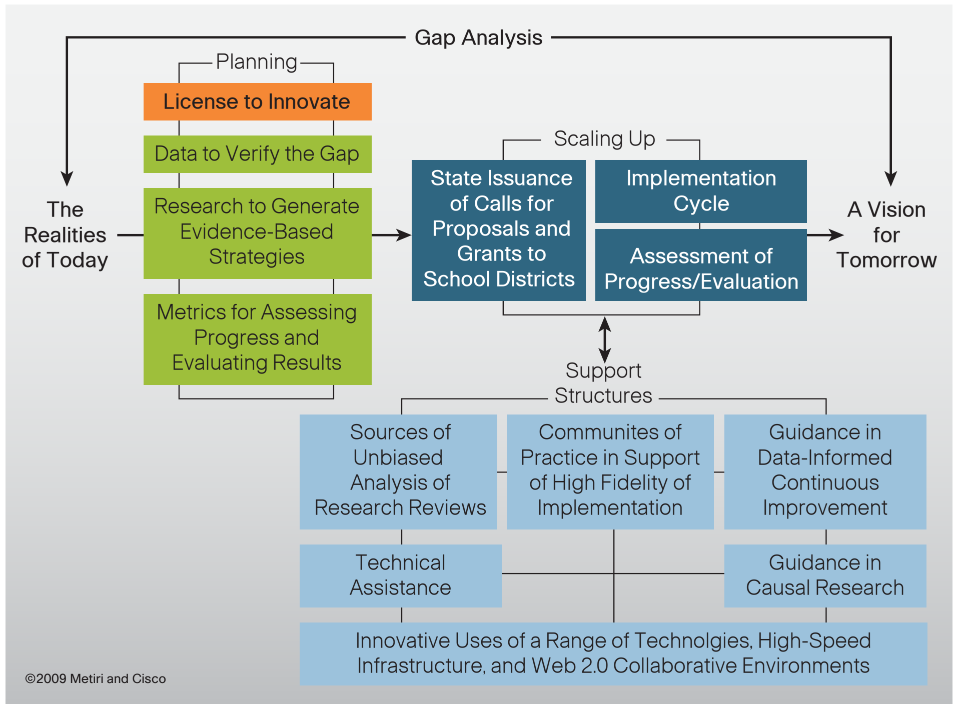
A Logic Model

State Education Agencies (SEAs) are charged with the responsibility and authority to translate the enacted laws into educational programs that meet the legislative intent. Federal and state funds flow through the SEAs to the Local Education Agencies (LEAs), most often in the form of formula or competitive grant programs. It is through these SEA programs that school districts access federal and state education funds. SEAs across the U.S. are gearing up now to put the structures in place to meet the Congressional/legislative intents for these federal funds.

The intent of this policy brief is to offer a logic model for translating "policy into practice," in ways that meet the intent of the legislation while maximizing the return on investment of public funds. The model (see Figure 1) presents a set of critical decision points essential to the translation of public law into smart, intelligent programs in school districts across the country.

The model builds on the fact that education policymakers are increasingly using research and data to inform policy, program development, and practices.

Figure 1: An Innovation Logic Model: Policy to Practice Model for State Education Agencies Administering Federal and State Programs



Policy into Practice: One Step at a Time

The logic model is provided for SEAs charged with the responsibility of translating policy into school programs that meet legislative intent. The six key principles outlined on previous pages are embedded in the design. Brief descriptions of each of the four elements of the logic model follow: I. Gap Analysis; II. Planning; III. Scaling Up; and IV. Support Structures.

Four Elements within Logic Model

Element 1

Gap Analysis

The SEA reviews the legislation, budgetary language, and associated legislative testimony in order to identify the legislative intent, the stated purpose or goal(s), the identified needs to be addressed, and any required programs or strategies. Based on that review, the SEA clearly defines the goals; determines if there is a need for legislation; and identifies the gap(s) between what is occurring and what should be occurring through the new (or continued) programs.

Element 2 Planning

The SEA's next steps are to work with colleagues within the agency and educators from LEAs to provide background, definition, context, and direction for their legislatively mandated programs. To do so requires the SEA to investigate the following:

- **License to Innovate.** To innovate is to launch a new idea in a system that gains sufficient momentum so as to cause ripples of change in that system. The SEA can nurture innovation by fostering K–12 think tanks, bring "what works" into facilitated discussions on how to move from ideas to practice, fund innovative projects, and foster partnerships with innovative companies. The "license to innovate" is accomplished as the state calls for innovative ideas in its Request for Proposal (RFP) to the schools districts in its state.
- **Data.** The SEA identifies and reviews any available datasets that might inform the work, including data related to eligibility factors; characteristics and performance data on eligible schools, districts, or subgroups; etc.
- **Research.** Once a research basis had been established, the SEA identifies evidence-based, promising practices that have the highest probability of advancing the goals specified in the legislation. This can be scaffolded by the SEA though commissioned research briefs and associated policy forums.
- **Metrics.** The SEA then establishes the metrics for measuring advancement of the goals. These could include primary indicators of success, typically related to student outcomes, such as achievement, 21st Century skills, or engagement. The metrics could also include leading indicators of progress, typically related to changes in classroom practices, such as teacher proficiency, pedagogy, learning strategies, classroom culture, curricula, choice, intellectual safety, authenticity, etc.

Based on this work, a plan is developed to carry out the functions of the enacted legislation. This would include the determination of the process by which the funds would be allocated to LEAs typically identified in the legislation (e.g., competitive grants, formula grants, targeted subgroups, equity in geographic distribution, etc.).

Element 3 Scaling Up

To maximize the return on investment, states often will identify successful programs that are working in some schools and then put a process in place to replicate them elsewhere.

- **State Issuance of Call for Proposals.** Based on the aforementioned planning stage, the state makes a determination as to the nature of the call for proposals. In some cases, the state decides to focus the call on a specific evidence-based strategy or intervention. In other cases, the specific strategy or intervention is left to be proposed by the LEA, guided by specified criteria and/or priorities within the Call for Proposals. In an effort to build the capacity of LEAs to respond in an informed manner, the state might offer orientation or information sessions prior to the release of the Call for Proposals. The expected outcomes, measures of success, and/or interim progress indicators should be clearly identified in the Call.
- **State Awards of Grants.** The SEA determines the awards of grants to LEAs based on the eligibility criteria and the competitive or formulaic process identified in the Call for Proposals.
- **Implementation Cycle.** The implementation cycle should be sufficiently long to allow for the full cycle of change in schools. If allowed by the enacted legislation, that cycle should be at least 2 to 3 years. The multi-year grant period is instrumental in gaining the commitment of teachers and administrators to the change process. The awardees should be required to plan their implementation schedule with the intent of meeting milestones that would advance their attainment of the goals.

- **Assessment of Progress/Evaluation.** This area of assessment of progress and evaluation is often a challenge to the SEAs, in part due to restrictions on the percentage of funds available for evaluation. The ease of conducting a state level evaluation of all the LEA awardees' programs is dependent on the determination of core outcomes of the local programs by the state.

  States often approach the evaluation from both the formative and summative perspectives by requiring a combination of state level and local evaluation. In many cases the state level evaluation concentrates on the systematic collection of interim progress indicators that can be reported by school, but also aggregated at the state level, showing trend data over time (e.g., changes in classroom practices, changes in pedagogy, changes in teacher proficiencies, etc.). Such data can also be used for formative purposes at both levels. At the same time, the SEA will often require that the LEAs conduct a local evaluation where the focus is on student outcomes. In most cases, those local evaluations are then aggregated into a state level report. Most states find that, without strong evaluation support, most LEAs do not have the in-house capacity to conduct high-quality evaluations on the impact of their programs.

Element 4

Support Structures

Support structures are critical to the success of the grant programs.

- **Communities of practice.** With the advent of Web.2.0 tools has come what the Harvard professor Henry Jenkins calls a participatory culture. The state can tap into that opportunity by establishing virtual environments in which teachers and other education professionals involved in their programs can share experiences, collectively identify and address barriers, celebrate successes, identify and interpret research, and generally discuss all aspects of their experiences within the state's programs.
- **Sources of unbiased analyses or research.** Educators often do not have the time, resources, access, or experience to identify and digest the body of research related to new learning approaches. The state can be extremely helpful to educators by commissioning and publishing that work, making it available to educators electronically, and providing unbiased analyses of related research studies.
- **Guidance in data-informed continuous improvement.** The state's program outcomes, indicators of success, and associated metrics, can be critical elements of formative assessment and continuous improvement throughout the life of the program. The state should not only collect and analyze state-level data using established metrics, it should disaggregate that data for use by LEAs. In addition, it should provide training in the analysis of the disaggregated data in setting incremental targets and strategies to reach those targets in efforts to ensure continuous improvement.
- **Technical assistance.** Technical assistance is responsiveness to individual and collective needs of program participants. The state should provide avenues for program participants to identify needs, and then to respond accordingly to needs as resources allow.
- **Guidance in causal research.** The state role in this area is two-fold. First, where possible, the state should plan and execute experimental or quasi-experimental research studies that document causal effects of the program. Second, the state, where possible should help educators understand the difference between causal, correlational, and qualitative studies, to ensure informed decision making.
- **Innovative uses of technologies, high-speed infrastructure, and Web 2.0 collaborative environments.** The state should facilitate low-cost high-speed, high bandwidth access to the Internet for all students and educators.

- **State support structures** often include grantee meetings, professional development, access to resources and expertise, formal opportunities for collegial exchanges with other grantees, online communities of practice, evaluation guidance, access to analyses of research reviews, and, in some cases, opportunities to participate in research studies. They also include the technological foundations the state should provide including low-cost access to a high-speed network and a range of technology devices for student and teacher access, provisions for technical support, maintenance and repair, and periodic updates and redesigns within the system.

Summary

The elements of the logic model together form a systemic approach to bringing innovation in 21st Century Learning to schools.

Three examples of states that are being very intentional in their scaling up of educational technology programs are summarized below, with more in-depth descriptions included in Appendices A, B, and C. While these states did not use the logic model from this paper in the development, implementation, and assessment of their policy-to-practice approaches, each includes many of the elements from the logic model for innovation.

eMINTS (Missouri)

The state of Missouri had the foresight to establish one of the first state networks to offer interconnectivity for educators. With easy Internet access in the classroom, students' attraction to technology and its power to grab their attention quickly became evident. What also became apparent, however, was a need to assist teachers with tapping into the wealth of resources suddenly at their fingertips, and using technology to support pedagogy that would increase student achievement. Hence, MINTS and its successor program, eMINTS, were born.

Missouri's eMINTS (enhancing Missouri's Instructional Networked Teaching Strategies) professional development/technology initiative supports educators in integrating technology into inquiry-based, student-centered, interdisciplinary, collaborative teaching practices, which result in higher levels of student performance.

Since its inception as a demonstration project in 1997, eMINTS has expanded from a flagship professional development program for teachers to programs designed specifically for administrators, Instructional Specialists, early grades, and special education. eMINTS now reaches more than 38,000 students in grades 3–12 who learn in more than 2,000 eMINTS classrooms in the United States. The program can be found in nine states and Australia.

Source: eMINTS National Center. *About eMINTS.* http://www.emints.org/about/index/shtml
See Appendix A for full description.

Enhanced Peer Coaching (Washington)

Beginning in 2008, Washington State's Office of the Superintendent for Public Instruction (OSPI) distributed 50% of their Title II, Part D funding through competitive grants to eligible school districts interested in participating in a two-year, statewide Enhancing Peer Coaching Program.

The program prepared over 280 teacher leaders to serve as peer coaches for their colleagues in the systematic integration of technology into teaching and learning. Each coach used awarded funds to: participate in the eight-day Microsoft Peer Coaching course and two days of technology integration training; attend the regional technology conference; and pay for substitute/release time and equipment and software for participating classrooms.

Coaches worked with at least one collaborating teacher in Year 1, and will work with an additional teacher in Year 2.

The impact of the Enhanced Peer Coaching program persists even when funding discontinues for a participating school district. Collegial assistance with technology continued beyond the period of the grant program as the coaches are co-located with their collaborating teachers and as a result of the strong relationships that have been established.

Source: Superintendent of Public Instruction (OSPI), State of Washington. Enhanced Peer Coaching. http://www.k12.wa.us/EdTech/peercoaching.aspx. See Appendix B for full description.

Technology Immersion Pilot "TIP" (Texas)

The Texas Education Agency (TEA), at the request of the Texas Legislature, embarked on a visionary Technology Immersion Pilot (TIP) project to immerse technology into teaching and learning.

Begun in 2003, the program has called upon high-need middle schools to "carry out the act of learning beyond the classroom walls and beyond the school day" through total immersion of faculty and students in technology.

Using Title II, Part D monies, the TEA has provided competitive grants to 39 campuses statewide for 1:1 technology resources. TEA based the use of these funds on the assumption that state goals could be better achieved by immersing schools in technology, rather than introducing technology resources over a period of time.

The Evaluation of the Texas Technology Project (eTxTIP) was carried out concurrently with the TIP project. Under eTxTIP, researchers at the Texas Center for Educational Research (TCER), TEA's primary evaluation partner, conducted one of the largest ever, multi-year research studies in education technology.

Source: Texas Education Agency, Educational technology. Technology Immersion Pilot (TIP). http://ritter.tea.state.tx.us.technology/tip. See Appendix C for full description.

The Logic Model in Action: Innovation through Collaborative Learning Policy

One Scenario

How should a State Education Agency position the awarding of the federal funds for educational technology to gain the most return on investment, as defined by the goals set forth within the law?

As the logic model in Figure 1 indicates, one of the key challenges is clearly identifying the expected outcomes for the investment of public dollars, and the learning strategies that research points to as the most promising for accomplishing that return.

As the SEA tackles this challenge, all the elements related to the scaling up of effective programs must be addressed (e.g., the need to identify the essential and non-essential elements of the effective program; and the need for high fidelity of implementation of the essentials while, at the same time, allowing the school district to adapt the program to fit into the local culture).

Using the Logic Model

The following breakdown goes through the four sections of the logic model. It will show how this body of emergent research might positively influence the way in which an SEA positions the Call for Proposals for federal grant awards for educational technology. The four elements from the logic model in Figure 1 are:

I. Gap Analysis: The gap is determined by assessing the distance between the vision for tomorrow and the reality of today's situation.

   The $1 billion federal allocation for educational technology is authorized under the rules established by the No Child Left Behind Title IID (NCLB IID) legislation (with slight modifications). As such, the three goals for the Enhancing Education Through Technology (EETT) program are:

   - The improvement of student achievement through the use of technology;
   - The assistance to every student in crossing the digital divide as measured by student technology literacy at the 8th grade level;
   - The effective integration of technology resources and systems with teacher training and curriculum development to establish research-based instructional methods that can be widely implemented as best practices.

   Each SEA would need to use data to document evidence of need for at least one of the three goals. Most states will acknowledge that, while they are making progress in all three areas, there is much left yet to be accomplished. For this example, let us assume the following targets have been established for the 2009 Call for Proposals for EETT.

   Target 1: EETT schools will increase science and mathematics achievement at middle schools through effective uses of technology.

   Target 2: EETT schools will increase technology literacy among middle school students.

   Target 3: EETT schools will integrate research-based, technology-enabled learning practices into school practices in middle school mathematics and science, supported by associated professional development for teachers and administrators.

II. Planning

   Data: Based on the targets established as outlined above, the SEA identifies the initial gap as evidenced by science and mathematics scores for middle school students in the state that are below proficiency; and differences between targeted levels of technology literacy and those most recently reported. These are considered in the context of demographics, and data from the leading indicators.

Definition of Collaboration/ Cooperation

For the purposes of this paper, collaboration and cooperation are used interchangeably to describe situations where individuals work together to achieve mutual goals.

Research: At this stage, the SEA would review all literature on increasing academic achievement in middle school mathematics and science through technology. One of the areas that would emerge would be the significant impact of collaborative/cooperative learning on increases in deep learning across curricular areas, especially math and science.

While further research would undoubtedly uncover research-based programs that could advance the targets, for this exercise the focus will be on collaborative/cooperative learning.

A Brief Synopsis of the Research on Collaborative/Cooperative Learning

A systematic review of the literature on collaborative/cooperative learning and subsequent meta-analysis revealed the following findings.

Key findings from the literature review:

- Cooperative learning is significantly more effective in achieving higher academic learning outcomes in comparison to competitive learning or individual learning.[2,3]
- In order to get results, cooperative learning must be implemented with fidelity (i.e., teachers must explicitly teach students to work cooperatively, and must monitor and assess the quality of students' cooperative learning over time).[4,5,6]
- Cooperative learning in conjunction with technology results in significantly higher academic gains when students work in small groups versus when students work individually or in larger groups.[7]
- Results from cooperative learning are higher for homogeneous groups versus heterogeneous overall, but those results differ depending on the performance level of the students and the subject area.[8]

The Metiri Group's companion research study found that scaffolding (i.e., sequencing, guided inquiry, reflective questioning, explicit cooperative strategies, etc.), when used in combination with cooperative learning, resulted in significantly higher gains when compared to cooperative learning without scaffolds, especially for complex tasks that involve higher order thinking (see boxed text next page).[9]

The general literature review also revealed results from specific cooperative learning strategies. For example, in situations where intellectual conflict is appropriate, the cooperative learning strategy of constructive controversy results in significantly higher academic gains in comparison to concurrence seeking, debate, and individual learning. Constructive controversy includes a 5-step approach where students engage in: 1) researching a position, 2) presenting the best case, 3) discussions where students argue for their positions, 4) reversing perspectives, to research and argue for the opposing position, 5) dropping all advocacy and creating a synthesis or integration of opposing opinions.

The bottom line is that, when students learn in collaborative groups, they learn more, provided the following caveat is taken into account. To be effective, collaborative/cooperative learning must be facilitated with fidelity. Results improve when the group size is small and, when the task is complex—especially when the collaborative/cooperative learning is scaffolded. (A summary of the key sources of research findings is included in Appendix D.)

Collaboration and Scaffolding of Learning: A Meta-Analysis

A 2009 meta-analysis conducted by lead researcher Susan Williams from the Metiri Group was commissioned by Cisco Systems as a companion piece to this policy brief.

The review was intended to build upon the previous meta-analyses, but focused on recent studies. The recent studies were related to collaborations that took into account the need for students to be proficient with highly complex tasks given the high tech, fast-paced, complex, world in which they live, learn, and will eventually work.

Results from the meta-analytic review of 12 studies indicated small, but significant positive effects favoring cooperative learning over traditional learning for both simple tasks (ES=.33) and complex tasks (ES=.225). Additionally, a review of 6 studies found significant, positive effects in academic achievement when cooperative learning included scaffolding versus cooperative learning alone. The effect was small for simple tasks (ES=.225) and moderate for complex tasks (ES=.48).

The net effect is that when a student who is scoring academically at the 50th percentile on complex tasks, is subsequently engaged in high quality cooperative learning, his score jumps on average by 8 percentiles (i.e., the net effect of the cooperative learning is an increase from 50% to 58%). A student already engaged in cooperative learning, scoring at the 50th percentile, on average, will increase his score by 19% when the teacher adds scaffolding into the instruction.

Metrics: At this stage, the SEA would review the literature to identify key indicators of success for the project related to students. The SEA representatives might include the student level and classroom level indicators listed in the tables below.

Table 1: Sample Student Outcomes for Evaluation

Sample Student Outcomes
Mathematics Achievement as evidenced by benchmark assessments, state achievement tests, rubric analysis, etc. all related to standards
Science Achievement as evidenced by benchmark assessments or state achievement tests, rubric analysis, etc. all related to standards
Student Collaboration (online and off-line) as evidenced by self, peer, and teacher rubric analysis, teacher review of online discussions, blogs, and wiki development
Team Effectiveness as evidenced by team and teacher rubric analysis, and rubrics related to team products
Engagement in the Learning (cognitive, affective, and behavioral), as evidenced by teacher observations, and student engagement surveys
Quality of Team Projects as evidenced by self, peer, and teacher rubric analysis related to content, critical thinking, creative thinking, deep learning, inquiry, visual representation, etc.

Table 2: Sample System/Classroom Outcomes for Evaluation

Sample System/Classroom Outcomes:
Quality, type, and frequency of student collaboration as evidenced by teacher lesson plans, periodic observations, teacher surveys, video capture, and student surveys
Changes in instructional approaches as evidenced by teacher lesson plans, periodic observations, and student surveys
Characteristics of assignments related to inquiry, thinking, collaboration, and products as evidenced by teacher lesson plans, periodic observations, and student surveys
Engagement elements in the classroom (Product, Process & Content) as evidenced by teacher lesson plans, periodic observations, and student surveys

III. Scaling Up

The research on cooperative learning clearly demonstrates the value to academic achievement in mathematics and science. In addition, two key aspects of technology literacy are effective online communications and multimedia productions. These could be combined to establish clear priorities in the SEA's Call for Proposal. For example, school districts applying for funds might be required to establish clear goals and objectives for the project related to all of the following:

- Middle school mathematics or science standards
- High quality, collaborative, online learning
- Student engagement in mathematics or science
- Student construction of team projects in mathematics and science

Furthermore, the Call for Proposal might require that the applicant identify an online learning environment (e.g., Moodle, SharePoint, First Class, wiki spaces, etc.) that the school would establish and support through the award, and that students and teachers would use to augment collaborative learning during the project. This would require access to a robust technology infrastructure and access to high-speed broadband, as well as student and teacher technology devices for access.

In order to ensure high quality proposals, the state might consider a series of orientation events or webinars that orient all interested potential grantees to the specific research upon which the Call for Proposal was based. At those events, the research findings could be presented along with examples, so applicants could see learning that is technology-enhanced, collaborative, and engaging, while focused on mathematics and science.

IV. Support Structures

Once the grantees have been awarded the funding for the projects (hopefully multi-year), the SEA should begin building the support structures and should begin facilitating sessions that discuss sustainability to ensure ongoing positive impact beyond the grant period. One of the most effect means for doing so is the careful documentation of the impact of the program changes. If educators see results, they will find ways to continue the program.

Communities of Practice (CoP)

Once the funding has been secured, the first steps to get the project rolling are to convene a face-to-face event; establish an online environment that will facilitate sharing exchanges; professional development; online discussions; and then model beginning the first day of the project. Key to success will be the ease of use, relevancy of the resources, discussion topics, online blogs/wiki, formal sequencing and facilitation of the online discussions; as well as opportunities for informal, just-in-time online collaboration. The CoP should be integrated into every facet of the project and participants scaffolded according to their entry level expertise.

Research Reviews. The research basis for the project should be available online, and should be in a wiki space or webspace where others can contribute to that research base.

Guidance in data-informed, continuous improvement. Discussion needs to take place early in the project related to both the state-level evaluation and to the expectations on the local evaluation. In some cases the state should provide a mechanism for data collection and ensure that the data collected for the state-level evaluation will be made available to individual school and/or district grantees. Such support ensures that the burden of data collection will be worth the effort. It also enables the grantee to plan their own local evaluation in the context of the state level data, use that data for formative purposes, and ensure non-duplication of data collection.

Beginning with the baseline data collection, the SEA should conduct sessions for the grantees to review their own data as well as the state level data for formative purposes. That should immediately be followed by planning sessions by the grantee teams where they use the data to drive their new targets, strategies, professional development, and implementations.

Causal Research. The state might also be interested in designing a quasi-experimental or experimental design study to investigate the impact on student or system/classroom outcomes. This requires pre-planning to ensure that grantees will fully participate, and to allow for research designs that may call for random assignments to treatments or controls, or for matched sets of participants, classrooms, or schools. Typically this requires resources from outside of the SEA.

In Summary

The scenario above provides insight into the process a state might use to translate emergent research into policy (i.e., Call for Proposal) that creates the stimulus for school districts to apply emergent research to practice.

The logic model provides the elements to consider as the state steps forward to stimulate positive, evidence-based change.

The following pages provide actual examples of how three different states have systemically leveraged the NCLB II D funds. Each of the three is an example of the logic model in action.

Appendix A: The Missouri eMINTS

The state of Missouri had the foresight to establish one of the first state networks to offer interconnectivity for educators. With easy Internet access in the classroom, students' attraction to technology and its power to grab their attention quickly became evident. What also became apparent, however, was a need to assist teachers with tapping into the wealth of resources suddenly at their fingertips and in using technology to support pedagogy that would increase student achievement. Hence, MINTS and its successor program, eMINTS, were born.

Missouri's eMINTS (enhancing Missouri's Instructional Networked Teaching Strategies) professional development/technology initiative supports educators in integrating technology into inquiry-based, student-centered, interdisciplinary, collaborative teaching practices that result in higher levels of student performance.[10]

A statewide program, eMINTS takes advantage of Title II, Part D funding by awarding two-year competitive grants to high-need districts across the state. Proposed projects must promote the use of the four elements that comprise the eMINTS instructional model: high-quality lesson design, inquiry-based learning, technology-rich classroom environment, and building of community in the classroom and in teacher professional development.[11] At the same time, however, each program is uniquely designed to meet the needs of the participating districts, teachers and students.

Ste. Genevieve Elementary School, for example, a recipient of a 2008–2009 grant, sees the eMINTS project as "providing the structure and coordination for teachers in this rural elementary building. Needs assessment for the elementary school pointed out low MAP [Missouri Assessment Program] scores, problems with collaboration and a shared school vision, a weak use of technology by teachers, and a strong desire by students and their parents for more technology and more hands-on activities. The district made attempts to coordinate reform efforts, and the staff developed a school portfolio. These choices were effective, but did not bring about desired change. By implementing the eMINTS professional development program for teachers, the staff is collaborating more and providing more beneficial instruction through the use of inquiry-based and constructivist methods."[12]

Value of a Statewide Model

Placing all competitive funds into one program was a significant decision for Missouri. "In the past," says Deb Sutton, Director of Instructional Technology, Missouri Department of Elementary and Secondary Education (DESE), "we used funds for varying purposes, but found it difficult to evaluate each program individually. With eMINTS, it is easier to conduct ongoing evaluation at both the district and state level and to maintain the overall fidelity of the program." Districts' reactions to this statewide approach were initially cautious, with concerns that the labor could be intensive and costly. But the investment has proven to pay off. Analysis of Missouri Assessment Program (MAP) scores, reported by outside program evaluators from 2001–2006, has shown consistently positive results for students in eMINTS classrooms when compared to their peers not enrolled in eMINTS classrooms.[13]

Research and Evaluation

According to Monica Beglau, Ed.D, Director, eMINTS National Center, the eMINTS program draws from a compendium of research-based components including educational technology, systemic school intervention, constructivism, cognitive coaching, and professional development. The program drew on findings published in Apple Classrooms of Tomorrow (ACOT) research and endorses teaching strategies promoted by Missouri's Project Construct (a project begun by Missouri Department of Elementary and Secondary Education [MDESE] that incorporates constructivism and aligns with state and national standards.)[14] The eMINTS professional development program was among the first to earn alignment with ISTE's National Educational Technology Standards for Teachers (NETS•T™). eMINTS has also been designated an Affiliate for the Partnership for 21st Century Skills. Experts from the eMINTS National Center, a collaborative program developed by the University of Missouri, MDESE, and the Missouri Department of Higher Education developed the research-based professional development.

eMINTS classrooms require high levels of technology for students and teachers:

- Computers (at least one computer for every two students at grades 3–12)
- Teacher laptop computer
- SMART Board (interactive white board) and projector
- Peripherals: printer, camera, scanner
- Microsoft Office and software that helps students organize notes, writing, and multi-media projects
- 80–200 hours of contact hours of professional development training for teachers, depending on program

– eMINTS Fact Sheet

Source: eMINTS National Center. http://www.emints.org/index.shtml

In 2006–2007, eMINTS and the Education Development Center (EDC) (eMINTS external evaluation consultant) developed three evaluation components:

1. Evaluation of the eMINTS professional development program — to insure that the program contents and processes are delivered with fidelity to the program's goals and intent.
2. Evaluation of the teacher and student product — an electronic portfolio of specific artifacts (both teacher and related student products) to document the effect of the professional development on the teacher's practice, the teacher's mastery of key eMINTS objectives, and the impact on student learning.
3. Evaluation of student academic performance — analysis of student performance as measured by standardized academic assessment instruments.[15]

eMINTS has a two-pronged approach to this evaluation. As part of their grant stipulations, districts are required to hire an outside evaluator to conduct local project evaluation and to submit a final evaluation after two years. To support them in this process, the district's planning team and their external evaluator participate in a leadership institute. A matrix of goals and objectives and types of pre-post data that need to be gathered to show impact are identified during this session and must align with the elements of the eMINTS instructional model.

A second form of evaluation is conducted by the eMINTS National Program and focuses on program fidelity. The Department of Elementary and Secondary Education uses data from both of these evaluations for state and Title II, Part D program evaluation.

Program Impact

According to the EDC report, *An Investigation of Program Fidelity and Its Impact on Teacher Mastery and Student Achievement*, "The eMINTS program is being implemented with a high level of fidelity and integrity by both the eMINTS staff and participants and graduates of the PD4ETS [professional development for educational technology specialists] a train-the-trainer program." It went on to report that, "Teachers are mastering most, but not all of the core eMINTS concepts and that the maintenance of a high level of Program Fidelity/Integrity is important for ensuring that teachers are mastering the core program concepts, which may then result in higher levels of student achievement.[16] In analyses of the differences between the performance of eMINTS students compared to non-eMINTS students, the statistical significance varied by year. However, the overall trends established higher achievement on the MAP tests for eMINTS students in all subject areas (communication arts, mathematics, science and social studies) when compared to non-eMINTS students.[17]

Statistically significant differences (eMINTS students achieving higher scores than their non-eMINTS peers) occurred in:

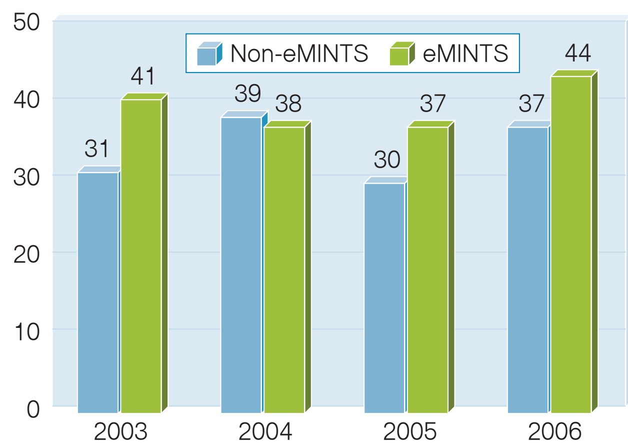
- 3rd-Grade Communication Arts (2001, 2003, 2004, 2005)
- 3rd-Grade Science (2001, 2003)*
- 4th-Grade Mathematics (2001, 2002, 2003, 2005, 2006)
- 4th-Grade Social Studies (2001, 2002, 2003)*

Beginning in 2003, examination of eMINTS versus non-eMINTS student MAP scores included analysis of difference for students in particular sub-groups, such as students in special education, students receiving Free and Reduced Lunch, and students in ethnic groups that have historically experienced gaps in achievement when compared with other students. Statistically significant differences in MAP scores for eMINTS students when compared to their non-eMINTS peers in the following subgroups were noted:

- Title I students on 4th-Grade Mathematics (2001, 2002)
- Special education students on 4th-Grade Mathematics (2002, 2003)
- Students receiving Free and Reduced Lunch on 3rd-Grade Communication Arts (2003, 2005)
- Students receiving Free and Reduced Lunch on 4th-Grade Mathematics (2003, 2005)
- African-American students on 4th-Grade Mathematics (2004)[18]

Figure 2 shows how 4th-grade eMINTS students consistently outperform their non-eMINTS peers on the Missouri Assessment Program (MAP) Mathematics Assessment (in 2004, the difference was not significant). Students included in this graph are from districts that qualify under federal poverty guidelines for being at risk for school failure.

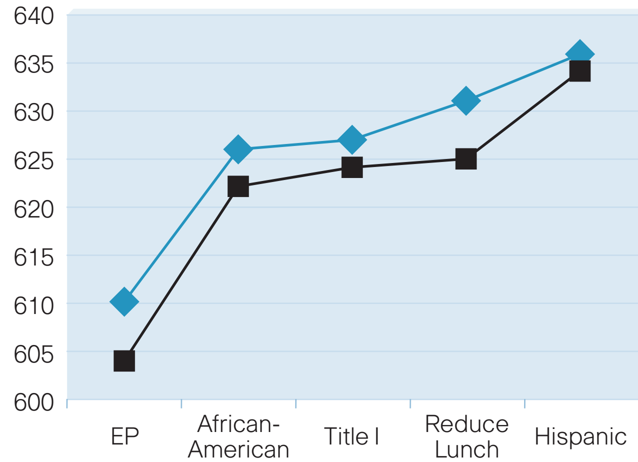
Figure 2: 4th Grade Mathematics Non-eMINTS vs. eMINTS Student Results (2003 – 2006)



*Science and Social Studies were not analyzed after 2003, when many districts stopped participating in MAP tests in those subjects.

Figure 3 shows differences between eMINTS and non-eMINTS students on the 2006 3rd-grade MAP Communication Arts Assessment for sub-groups. It is clear that eMINTS helps to level the playing field for students who have historically struggled with achievement by giving them a better opportunity to score at higher levels than students who are not in eMINTS classrooms.

Figure 3: 3rd Grade Communication Arts (2006) Means by Demographics of Underserved Populations



Source: eMINTS Evaluation Reports 2003–2006 at: http://www.emints.org/evaluation/reports/

eMINTS Evolution

Since its inception as a demonstration project in 1997, eMINTS has expanded from a flagship professional development program for teachers, to programs designed specifically for administrators, Instructional Specialists, early grades, and special education. Support structures have sustained that growth through the use of online communities targeted for specific interest groups and eMINTS Moodle, an online collaborative learning environment for eMINTS staff, program participants, and colleagues. eThemes, an extensive database of content-rich, age-appropriate resources organized around specific themes, is available for teachers' use in the classroom.[19] The eMINTS teachers can make specific requests for resources as a service provided by the eMINTS National Center.

eMINTS now reaches more than 38,000 students in grades 3–12 who learn in more than 2,000 eMINTS classrooms in the United States.[20] The program can be found in nine states and Australia.

Appendix B: The Washington State Enhancing Peer Coaching Program

Beginning in 2008, Washington State's Office of the Superintendent for Public Instruction (OSPI) distributed 50% of their Title II, Part D funding through competitive grants to eligible school districts interested in participating in a two-year, statewide *Enhancing Peer Coaching Program*. The program prepares over 280 teacher leaders to serve as peer coaches for their colleagues in the systematic integration of technology into teaching and learning.[21] Each coach uses awarded funds to: participate in the eight-day Microsoft Peer Coaching course and two days of technology integration training; cover costs for registration and travel expenses for the Northwest Council for Computer Education Conference (NCEE); and pay for substitute/release time and for equipment and software for participating classrooms. Coaches work with at least one collaborating teacher in Year 1, and select another or additional teacher in Year 2.

Value of a Statewide Model

Washington's OSPI has learned the value of offering school districts opportunities to participate in statewide programs that take advantage of Title II, Part D funding. "Historically, we focused our Title II, Part D competitive grants on district-led innovative projects. But over time, we realized a statewide project offered better possibilities for sustainable models that could be evaluated at a state rather than local level," says Dennis Small,[22] Education Technology Director for OSPI. This strategy has offered a less risky option for districts that, in the past, had needed to find and fund their own evaluator for their independent programs (particularly difficult for small rural districts). This option is also less dependent on available funding year to year. It has allowed for more fidelity of implementation and evaluation across districts or regions to gauge effectiveness on a broader scale.

Washington selected a highly successful peer-coaching model developed by the Puget Sound Center for Teaching and Learning as the basis for their current statewide project.

The *Enhancing Peer Coaching Program* has evolved from this program to take advantage of Microsoft's eight-day Peer Coaching course and two days of technology integration professional development, both delivered by nine state-funded Education Technology Support Centers (ETSC) geographically dispersed across the state.

"Collaboration with the ETSC program and taking advantage of Microsoft's free professional development curriculum have been key to providing the support and reduced costs essential to program sustainability. The ETSCs have helped in getting the word out about the success of the program. As a statewide program, the ETSCs can offer incentives such as a '2 for the price of 1' workshop option, which allows for participation by both peer coaches and their collaborating teachers," says Dennis Small.

Offering this modestly priced fee-for-service allows districts the opportunity to participate in high quality professional development and fund their own equipment once funding is no longer available. Currently, Moodle, an open-source online learning system, is used by coaches for training support and to communicate with teachers between face-to-face sessions. To further scale and sustain an affordable model, OSPI plans to offer more online professional development options and online community building within the next year.

Washington State OSPI is gearing up to use Title II, Part D competitive funding made available through ARRA funding. The new two-year program will offer grant awards of 62 hours of professional development to increase proficiency in the use of digital technology to support instructional strategies that integrate technology into standards-based curricula and digital technology for the classroom.

Source: OSPI. Education Technology Teaching & Learning in the 21st Century (TL21) Program.

http://www.k12.wa.us/EdTech/tl21program.aspx

Research and Evaluation

Competitive grant applications for participating in the *Enhancing Peer Coaching Program*, have soared from 205 in the first year to over 600 in the most recent round. "Districts wanted a proof-of-concept that the program has value. With a strong research foundation and formative and summative evaluation, we have been able to share the impact and success of this initiative," says Dennis Small. According to the *Enhanced Peer Coaching Program in Washington State: Review of Literature* report, prepared by Evaluation and Research Associates (ERA) of the Puget Sound Center for Teaching, Learning and Technology, "One can conclude from a review of the literature that benefits from implementing a peer coaching program reach coaches, teachers, students, and often lead to improvements at the school-level. Teachers are more likely to apply what they learn from a reform model of professional development such as peer coaching and, therefore, students are more likely to make learning gains when their teachers have peer coaches."[23]

Evaluation questions for the program focused on "the implementation and usefulness of the training sessions, the extent grant resources were utilized, how peer coaching was implemented at the school-level including benefits, challenges, and support, the impact on the teaching practice of coaches and collaborating teachers, and the impact on student learning."[24] Data to answer these questions was gathered from facilitators, coaches, collaborating teachers, and school administrators using mixed methods. The methods included surveys and pre-post measures of technology integration skills for quantitative data, and open-ended responses, document review, and site visits and observations for qualitative data.[25]

Program Impact

Results from the *Enhanced Peer Coaching Program in Washington State, Final Evaluation Report*, compiled by ERA, show improvement by both teachers and coaches in their ability to integrate technology in ways that engage students after one year of participation in this program.

Collaborating teachers experienced improvement in their:

- Ability to integrate technology to engage students in learning
- Understanding of how technology can improve curricula
- Comfort level in using technology

They acknowledged that they would not have used technology in their teaching or created lessons where students use technology without the support of the peer coach.[26]

Pre-post measures of technology integration skills, from the PILOT-Technology Integration Survey, showed a statistically significant increase in the mean levels of technology use in the classroom by both participating teachers and the coaches.

Collaborating Teacher Spring Report

In a scale question where 1 = Little Improvement and 5 = Significant Improvement, the collaborating teachers indicated they experienced the most change in their ability to integrate technology in ways that engage students in learning (3.86). They also noted fairly significant improvements in their understanding of how technology can be used to improve academic curricula (3.80) and in their comfort level in using technology equipment in the classroom (3.78). The lowest mean level of improvement perceived by the collaborating teachers in their practice was 3.25, in their expertise in using technology to promote critical thinking and problem solving skills among students.

Table 3 shows the collaborating teachers ratings on each of the skill categories.[27]

Table 3: Level of Change Collaborating Teachers Perceived in their Teaching Practice

Topic	Mean	1	2	3	4	5
		Little Improvement				Significant Improvement
Ability to integrate technology in ways that engage students in learning	3.86	2.4%	8.8%	22.4%	30.4%	33.6%
Understanding of how technology can be used to improve academic curricula	3.80	3.2%	6.4%	26.0%	34.4%	28.8%
Comfort using technology equipment in the classroom	3.78	1.6%	10.4%	24.0%	35.2%	28.0%
Using technology to support collaborative student learning activities	3.64	5.2%	8.4%	25.6%	36.0%	22.8%
Comfort using technology for teacher productivity, e.g., presentations, management, lesson planning	3.61	5.6%	10.0%	25.2%	34.4%	23.6%
Awareness of Web-based resources	3.46	6.4%	13.6%	25.6%	32.4%	19.6%
Comfort using applications (software or Web-based) with students	3.38	6.8%	13.6%	27.6%	33.2%	15.2%
Expertise in improving standards-based lessons through use of technology	3.28	6.4%	15.6%	32.0%	28.4%	13.2%
Expertise in using technology to promote critical thinking and problem solving skills among students	3.25	5.6%	20.0%	32.0%	26.8%	14.8%

Source: Evaluation and Research Associates (ERA) of the Puget Sound Center for Teaching, Learning and Technology. (August 2008). *Enhanced Peer Coaching Program in Washington State, Final Evaluation Report*, http://www.k12.wa.us/EdTech/peercoaching.aspx, Accessed on April 24, 2009.

Peer Coach Report

The improvements reported by the coaches were slightly higher overall than the improvements rated by collaborating teachers on their own practice (Table 4). The coaches believed the most improvement by collaborating teachers in the Peer Coaching program was in their comfort level in using technology equipment in the classroom and their ability to integrate technology to engage students.

The coaches noted a fair amount of improvement in all categories, with the lowest mean of 3.42 on a scale where 1 = Little or No Improvement and 5 = Significant Improvement, for an increase in their expertise in improving standards-based lessons through use of technology. This was also the same category where collaborating teachers noted the least amount of improvement for themselves.[28]

Coach Collaboration Skills

Overall, coaches' ratings of their own collaboration and coaching skills increased significantly in pre- and post-measures. On a scale where 1 = Not Very Skilled and 5 = Expert Skills, the mean rating of collaboration skills increased from 2.63 to 3.62, including an increase from 3% of coaches rating their skills as expert in the pre-measure, to 8% in the post-measure.

Rating their overall ability to collaborate with another teacher before the coaching program, 66% of coaches indicated they were either skilled or very skilled, and 31% indicated they were Not Very Skilled or Somewhat Skilled. After the coaching program, 89% of coaches indicated they were either Skilled or Very Skilled, and 3% indicated they were Not Very Skilled or Somewhat Skilled.[29]

Table 4. Coaches' Perceived Improvement in Collaborating Teacher(s)

Topic	Mean	1	2	3	4	5
		Little Improvement				Significant Improvement
Ability to integrate technology in ways that engage students in learning	3.95	0.6%	5.6%	22.2%	40.7%	30.2%
Comfort using technology for teacher productivity, e.g., presentations, management, lesson planning	3.86	2.4%	4.3%	25.0%	39.0%	27.4%
Understanding of how technology can be used to improve academic curricula	3.78	1.2%	10.5%	22.8%	38.3%	25.9%
Using technology to support collaborative student learning activities	3.72	3.7%	8.0%	22.8%	41.4%	22.2%
Awareness of Web-based resources	3.65	3.7%	11.0%	26.2%	30.5%	25.0%
Comfort using applications (software or Web-based) with students	3.64	3.7%	4.9%	34.1%	34.8%	20.1%
Expertise in using technology to promote critical thinking and problem solving skills among students	3.47	3.7%	11.1%	34.0%	30.9%	16.7%
Expertise in improving standards-based lessons through use of technology	3.42	3.1%	13.0%	37.3%	26.1%	16.8%

Source: Evaluation and Research Associates (ERA) of the Puget Sound Center for Teaching, Learning and Technology. (August 2008). *Enhanced Peer Coaching Program in Washington State, Final Evaluation Report*, http://www.k12.wa.us/EdTech/peercoaching.aspx, Accessed on April 24, 2009.

Table 5: Pre-Post Collaboration Skills

Choice	Pre-Survey Percentage of Respondents	Post-Survey Percentage of Respondents
1= Not Very Skilled	1%	0.0%
2 = Somewhat Skilled	30%	3.0%
3 = Skilled	36%	35.9%
4 = Very Skilled	30%	52.7%
5 = Expert Skills	3%	8.4%
MEAN	2.63	3.62*

** Statistically significant increase, p<.001 (independent samples t-test, two-tailed)*

The impact of the Enhanced Peer Coaching program persists even when funding discontinues for a participating school district. According to Dennis Small, "We have seen benefits of the peer coaching model even after funding for the program goes away. Collegial assistance with technology continues as the coaches are co-located with their collaborating teachers and as a result of the strong relationships that have been established."

Based on his experience with offering this statewide program, Dennis Small suggests the following for states considering use of Title II, Part D funds for statewide projects:

1. Do some needs assessment and have an open dialogue about what the program may look like for a particular school district. A district wants to ensure the program fits with its own initiatives and is not competitive or in opposition to what it is already doing.
2. Do a proof-of-concept. Start on a smaller scale to show value.
3. If the program includes a statewide external evaluator, it is valuable to provide information back to the districts to help inform and scale their program and for use in communicating the success. It is also important to make research available to districts.

Appendix C: The Texas Technology Immersion Pilot (TIP)

The Texas Education Agency (TEA), at the request of the Texas Legislature, embarked on a visionary Technology Immersion Pilot (TIP) project to immerse technology into teaching and learning. Begun in 2003, the program has called upon high-needs middle schools to "carry out the act of learning beyond the classroom walls and beyond the school day" through total immersion of faculty and students in technology.[30]

Using Title II, Part D monies, the TEA has provided competitive grants to 39 campuses statewide for 1:1 technology resources, based on the assumption that use of technology in Texas public schools could be better achieved by immersing schools in technology rather than introducing technology resources over a period of time. "We observed that most schools implemented a cyclical approach to technology integration," says Anita Givens, Associate Commissioner for Standards and Programs, "first purchasing technology for teachers, then preparing them to use that technology, and finally, providing technology and resources for student use. We decided to accelerate that process by providing teachers and students a bundle of all the essential tools they need to support a fully immersed school all at one time."[31]

These technology immersion packages consist of products and services offered by leading hardware, software, content and service providers bundled together through partnerships formed by the vendors themselves and delivered by vendors as a team.[32] The six TIP resource components include:

- A wireless mobile computing device for each student for use at home and school
- Ongoing professional development for teachers and administrators through proven methods
- Online instructional resources
- Online formative and diagnostic assessment tools
- Productivity tools
- Technical support

TIP emphasizes the importance of leadership and support as overarching components to the successful use of these resources.[33]

Research and Evaluation

The Evaluation of the Texas Technology Project (eTxTIP) was run concurrently with the TIP project. Under eTxTIP, researchers at the Texas Center for Educational Research (TCER), TEA's primary evaluation partner, conducted one of the largest ever multi-year research studies in education technology. The project used a mix of qualitative and quantitative methods in a quasi-experimental design with participating grade 6–8 middle schools randomly assigned either an experimental (immersion site) or a control (non-immersion site) status. Data collection began in 2003 and continued through 2008.

The goal of the eTxTIP project was to evaluate the impact of technology immersion on middle school student achievement in core academic subjects. A secondary goal of eTxTIP was to fully replicate the research project's materials for other states and local education institutions so that they could be guided in applying a scientifically-based evaluation approach to the assessment of education technology implementations.[34]

Individual district evaluation has also been an integral part of the TIP evaluation process. Once awarded a grant, district leaders have participated in a Leadership Institute. Included in that session is a discussion of expectations and the identification of criteria and metrics for success.

Program Impact

In January 2009, the eTxTIP project released a four-year final evaluation of the implementation and effectiveness of the technology immersion model, *eTxTIP Evaluation of the Texas Technology Immersion Pilot Final Outcomes for a Four-Year Study (2004–05 to 2007–08)*.[35] The study addressed five research questions:

- What was the effect of Technology Immersion on teachers and teaching?
- What was the effect of Technology Immersion on students and learning?
- What was the effect of Technology Immersion on students' academic achievement?
- How well was Technology Immersion implemented?
- What was the relationship between implementation and student academic outcomes?

One of the most significant findings from the evaluation is the greater academic achievement experienced by students who had the opportunity to use technology both at school and at home.

"Students' use of their laptops for home learning—a measure of the extent to which a student used a laptop outside of school for homework in the four core-subject areas or for learning games—was the strongest implementation predictor of Texas Assessment of Knowledge and Skills (TAKS™) reading and mathematical scores."[36]

According to the report, "these findings point to the important role that individual student laptops play in promoting ubiquitous learning and in equalizing the out-of-school opportunities for students in disadvantaged family and school situations." The report further notes that, "schools and teachers also played an important role. Teachers at higher immersion schools encouraged students' use of laptops outside of school by engaging students in projects or assignments that motivated students to continue working outside of class."[37]

The study also found that students who continued in technology-immersed learning in High School showed gains in achievement.

In the eTxTIPS *Traits of Higher Immersed Schools* report, traits emerged from Higher Technology Immersion Schools and Teachers.[38]

A few notable examples include:

- Schools had district leaders with clout who were strongly committed to the Technology Immersion concept, maintained a close and ongoing relationship with the middle school, worked as a team with campus leaders and monitored practices.
- Principals articulated a vision for Technology Immersion, strongly supported teachers' professional development, provided encouragement for changed practice, expressed expectations for technology use, and monitored teacher practice.
- Schools typically had adequate levels of campus support for the project implementation (at most, a campus staff-to-student laptop ratio of about 1:250).
- Schools typically gained parent and community support for the project at the beginning and then continued outreach efforts — informational, educational and financial — across years.
- Schools encouraged students' use of the laptops outside of school by engaging students in projects or assignments that motivated them to continue working outside of the classroom.

Value of a Statewide Program

According to Anita Givens, "We experienced a tremendous interest from school districts to participate in TIP with far more applications than available grants." In fact, in some cases, districts have chosen to move forward with 1:1 immersion without funding. At the same time, however, TEA has acknowledged the need voiced by some districts to participate in less costly immersion projects. TEA is now offering additional competitive grants through Title II, Part D funding with fewer implementation requirements, along with a strand of funding for virtual learning.

Support Structures for Technology Immersion

To assist school districts in their ability to implement TIPS with fidelity, TIP created several support structures. Examples include:

- A *TIP Toolkit*, which offers suggestions and recommendations from lessons learned to assist with implementation (http://ritter.tea.state.tx.us/technology/tip/)
- Participation by grant awardees in the TIP Leadership Institute, providing a forum for collaboration among districts and for sharing successful teaching strategies.
- TIP Continuation grants, also funded by Title II, Part D, for cadres of teachers and administrators to further their professional development through the Intel® Teach Program.
- eTxTIP's replicable research project materials for other states and local education institutions to use for guidance in applying a scientifically based evaluation approach to the assessment of education technology implementations.[39]

Appendix D: Research Reviews on Cooperative Learning

METIRI Group

This following synopsis indicates that, when students learn collaboratively, their achievement scores increase significantly.

Collaboration and Scaffolding of Learning: A Meta-Analysis

A 2009 meta-analysis by lead researcher Susan Williams40 was conducted as commissioned by Cisco Systems. The review was intended to build upon the previous meta-analyses, but focused on more recent studies. The recent studies were related to collaborations that took into account the need for students to be proficient with highly complex tasks given the high tech, fast-paced, complex, world in which they live, learn, and will eventually work. Results from the meta-analytic review of 12 studies indicated small, but significant positive effects favoring cooperative learning over traditional learning for both simple tasks (ES=.33) and complex tasks (ES=.225). In a second analysis, a review of 6 studies found significant, positive effects in academic achievement when cooperative learning included scaffolding versus cooperative learning alone. The effect was small for simple tasks (ES=.225) and moderate for complex tasks (ES=.48). The net effect is that when a student who is scoring academically at the 50th percentile on complex tasks is subsequently engaged in high quality cooperative learning, his score jumps on average by 8 percentiles (i.e., the net effect of the cooperative learning is an increase from 50% to 58%). A student already engaged in cooperative learning, scoring at the 50th percentile on average, will increase his score by 19% when the teacher adds scaffolding into the instruction.

Small group and individual learning with technology: A Meta-Analysis

The 2001 meta-analysis by lead researcher Yipling Lou[41] conducted synthesized empirical research on the effects of small group learning versus individual learning when students learn using computer technology. Results from 122 studies indicated that, on average, small group learning resulted in significantly more positive learning than did individual learning on two cognitive outcomes, academic achievement and group task performance. An individual's cognition was significantly enhanced by cooperative learning and technology when a) students had group work experience or instruction; b) specific cooperative learning strategies were employed; c) group size was small (i.e., two members); d) tutorials or practice software, or programming languages were used; e) learning computer skills, social sciences, and other subjects such as management and social studies; and f) students were either relatively low in ability or relatively high in ability. The authors' analyses suggested that, when all of these factors were present, the effect size was .66, which translates into an increase for average learners of 26 percentiles. They commented that the prior group learning experience and the teachers' use of explicit cooperative learning strategies highly influenced how much students learn when working in groups.

Energizing Learning: The Power of Constructive Controversy

The authors of the article *Energizing Learning: The Power of Constructive Controversy*[42] discuss the merits of constructive controversy as an instructional product. Their meta-analysis reports that constructive controversy results in higher academic achievement (ES=.70), cognitive reasoning (ES=.84), perspective taking (ES=.97), and motivation (ES=.68) than does concurrence seeking. Similarly, constructive controversy is more effective across all those same outcomes than debate, and than individualistic processes.

Cooperative Learning Methods: A Meta-Analysis

A 2000 meta-analysis *Cooperative Learning Methods: A Meta-Analysis*[43] reviewed 164 studies investigating eight cooperative learning methods used in schools. All of the eight cooperative learning methods had a significant positive effect on student achievement. The student provides comparisons of the effectiveness of the eight methods, with Learning Together™ resulting in the greatest effect, both when compared to competitive learning and when compared to individual learning. Other top programs in order of effectiveness were: Academic Controversy, Student-Team-Achievement-Divisions (STAD), and Teams-Games-Tournaments (TGT).

Within-Class Groupings: A Meta-Analysis

A 1996 meta-analysis by lead researcher Yiping Lou[44] explored within-class groupings. The overall findings suggest a small but significant effect on academic achievement (+.017) favoring small-group learning over large group; and a small, but significant effect on academic achievement (+0.12) for homogeneous groups over heterogeneous groups.

With academic achievement as an outcome, the optimal sized groups for learning were reported to be 3- to 4-member teams, and, while pairs achieved at significantly higher levels than students working individually, groups of 6- to 10-member teams did not. It also did not seem to matter whether groups stayed together or changed members. When the effects of within-class groupings were analyzed by subject area, the authors reported larger effects in math and science than in reading, language arts, and other courses.

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