Technology for 21st Century Teaching and Learning

Proposal Summary

Superintendent Bergeson proposes a comprehensive statewide program for the **integration of technology into teaching and learning**. This proposal outlines a seven-year implementation that phases in a cost-per-FTE of $87 in the first year to $282 in 2015. Superintendent Bergeson proposes that the Legislature fund the *Technology for 21st Century Teaching and Learning Program* as a unique allocation not connected to NERC (non-employee related costs).

Superintendent Bergeson envisions five goals for the *Technology for 21st Century Teaching and Learning Program*. Each goal is **research-based** and **designed with high-impact strategies** that will bring the resources – instructional and technological – of a 21st century classroom to every K-12 public school student across Washington State.

1. Integrate digital technologies into teaching and learning as multi-modal support for the rigorous study of core subjects
2. Integrate state standards for the use of digital technologies. These proficiencies are necessary for life beyond the classroom.
3. Integrate a program of professional development that trains educators to shift their instructional practice from teacher-led to learner-centered. Use coaching as a medium to support technology integration.
4. Integrate digital technologies into the learning environment to enable rich and ample opportunity for students to interact, research, learn and create at any time.
5. Integrate digital technologies into school systems – professional, administrative, technological – that support powerful teaching and the development of 21st century skills.

Background – Funding & Practice in Washington

State funds. School districts currently use NERC as the primary state funding source for technology and its related expenditures. The NERC formula provides a dollar amount per certified staff member, instructional and administrative. For the 2006 school year, this source of funding generated $9,112 per employee. Each year, the Legislature adjusts the NERC allocation to the Implicit Price Deflator (IPD) rate. However, when the NERC formula was implemented over 20 years ago, technology was not a funding consideration and therefore has never been adequately supported by state funding. Some districts augment NERC funding with local technology bonds and levies.

Federal funds. There are two sources of funding for educational technology that supplement state and local support.

- Title II D of the No Child Left Behind Act (NCLB) − Enhancing Education Through Technology grant (EETT) generates an allocation based, in part, on the number of disadvantaged students in a district. In recent years, the allocation per student has averaged $1.64.
- The E-Rate program supports internet connectivity and provides money to build building-based networks. Administered by the Schools and Library Division (SLD) of the Federal Communications Commission (FCC), these dollars are critical for districts with high

concentrations of students from low-income households. The formula is based primarily on the percentage of disadvantaged students. Districts apply directly to the federal government for E-rate funds. Over the past five years, districts in Washington have received an average of nearly $17 million annually in E-rate reimbursements, although the amount of funding per district has varied widely.

Technology Planning. Eligibility for federal technology funding requires that each district develop a state-approved 3-year technology plan aligned with their school improvement plan. In these plans, districts must address the essential conditions required to create learning environments, which are equitable and conducive to powerful uses of technology.

Vision, leadership, support, infrastructure, instructional resources and professional development are some of the elements that form the essential conditions.

Research

Numerous studies have researched the positive effect of technology on learning and student achievement. See Appendix A for a list of studies and their key ideas.

The Vision – Every Classroom is a 21st Century Learning Environment

Superintendent Bergeson envisions schools that…

Integrate a global perspective into learning *and teach responsible digital citizenship from the earliest grades.*

Leverage the reach and power of digital technology *to create learning projects relevant to modern life – projects that solve real problems and demand scrupulous attention to research and study.*

Empower learners to communicate and collaborate with the world beyond the classroom *-- connect students to dynamic and creative learning communities that engage peers, leaders, artists, scientists and business people from around the world.*

Technology is the Price of Admission

Superficially, this proposal configures technology for a classroom environment – a schematic for equipment acquisition, placement and maintenance. However, what's at stake here is not the money to buy computers. It's the threshold we must cross to make 21st century teaching and learning a reality.

Technology integration without a corresponding shift in pedagogy will weaken the impact of *Technology for 21st Century Teaching & Learning*. The shift is already underway. Today, we see the stand-and-deliver pedagogy that sustained 19th and 20th century classrooms losing ground to a new kind of instructional practice. Surprisingly, this quiet evolution of teaching style does not belong solely to the new wave of educators in pre-service. Rather, we are seeing teachers with 10 months, 10 years and more, making a remarkable transformation from expert and lecturer to guide and co-learner.

These powerful 21st century educators use technology as a teaching partner. In their classrooms:

- Knowledge is an open-ended, fathomless commodity, unbound by the limits of textbook facts and bias.
- The teacher doesn't have to know everything about a subject but must know how to hook, guide and coach students into the realm of deep, meaningful understanding of subject content.
- Academic standards come to life with learning projects that apply the core skills and disciplines of science, literature, mathematics, the arts, history and geography to solve real-world problems.
- Connected classrooms use the power of web presence − real-time dialogue with the scientists, artists, historians, politicians and writers whose ideas and actions are defining culture and society.
- Just as real world professionals do not partition writing from science, mathematics from archeology, reading from cartography, classrooms become a rich centrifugal hub where the integration of academic skills across subject areas is a natural outcome of the conversation taking place between students and the real-world.
- The artifacts of learning play to a real audience online – peers and experts who charge the learning experience with analysis, critique and new ideas.
- The teacher is free to learn along with the class − embodying by example − the joy and benefit of life-long learning.

There is an exciting opportunity here not to be lost to the short-sighted expediencies of funding and fast, promotable implementation. **The success of this proposal rests on professional development**. We have the teaching talent – our challenge is to empower each educator to deepen their expertise and transform state classrooms into powerful 21st century learning environments.

Superintendent Bergeson outlines a comprehensive program of professional development for teachers and administrators statewide in a separate proposal.

Principles

Superintendent Bergeson bases her funding proposal for educational technology on these principles:

- Washington students will encounter workplaces and institutions of higher education that integrate technology into every aspect of their operations.
- Digital technologies frame the infrastructure of 21st century life and, so, are critical to 21st century education.
    - Digital technologies support skill sets and competencies that have direct application to the world students will encounter at graduation.
    - Digital technologies have great potential to support powerful teaching and student-centered learning environments.
- Digital technologies must be broad-based across Washington's K-12 schools and used intensively by educators, administrators and students.

- Digital technologies produce the greatest gains in student achievement when they are an integral element of powerful teaching and classroom activities that support self-directed learning.
- Technology is critical if teachers and students are to communicate, collaborate, share new knowledge and extend teaching and learning beyond school walls and classroom hours.
- Students must become technologically fluent, able to create high-quality knowledge products that demonstrate what they know and can do.
- All students, regardless of socio-economic or cultural background, must be able to access technology at school. Technological fluency is the basic skill that enables participation in a global economy.

Operationally, this program is designed to develop and sustain:

- Results-oriented professional development.
- High-quality teaching and learning resources in every classroom.
- Robust technical support for classroom-based educational technology.

Strategic Planning

It is critical that Washington State moves forward with the highest attention paid to strategic planning for sustainability and success over time. Each school and its staff must be ready to benefit − committed fully to the program and its vision. For this reason, Superintendent Bergeson has structured the *Technology for 21st Century Teaching & Learning Program* with a seven-year implementation.

Superintendent Bergeson believes that the involvement of district library media specialists is essential to the success of *Technology for 21st Century Teaching and Learning*. These highly-capable staff members are often the driving force behind the promotion of ICT (Information & Communication Technology) and media literacy skills. The Superintendent envisions that library media specialists will support project planning, implementation and the documentation of best practices.

Pilot project

The program commences with a carefully designed pilot. Project staff will focus on the development of high-quality training targeted to specific teaching and learning initiatives. There will be a significant emphasis on activities that produce effective coordination among curriculum groups at all levels.

During the pilot, project staff will address critical infrastructure issues − wireless capability, bandwidth, security. Superintendent Bergeson regards these factors as foundational to sustainability.

Strategic Objectives

An important proviso. Digital technologies have transcended the boundaries and limitations of geography and culture. They have reset the speed of change and will not be tethered to the imaginative capacity we hold today. Will laptops as we know them be around in 2015? Maybe.
For this reason, Superintendent Bergeson positions the strategic objectives of the *21st Century Teaching & Learning Program* as well-considered projections that – in their totality – describe a 21st century learning environment. The building code for a sustainable program will comprise strategies that position K-12 public education to:

- Adapt quickly and intentionally to emerging technologies.
- Adapt quickly and intentionally to new ideas about digital technology that animate its value to education.

These strategic objectives reflect a seven-year implementation cycle. All equipment will comply with state standards for educational technology.

Equip all K-12 classrooms with a presentation station, and train the teachers to maximize the use of these resources for research-based instruction:

- Computer with internet connectivity.
- Mounted LCD projector.
- Document camera.

Equip all students in grades 9-12 with a personal laptop to use throughout high school:

- Load the laptops with engaging, high-quality curricular materials.
- Train teachers to maximize the use of these resources for research-based instruction.

Equip all students in grades 7-8 with a laptop device for school use as they study core subjects:

- Load the device with engaging, high-quality curricular materials.
- Train teachers to maximize the use of these resources for research-based instruction.

Equip all students in grades 4-6 with computers-on-wheels (portable computer lab) for 1:1 access, as needed:

- Time on the computer is directed to the study of core subjects.
- Load the computers with engaging, high-quality curricular materials.
- Train teachers to maximize the use of these resources for research-based instruction.
- Support a 3:1 ratio of computers to students, in the classroom if possible – if not, in the computer lab or library-media center.

Support computer-based instructional access for all students in grades K-3. The number of computers must reflect a 3:1 ratio of computers to students, in the classroom if possible – if not, apply the ratio to the computer lab or library-media center.
Equip all K-12 classrooms with interactive whiteboards:

- Load the devices with engaging, high-quality curricular materials.
- Train teachers to maximize the use of these resources for research-based instruction.

Support technology integration in all K-12 schools:

- Fund and implement peer coaching programs for teachers that support technology integration or comparable strategies such as building-based technology resource personnel.
- Fund adequate levels of technical support across districts and the build-out of critical network infrastructure for all districts.
- Identify and purchase key online educational resources to augment curricular materials.
- Take advantage of state purchasing agreements and leasing options to minimize hardware and software costs.

Implementation Plan

	Presentation Stations	7-12 Student Computers	K-6 Computers	Interactive Whiteboards	Support, Resources and Network Infrastructure
Year 1 - $87/ FTE	Deploy technology to 25% of all classrooms with training. Begin with classrooms that do not have standards-based computers, projectors or document cameras.	Pilot laptops (up to 5%) across grades 7-8 and 9-12. Develop and scale training. Select high-quality curricular materials.	20% of K-6 classrooms funded for 3:1 computer ratio. Pilot computers-on-wheels (up to 5%) across grades 4-6. Develop and scale training. Select high-quality curricular materials.	Pilot (up to 5%) to classrooms. Start with Grades K-3. Develop and scale training. Select high-quality curricular materials.	Initiate funding at a 20% level − Technical support − Instructional practice/tech integration support − Online resources − Network infrastructure build-out Identify best practices for online resources, technical support and network infrastructure. State purchasing agreements and leasing options established to minimize hardware and software costs.
Year 2 - $195/FTE	Deploy technology to 25% more classrooms with training.	Add 20% more classrooms in grades 7-8 and 9-12.	20% more K-6 classrooms funded at 3:1 computer ratio. Add 20% more classrooms in grades 4-6.	Add 15% more classrooms.	Increase support to 40% − Technical support − Instructional practice/tech integration support − Online resources − Network infrastructure build-out
Year 3 - $232/FTE	Deploy technology to 25% more classrooms with training.	Add 25% more classrooms in grades 7-8 and 9-12.	20% more K-6 classrooms funded at 3:1 computer ratio. Add 25% more classrooms in grades 4-6.	Add 20% more classrooms.	Increase support to 50% − Technical support − Instructional practice/tech integration support − Online resources − Network infrastructure build-out
Year 4 - $256/FTE	Deploy technology to final 25% of classrooms with training.	Add 25% more classrooms in grades 7-8 and 9-12.	20% more K-6 classrooms funded at 3:1 computer ratio. Add 25% more classrooms in grades 4-6.	Add 20% more classrooms.	Increase support to 60% − Technical support − Instructional practice/tech integration support − Online resources − Network infrastructure build-out

Year 5 - $258/FTE	Maintain the technology infrastructure, provide continued training.	Add the final 25% of classrooms in grades 7-8 and 9-12. Upgrade pilot technology.	Add the final 20% of K-6 classrooms funded at 3:1 computer ratio. Add the final 25% of classrooms in grades 4-6. Upgrade pilot technology.	Add 20% more classrooms.	Increase support to 80% - Technical support - Instructional practice/tech integration support - Online resources - Network infrastructure build-out
Year 6 - $260/FTE	Maintain the technology infrastructure, provide continued training.	Maintain the technology infrastructure, provide continued training.	Maintain the technology infrastructure, provide continued training.	Add the final 20% of classrooms. Upgrade pilot technology.	Increase support to 100% - Technical support - Instructional practice/tech integration support - Online resources - Network infrastructure build-out
Year 7 - $282/FTE	Maintain the technology infrastructure, provide continued training.	Maintain the technology infrastructure, provide continued training.	Maintain the technology infrastructure, provide continued training.	Maintain the technology infrastructure, provide continued training.	Maintain support for technical support, instructional practice/tech integration, online resources and network infrastructure.

Notes on the Implementation Plan

Contingencies

Beginning with year 2, equipment rollout at the district level is contingent upon:

1. Completion of basic training by **all staff in each funded building**.
2. Commitment to use equipment as an **integral element of classroom instruction**.

Professional Development

Superintendent Bergeson positions this proposal as one of building blocks in a larger strategy designed to improve teaching and learning across Washington. For this reason, the FTE cost outlined in the implementation plan does not include funds for professional development beyond basic training on the hardware and software.

Superintendent Bergeson addresses the need for a **comprehensive program of professional development for teachers and administrators** in a separate proposal. This program will deliver professional development focused on instructional practice and targeted training that supports technology integration.

Absent funding, Superintendent Bergeson recommends the training outlined below as a minimum course of action for professional development:

- 3 days of technology integration training tailored to the subject and grade level of the teacher.
- 2 days of follow-up training.
- Membership in a learning community that involves all the teachers within each training group.

From page 4…

There is an exciting opportunity here not to be lost to the short-sighted expediencies of funding and fast, promotable implementation. ***The success of this proposal rests on professional development****. We have the teaching talent – our challenge is to empower each educator to deepen their expertise and transform state classrooms into powerful 21st century learning environments.*

E-textbooks, Hardware Use, Grade-level Configuration

- There will be considerable savings with the transition to electronic textbooks. Those cost benefits are not reflected in the FTE costs in this proposal.
- Replacement cycle assumptions for hardware:
    - Presentation station: computer - 4 years, LCD projector – 5 years, document camera - 5 years
    - Grades 9-12 personal laptops, 7-8 laptop devices, 4-6 computers-on-wheels – 4 years
    - Grades K-6 computers – 4 years
    - Interactive whiteboard – 5 years
- All hardware included in this program is intended for **instructional use on a regular basis**, so administrative computers and their peripherals and computers dedicated to testing or other restricted uses are not included in this proposal's funding model. Superintendent Bergeson details her strategy for district data collection and its associated hardware in a different proposal to the Basic Education funding task force.
- The framework for the implementation strategy aligns with traditional grade spans − K-3, 4-6, 7-8 and 9-12. Districts with intermediate schools, middle schools and other grade-level configurations will be able to modify the targets and milestones of the final project plan to fit local needs.

Appendix A: Research

Confronting the Challenges of Participatory Culture: Media Education for the 21st Century, 2006
http://www.digitallearning.macfound.org/atf/cf/%7B7E45C7E0-A3E0-4B89-AC9C-E807E1B0AE4E%7D/JENKINS_WHITE_PAPER.PDF
Author: Henry Jenkins with Kate Clinton, Ravi Purushotma, Alice J. Robison, and Margaret Weigel
Key Ideas:

- Education leaders must reframe the digital divide. The issue is not *access* to technology. The issue is *opportunity to participate*.
- Children must develop the cultural competencies and social skills necessary for full involvement in a participatory culture.
- Participatory culture shifts the focus of literacy from individual expression to community involvement.
- Most new literacies involve social skills developed through collaboration and networking.
    - These skills are based on traditional notions of literacy and skill sets taught in the classroom – research, technological and critical thinking.

Effects of Using Instructional Technology in Elementary and Secondary Schools; What Controlled Evaluation Studies Say, 2003 http://sri.com/policy/csted/reports/sandt/it/Kulik_ITinK-12_Main_Report.pdf
Researchers: Kulik, James (SRI International)
Key ideas:

- PD for teachers and easy access to the Internet for students and teachers enhance the learning effectiveness of instructional technology.
- Student familiarity and knowledge of computers influences the effectiveness of technology-based instruction.
- "Integrated Learning systems (ILS) have been producing positive results in mathematics programs for decades, and computer tutorials in natural and social science classes have had an almost uniformly positive record if effectiveness over the last three decades." (taken from CARET Review of Kulik's 2003 work)

Student Learning, 2005
http://caret.iste.org/index.cfm?fuseaction=evidence&answerID=6
Researchers: CARET (Center for Applied Research in Educational Technology) staff
Key idea:

- Commitment to technology integration (equipment, software, access, teacher development) can lead to increased test scores.

Studies Validate Project-Based Learning, 2001
http://www.edutopia.org/project-based-learning-research
Researchers: Edutopia Staff, George Lucas Education Foundation
Key idea:

- A growing body of academic research supports the use of project-based learning in schools as a way to engage students, cut absenteeism, boost cooperative learning skills and improve test scores. Those benefits are enhanced when technology is used in a meaningful way in the projects. This synopsis describes 9 studies incorporating project-based learning implementations. Five of the studies included technology as a context.

Two examples:

- *Challenge 2000.* The project conducted a performance assessment designed to measure students' skills in constructing a presentation aimed at a particular audience. Students from Multimedia Project classrooms outperformed comparison classrooms in all three areas scored by researchers and teachers: student content, attention to audience, and design. The Multimedia Project involves completing one to four interdisciplinary multimedia projects a year that integrate real-world issues and practices. Researchers observed increased student engagement, greater responsibility for learning, increased peer collaboration skills, and greater achievement gains by students who had been labeled low achievers.
- *Co-nect.* Students using the Co-nect program, which emphasizes project-based learning and technology, improved test scores in all subject areas over a two-year period on the Tennessee Value-Added Assessment System. The Co-nect schools outperformed control schools by 26 percent.

ACOT Library, 1985 - 1995
http://www.apple.com/education/k12/leadership/acot/library.html
Researchers: David C. Dwyer, Ph.D., et al
Key ideas:

- In ACOT classrooms, students and teachers had immediate access to a wide range of technologies, including computers, videodisc players, video cameras, scanners, CD-ROM drives, modems, and online communications services. In addition, students could use an assortment of software programs and tools, including word processors, databases, spreadsheets, and graphics packages.
- In ACOT classrooms, technology was viewed as a tool for learning and a medium for thinking, collaborating and communicating.
- ACOT's research demonstrated that the introduction of technology into classrooms can significantly increase the potential for learning, especially when it is used to support collaboration, information access, and the expression and representation of students' thoughts and ideas. Realizing this opportunity for all students, however, required a broadly conceived

approach to educational change that integrated new technologies and curricula with new ideas about learning and teaching, as well as with authentic forms of assessment.

- ACOT's mission was to advance the understanding of teaching and learning in global, connected communities of educators and learners. This included investigating how teaching and learning change when people have immediate access to technology as well as helping people better understand how technology can be an effective learning tool and a catalyst for change.

Qualities Shared by Five Technology-Rich Schools, 1996

http://rand.org/pubs/monograph_reports/MR682/ed_ch2.html#RTFToC12

Researchers: Thomas K. Glennan, Jr., Arthur Melmed

Key ideas:

Five schools with different objectives, serve different populations, and use technology in quite different ways. But they share common practices important for public policy development.

We note the following:

- Each of the schools is "learner-centered," placing emphasis on the individual treatment of students according to their needs and capabilities. Perhaps the most explicit attention to this issue is found at the Taylorsville school where a computer-based instructional management system is used to support the development and use of individual student instructional strategies. Northbrook emphasizes clusters of students and teachers who stay together for several years so that they can know one another well. East Bakersfield has students develop individual portfolios that help them understand what they know and need to know to find productive roles after graduation.
- Each of the schools seemed to utilize and emphasize curriculum frameworks to ensure that the goals for student outcomes were clearly understood. The Christopher Columbus school program was put in place after an effort of several years to develop a curriculum framework and strategy by the Union City district. Taylorsville used standards developed by the Modern Red School House design team at the Hudson Institute to guide its educational offerings. Blackstock used the California frameworks that were in existence before the school reform started. In the view of the authors, the workshop was notable for the emphasis each of the school leaders placed on the learning that was to take place as opposed to focusing on the features of the technology that existed.
- Each of the schools had a density of computers that far exceeds that which is common in schools today. In fact, in all cases but one, the density exceeded the average density of the top 4 percent of schools, which is 3.9 students per computer. The ubiquitous access to computers in most of these schools makes many of their programmatic features possible.
- All the schools had restructured their programs substantially. Class periods were lengthened and interdisciplinary programs introduced to retain necessary subject coverage. Project-based learning received considerable attention, but several of the schools also made use of more

traditional drill and practice programs. Blackstock and Northbrook had substantially modified their buildings to facilitate and exploit the use of technology.

- Each of the school programs appeared to be the product of a fairly concentrated development effort. The character of the school had not simply evolved over time as more and more equipment arrived. Instead, explicit, focused development efforts were undertaken. Some were whole school developments, as was the case with Taylorsville, Northbrook, and Christopher Columbus. Alternatively, some had initially focused on one facet of a larger vision, as appears to have been the case in Blackstock and East Bakersfield.
- Each school's development was pushed forward by an initial increment of external funding. The sources were varied. The California schools received funds from a state technology program. The Christopher Columbus school had Chapter I and private sector funds. The Taylorsville school received funding from New American Schools Development Corporation. Northbrook got initial startup funds from its district and has sustained its development with additional grants and Chapter I funds. Thus the creation of a radically changed school (whether or not it is technology rich) requires an initial investment that defrays the exceptional costs of startup--both training and the technology itself.
- Relations among adults in the schools appeared changed. While this issue was not addressed by all the school leaders, several noted that there was considerably more consultation among teachers about the curriculum and about the progress of individual students. At Blackstock, the lead teachers in the smart classrooms appear to have adopted roles of assisting other staff with issues related to technology, curriculum, and instruction.
- School outcomes were described in rich ways. While it appears that all the schools showed some or major improvement against traditional accountability measures, many other indicators were used. Increased student and parent engagement, better job placement success, strong support from students and parents, and improved attendance were all cited.
- And not least, the annual per-student technology and technology-related cost for these pioneer technology-rich schools ranges between under three and over five times the average $70-$80 per student for all U.S. schools.

These schools model some of the best practices across the nation. The whole school has been involved, not just one or two teachers. The instructional program has been changed to exploit technology. Each of these schools is reported to have improved the learning of substantial portions of its students. Whether these schools are representative of high tech schools of the future is an open question, however. Technology is changing rapidly, and educators are still in the comparatively early stages of exploring ways in which learning can be enhanced by the application of technology.

Oversold & Underused: Computers in the Classroom, 2001
http://books.google.com/books?id=sdSutyVQfzYC
Author: Larry Cuban
Key Ideas:

- Even with large investments in technology in schools, it has not substantially changed the way teachers and students work in classrooms (p. 189).
- Students and teachers had access to technology and were not afraid of using it, but found that technology was not integrated effectively into the classroom (pp. 132-134).
- Changes in teacher's beliefs, practices, and infrastructure will… shift from the prevailing teacher-centered to a **student-centered practice** (p. 155).
- Offers solutions and policy recommendations which include speeding up process to make computers readily available to students, eliminate the gap in Internet access between urban and suburban schools, invest more in **online curriculum** and **distance learning**, increase on-demand technical support for teachers, and offer more **professional development** (pp. 179-180).

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*Factors that Affect the Effective Use of Technology for Teaching and Learning, Lessons Learned from the SEIR*TEC Intensive Site Schools*, June 2007
http://www.seirtec.org/publications/lessondoc.html
Researchers: SEIR*TEC
Key ideas:

- Leadership is the key ingredient.
- If you don't know where you're going, you'll end up someplace else.
- Technology integration is a *s-l-o-w* process.
- No matter how many computers are available or how much training teachers have had, there are still substantial numbers who are "talking the talk" but not "walking the walk.
- Effective use of technology requires changes in teaching, and the adoption of a new teaching strategy can be a catalyst for technology integration.
- Each school needs easy access to professionals with expertise in technology and pedagogy.
- While many of the barriers to using technology to support learning are the same for all poor communities, some populations have some additional issues.
- In some schools, infrastructure remains a serious barrier to technology adoption.
- Educators can benefit from tools that help them gauge the progress of technology integration over time.

Foundations for Success: 4. Report of the Task Group on Instructional Practices, March 2008
http://www.ed.gov/about/bdscomm/list/mathpanel/report/ip.doc
Researchers: Russell Gersten, Joan Ferrini-Mundy, Camilla Benbow, Douglas H. Clements, Tom Loveless, Vern Williams, Irma Arispe, Marian Banfield
Key idea:

- Existing research, and the many available reviews of this body of research, suggests that specific categories and uses of educational technology can make a significant, positive contribution to students' learning of mathematics. The Task Group conducted its own meta-analyses to evaluate those conclusions of previous reviews.

An experimental study of the effects of Cognitive Tutor Algebra I on student knowledge and attitude, May 2002
http://www.carnegielearning.com/wwc/originalstudy.pdf
Researchers: Pat Morgan, Moore Independent School District and Steven Ritter, Carnegie Learning
Key ideas:

- An analysis of variance indicated that overall, Cognitive Tutor students did significantly better than students in traditional classes. This is true at all four of the schools that used Cognitive Tutor.
- A finer grained ANOVA focused on the six teachers who taught both types of classes reveals this is not consistent across teachers.
- The strongest advantage for Cognitive Tutor was found among the teachers with the lowest results in their traditional classes.

Analysis of 2005 MAP Results for eMINTS Students, January 2007
http://www.emints.org/evaluation/reports/map2005.pdf
Researchers: Lance Huntley and Tracy Greever-Rice
Key ideas:

- The analysis of student MAP scores in the FY04 cohort of eMINTS schools shows significant differences by eMINTS enrollment status on the MAP Communication Arts and Mathematics tests.
- Analyses of MAP scores for special education students, students receiving Title I services and students receiving free and reduced lunch suggest that eMINTS enrollment significantly increases their scoring on the MAP tests.
- These results support previous analyses of eMINTS cohorts.

Examining 25 years of technology in U.S. education, 2002
http://portal.acm.org/citation.cfm?id=545166&dl=GUIDE&dl=ACM
Norris, C., Soloway, E., and Sullivan, T. 2002. Examining 25 years of technology in U.S. education. Commun. ACM 45, 8 (Aug. 2002), 15-18.Researchers: Norris, C., Soloway, E., and Sullivan, T
Key ideas:

- Conditions must be met for technology to have a positive effect on teaching and learning in primary and secondary grades. Conditions include sufficient access to technology, adequate teacher preparation, effective curriculum, supportive school/district administration, and supportive family/community.
- As the number of computers available in classroom increases, so does use of computers.
- The digital divide in the US continues to put children at considerable risk
- One option to address access issues – other than a 1:1 PC ratio might be handhelds

Educational Technology in Indiana: Is it Worth the Investment? Education Policy Brief. Volume 4, Number 4, Spring 2006, 2003
http://eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED491297&ERICExtSearch_SearchType_0=no&accno=ED491297
Researchers: Palozzi, Vincent J.; Spradlin, Terry E.
Key ideas:

- Grade 8 students in Cincinnati, Ohio, public schools are now able to apply to the district high school of their choice via computer, resulting in more educational options to better match students' long term career goals.
- Michigan requires high school students to take at least one credit or non-credit online course as part of their graduation requirements.
- Indiana reported that Maine found that providing home wireless networking and take-home laptops to students, who would otherwise be without access due to economic hardship, can increase student performance.

Teacher professional engagement and constructivist-compatible computer use, 2000, Report no. 7
http://www.crito.uci.edu/tlc/findings/report_7/report7.pdf
Researchers: Becker, H. J., & Riel, M. M. (2000).
Key ideas:

- Professionally engaged teachers who also train other teachers tend to involve students in communicating, producing, and presenting ideas using computers.
- Teachers who work in collaborative settings and who take the initiative to change their teaching environment create collaborative work settings and student-initiated activities in their classrooms.

- Teachers who exhibit traits considered important for effective teaching will make more effective use of technology. Those teachers seem to make more effective use of most any relevant educational resource.