Report Of The Special Commission On Educational Technology

April, 2004

Members of the Special Commission on Educational Technology
April, 2004

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** Signed the report, but as noted does not agree with the first paragraph of subpart (2) Revenue Sources in PART 6.

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PART 1: INTRODUCTION

(1) Commission Purpose and Make-Up

The Special Commission on Educational Technology was established pursuant to section 52 of Chapter 300 of the Acts of 2002, as amended by section 9 of Chapter 429 of the Acts of 2002, and section 73 of Chapter 140 of the Acts of 2003. The purpose of the Commission was to:

1. *Review how technology can be best utilized to improve teaching and learning in public education;*
2. *Examine the need for additional educational technology in schools throughout the state and the types of technology needed;*
3. *Examine ways to enhance professional development and teacher training in the effective use of technology in support of curriculum;*
4. *Examine statutory or regulatory changes needed to enhance educational technology, including, but not limited to integrating technology into school building design;*
5. *Examine the funding of major education/technology initiatives in the Commonwealth (and throughout the country) and the impact that such initiatives have had on teaching, learning, and student achievement, including standardized testing;*
6. *Evaluate the need for a pilot program for 7th and 8th grade students and teachers in up to 9 schools districts to provide one to one, wireless, portable full featured computing devices including, but not limited to, potential funding sources for such a program and a structure for the implementation of such a program;*
7. *Evaluate effective methods of measuring student achievement and learning using technology.*

The Commission consisted of members of the House and Senate as well as persons appointed by Governor Romney from both the business and education communities. The Chairman of the Board of Education, Commissioner of the Department of Education, and the state's Chief Information Officer were also members of the Commission.

(2) Commission Process

We began our work in October of 2003. To make the task more manageable, members were divided into 4 subcommittees each of which focused on different areas covered in the Commission's mandate. These subcommittees met individually and came up with recommendations in their particular areas which they presented for discussion by the full Commission membership. We held 5 full Commission meetings. At several of these meetings, individuals involved in the field of educational technology made presentations to the Commission. We heard from Maureen Chew, Chief Information Officer of the Department of Education, who provided an overview of educational technology in Massachusetts' schools and future needs; Lillian Kellogg, Vice President for Strategic Relations, NetTrekker, who discussed 21st century teaching and learning tools; Irene Vassos, Technology Coordinator, Pittsfield Public Schools, and Robert Cornacchioli, Director of Instruction and Media Services, Shrewsbury Public Schools, who presented a view from the trenches; Professor Michael Muir, Director Maine Center for Meaningful, Engaged Learning at the University of Maine, who discussed the Maine Laptop Initiative; and Professor Christopher Dede, the Timothy E. Wirth Professor of Learning Technologies, Chair, Learning and Teaching Area, Harvard Graduate School of Education, who discussed learning for the 21st century.

Over one-half of the members visited the Shapleigh Middle School in Kittery, Maine where they saw first hand the Maine Laptop Initiative in action. Members also had telephone conversations with school officials in Henrico County, Virginia, who have been implementing a laptop initiative in their schools

since 2001. In addition, we reviewed extensive reports, materials and other research information on educational technology from sources throughout the nation, and spoke with various academic leaders from colleges and universities with expertise in the field.

(3) <u>Vision Informing Paradigm Changes</u>

The use of technology as a tool to enhance teaching and learning is a common vision which education leaders at every level of learning must embrace and build upon. The idea of school is so deeply ingrained in people's thinking that when they look at technology such as computers, they see it in a particular and very narrow way dominated by the nature of school as they've known it. This has led to considerable time, money and research being spent on taking sides about an enterprise that merely consists of injecting technology into an otherwise unchanged school system and then coming to the conclusion that it is not going to change school very much. In particular, our ideas of school are determined by a previous epoch of information technology, rooted in the 19th century, in which print, writing on a chalkboard, and a teacher lecturing in front of a class were the widely accepted ways of disseminating knowledge. As a consequence, computers in schools are being used in ways that fail to fully realize the potential of the computer to allow the possibility of a radically different way of learning. [1] We agree with what other states have found that the conversation about technology in schools is trapped in the wrong subject. The talk is all about does technology work as a fix for the old. Instead it should be about developing a vision of how this immensely powerful technology, the computer, can support powerful new forms of learning to serve levels of expectation higher than anything imagined in the past. [2]

The need to create a vision that embraces the opportunities technology presents is essential. We adopt a vision that sees school as a place where teachers do not simply provide information, they help students find information and learn skills – including some that neither knew before. Teachers bring wisdom, perspective, and maturity to learning. Students bring freshness and enthusiasm. Some of what they learn belongs to disciplines school has always recognized: reading, writing, mathematics, science and history. Some belongs to new disciplines or cut across disciplines. Most importantly, students and teachers are learning the art, skill and discipline of pursuing education through the frustrating and hard times of struggle and the rewarding times of getting closer to the goal. We envision school as a place where students learn largely by working on projects – a place where they want to be, an object they want to make, or a subject they want to explore. The contribution of technology is that it makes possible projects that are both very difficult and very engaging.[3]

As part of that vision we support the capacity of one to one computing as a tool which can help bring meaningful change to teaching and learning. We have made progress and spent considerable amounts of money in this state in providing computers for students in our public schools. Roughly 69% of the school districts in the state now meet or exceed a ratio of one computer for every five students. However, the focus all too often has been strictly on numbers and not how the technology can be most effectively used to help both teachers and student. In addition, the access to one's own computer that is available all the time (anywhere/anytime learning) is fundamentally different from the kind of access a student can get from a handful of computers in a classroom, or limited to computer labs. Based on the research we have seen, we maintain that the **minimal** action that will make a significant difference is ensuring that every child has available to them a personal computer. In our view, this is not only an equity issue, but it is about opening new ways of learning through having full-time access to a computer, giving access to a new world of knowledge, of **individualized learning for all children** not just those born to wealth.

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[1] "Looking at Technology Through School-Colored Spectacles." Seymour Papert, article published in Logo Exchange (1997)
[2] "Vision for Education: The Caperton-Papert Platform." Gaston Caperton and Seymour Papert – Essay for National Governor's Association meeting (1999).
[3] Ibid.

PART 2: THE PURPOSE OF TECHNOLOGY

(1) Focus on Learning

It is a maxim that curriculum and learning should drive the use of technology rather than technology driving education. In an early Commission meeting, Dr. Isa Zimmerman of Lesley University and a Commission member, reminded us of an underlying principle when she asked: "What can you do **with** technology that can't be done **without** it?" The Commission has used this question as a guiding focus when examining the need for ubiquitous technology for teachers and students. Consistent student under achievement and the gap in learning between white and minority students reinforce the need for a dramatic shift in classrooms if a different outcome is ever to be achieved.

The goal of technology is to improve student achievement through enhanced delivery of curriculum and instruction. Examining the current literature around the use of ubiquitous technology, demonstrates that the method and style of delivering lessons in a diversified manner can stimulate the classroom environment. The imaginations of teachers and students are the only limitations. Technology in conjunction with well-defined curriculum objectives, as defined by Massachusetts Curriculum Frameworks, can reshape and improve the method and style of traditional curriculum delivery. Successes in Maine, Virginia, Illinois, Canada, and Australia and other places support the position that ubiquitous and equitable technology can transform the educational environment in ways that traditional resources and methods cannot.

(2) Changing Teaching and Learning

Massachusetts must embrace technology by fully integrating it throughout the curriculum, the delivery of instruction, the preparation of teachers, and their continuing professional development. The availability of ubiquitous technology has been demonstrated (see bibliography in Appendix C) as a critical factor in meeting the following **student centered** objectives:
- Increased **student engagement** as shown through attendance, disciplinary data, and classroom participation;
- Enhanced **student achievement** as shown through test scores, grades, assessments, and broader portfolio work;
- Increased **student aspirations** for higher education and life long learning through opening up new learning opportunities and methods;
- Empower students to develop critical, **higher-order thinking skills** using technology;
- Increased **skills** that are required for 21st century knowledge-based employment;
- Fundamental **paradigm changes in teaching strategies**, curriculum delivery methods, and classroom management;
- Dynamic **professional development** activities to support teachers in fully utilizing technology.

(3) Personal Learning Technology for Students and Teachers

"Technological literacy" is **not** simply about mastering the use of computers and related web-based or software applications. Personal learning technology (laptops and associated software) is a powerful tool and leverage point to motivate students by **individualizing learning** opportunities around their interests. Providing ubiquitous tools will:
- Provide **equitable access** to rigorous, high-quality content resources over the Internet;
- Create rich and varied opportunities for **project-based investigations** and learning;
- **Empower analysis** and problem-solving on a more sophisticated level;
- **Support collaboration** and communication with and between students and adults in the same classroom—and beyond classroom walls;
- Advance **transformative teaching paradigms** and invigorate teaching as a profession.

Personal learning technology is about empowering the student to learn challenging content and critical, higher-order thinking skills—not to learn how to use technology. In so doing, the technology becomes an indispensable and virtually transparent tool. Personal learning technology makes possible individualization of education for everyone; most importantly, students take greater ownership and responsibility for learning and teachers become educational guides in channeling these quests.

Students fortunate enough to have personal one-to-one access to computer technology, and teachers trained in its use, begin to experience the benefits of technology in three fundamental areas:

1. The **culture of teaching and learning changes** as students become independent learners and educators become facilitators of learning;
2. **Access to educational resources expands** exponentially, both at home and at school, leading to improved mastery and application of knowledge;
3. **Acquisition of business and industry technology skills** become embedded tools in all curriculum areas. Tools include word processing, concept mapping, spreadsheets, databases and research skills, graphics, access to primary resources via the Internet, etc.

(4) Communities in Transition and Closing the Digital Divide

In national testing, Massachusetts is recognized as a leader in K-12 educational achievement. However, the quality of education for large segments of our population must improve in order for them to attain the high standards envisioned by the state's Education Reform Law. Investment in technology can be a critical tool to close achievement gaps among students and schools with varying access to educational resources. Moreover, it presents a vehicle to help move all students to the proficiency levels required by the federal "**No Child Left Behind Act"**.

Massachusetts is diverse in its mix of urban, rural and suburban communities. Many communities have been bypassed by the high-tech successes enjoyed by large sectors of the state. These communities are now attempting to diversify their economies from traditional manufacturing or natural resource-based industries, to new, technology-intensive economies. Such economies demand a highly skilled workforce. Harnessing technology is critical to delivering the quality educational opportunities needed by such a workforce. Technology can help bridge the digital and economic divide between those households and communities that have access to the information resources of the digital age and those who do not.[4]

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[4] The marriage of human resources and technology drives economic development and workforce preparedness. A study by the Maine Jobs Council found that Maine's computer deployment program was a necessity to remain economically competitive. In the words of the Council's recommendation: "Promote technological literacy—two out of three Maine workers report that they use computers on the job. By the time today's students graduate and enter the workplace, the figure will approach 100%. —*Maine Jobs Council Annual Report, 2002*

In the service, knowledge, and government sectors of the economy, computer literacy and the ability to use technology both to innovate and create efficiencies is essential. Technology competency is fundamental to the knowledge-industry workforce of the future. New sectors of the Massachusetts economy—such as plastics, biotechnology, financial services, health services, information technology and environmental technology—all require personnel with technology skills. Learning technology in Massachusetts schools can provide a feeder system and pipeline for these new business sectors while ensuring equal access to all regions of the state.

PART 3: IMPLEMENTING CHANGE

(1) One-to-One Threshold

   After reviewing available research and experiences in other states, we believe there is a need for a **one-to-one** computing initiative for all students in Massachusetts. We think one of the best ways to accomplish this is through wireless, portable full-featured computing devices, which provide both flexibility and portability. Our recommended initiative is focused on the impact of technology to transform teaching and learning and to increase achievement. **Teacher preparation** and **professional development** are **essential** to the successful implementation of this initiative (see Part 4). The premise of a wireless laptop initiative is that one-to-one access for each student each day in each classroom is the true threshold necessary to realize the tremendous potential of technology to change instruction and learning. Furthermore, one-to-one access encourages **anytime/anywhere** learning. Studies have shown that one-to-one computing is fundamentally more dynamic and successful than school environments where students must share technology tools, be it in the classroom or limited to computer labs.[5] Students and teachers need their own laptops during the school day and should be able to take them home at night.

   Those who have undertaken one-to-one computing efforts report that having technology available all the time and in the classroom learning environment, coupled with professional development opportunities for teachers, has changed the integration of technology into instruction from incremental to transformative.[6] They indicate it has enabled them to move from a traditional lecture model, where students take notes and regurgitate information, to where kids collaborate, problem-solve, do research, and actually construct knowledge. With all the new information available to them, learning has taken on a whole new complexion.[7] We argue against the current practice of "sharing technology" —it is not a pattern we tolerate in the work world nor should it be so in education.[8] As we stated in our introduction, this is both an equity issue and an issue of ensuring access to a new world of knowledge and individualized learning for all children.

(2) Examining the Literature

   Over the past 2 years, both Maine and Henrico County, Virginia have been proving the value and importance of educational technology in their middle and high schools where every student state-wide [county-wide in Virginia] has a wireless notebook computer. In Maine, nine pilot schools were deployed in March 2002 as exploration sites to preview the middle school initiative, and to serve as regional focal points for teacher professional development. A just released Maine study from MTLI (Maine Technology Learning Initiative) points to some significant gains in math, science and social studies standardized state test scores among 8th grade students in the nine original exploration sites.[9]

   A yearlong Canadian one-to-one laptop writing program reports increased gains in English scores. "School District 60 today announced a 22% increase in its English scores as a result of its Wireless Writing Program (WWP) research study, which confirmed that its computer-based writing initiative substantially improved the academic achievement of grade six and seven students, particularly in the area

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[5] For example, **Laptop Learning: A comparison of teaching and learning in upper elementary classrooms equipped with shared carts of laptops and permanent 1:1 laptops**, done in Andover, Massachusetts by education researchers Michael Russell, Damian Bebell, and Jen Cowan at Boston College (soon to be published). See also bibliography in Appendix C.
[6] Statement by Larry Frazier, director of technology Yarmouth, Maine, published in Teaching with Technology - One-to-One Computing, by Prof. Jim Lengel.
[7] Dr. Vicki Wilson, Assistant Superintendent, Henrico County Public Schools.
[8] At the middle school and high school levels, high quality technology-based lab modules (as well as a host of other business-related applications) acquaint students with the computer as a tool for learning broad areas applicable to the industrial process: applied physics, hydraulics, computer control, robotics, electrical systems, manufacturing systems and processes, computer technology, mechanical systems, etc. Even more important is the integration of technology in all subject areas. Pervasive access to wireless notebook computers will bring extended time-on-task for study and inquiry. Preliminary studies have shown that students who have laptops at home spend an average of three hours per night using them, most of which is for education.
[9] Mike Muir, Gerald Knezek and Rhonda Christensen, **Research Brief MLLS0401**, Feb. 26, 2004, MLTI.

of written expression. The initiative involved providing a laptop computer for each of the students involved. The results of the study showed that effectively integrating technology into the classroom improves students' writing ability, their performance and attitudes, classroom learning environments, and parent satisfaction with schools"[10].

Other states and many schools as well as school districts around the country have adopted, or are considering, one-to-one laptop initiatives. For example, Michigan, New Hampshire, Florida, Texas, Connecticut, Richmond, Virginia, Chicago, Illinois, districts in California, New Jersey, Oklahoma, Pennsylvania, South Carolina, and North Carolina. Other countries, such as Australia, Scotland, France, are doing likewise. The region that includes Marseilles in France (Bouche-du-Rhone) has allocated 4% of its total budget (not just education budget) to putting laptops in schools as an investment in the economic development of the region. See bibliography in Appendix C. Massachusetts needs to follow suit, or we will lose educational and economic competitiveness for our residents.

(3) <u>Motivation and Achievement</u>

The Maine demonstration schools for grades 7 and 8 show the compelling impact of technology on student motivation and achievement, convincing skeptics of the merits of a broader deployment. In just three months, one pilot middle school saw absenteeism and tardiness decrease 72%, disciplinary referrals decline 81%, and honor roll participation increase by 57%. Another small school showed even more dramatic effects. And Piscataquis Community Middle School, the earliest and most intensive of the advance deployments, recorded improvements in attendance, a 50% reduction in behavior letters sent home, and a 7-point improvement in MEA test data in one year – even more for those students in the bottom third academically (data from the State of Maine). The **Maine Education Policy Research Institute** has published a review of the first year of Maine's state-wide deployment, and the data from this research continues to indicate the excellent value and return on investment for the county, especially for those students that were being left behind under the previous system of teaching due in large part to different learning styles.

A recent discussion with Mr. Damian Bebell in his research from Boston College on technology and education indicates that students who are technologically savvy but who are limited to paper assessments do not do as well as students who are allowed to take online assessments. The potential for electronic testing is an area that should be given further consideration. Kansas and Iowa conduct most of their student assessments electronically.

(4) <u>Establishing Demonstration Sites</u>

While we strongly believe one-to-one computing is essential for all students, we are mindful of the current fiscal climate. Hence, we support the deployment of **demonstration sites for one-to-one wireless, portable, full-featured computing** programs in various **middle schools** throughout the state as the initial step in a structured roll-out option. We recommend wireless, portable computing because of the flexibility it provides for anywhere/anytime learning. Each demonstration site would include a built-in research component. These sites will lay the groundwork for content and curriculum development, as well as the development of best practices that will inform continued one-to-one roll outs in all schools. They will help to showcase the power of personal learning technology to actually transform school practices and curriculum and raise the literacy and achievement of students throughout the Commonwealth. Massachusetts must seize this opportunity to demonstrate the potential of technology to help transform teaching and learning in classrooms state-wide. See Appendices A and B for more detail on the specifics of this program.

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[10] David K. Vandergugten, Principal of Technology Services, School District 60 – Peace River North, http://www.prn.bc.ca/Wireless_Writing_Program.html

(5) Project Assessment and Research are Critical

Any program design for one-to-one wireless computing in schools should include aggressive, comprehensive, independent program evaluation by experts from local colleges and universities. Learning from the experience of the selected middle schools can guide future investments in technology, professional development, and assessment to maximize the impact on schools state-wide. We should draw on the methods used by the University of Maine, Boston College, foundation studies, and other institutions that have undertaken autonomous evaluations. These elements are contained in Appendix A.

PART 4. EMPHASIS ON PROFESSIONAL DEVELOPMENT

An absolutely critical element for success includes serious, embedded professional development for teachers and those preparing to become teachers to learn how to integrate technology to transform their teaching strategies. This can start with utilizing the **Technology Self-Assessment Tool** (TSAT) statewide to determine the technology proficiency of Massachusetts' educators. However, we would urge districts to look at the five year Department of Education (DOE) **Project MEET** studies for effective models of professional development. To support this richer, deeper work with technology, high-quality professional development must:

- Be practice-centered, field-based, and job-embedded (i.e. not single-shot, pullout training outside the school);
- Significantly change teaching practices and student learning opportunities in technology-rich (one-to-one) environments;
- Support teachers in providing hands-on learning activities; emphasizing higher-order thinking skills; linking to strong assessments; and undertaking classroom-focused professional development;
- Address more than simply the needs of "technology use," but include programming aimed at boosting the subject matter knowledge, good pedagogy, engagement, and leadership skills of teachers;
- Adopt the philosophy of "just-in-time" versus "just-in-case" professional development methods;[11]
- Help to develop undergraduate and graduate courses in colleges and universities in ways to change teaching and learning through use of technology;
- Provide on-going support through a variety of assistance such as:
  - Help Desks;
  - On-line conferences with other teachers;
  - On-line, self-paced courses to augment skill levels;
  - Dissemination of best practices;
  - Modeling and mentoring by master teachers and technology integration specialists who use technology in creative and successful ways;
  - Train-the-trainer models of professional development (utilize the successes of Massachusetts' Project MEET);
  - Sharing of exemplary model lessons;
  - Teacher meetings by discipline;
  - Informal teacher-chats to compare successes and pitfalls;[12]
  - Local and area summer institutes;
  - Sufficient release-time for on-going professional development, both formal and informal;
  - Utilization of electronic curriculum mapping to ensure curriculum change, excellence and framework standards in teaching;
  - Web-site sharing of best practices and model lessons, driven by database categories to assist teachers in finding good lessons.

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[11] Professor Muir emphasizes that professional development is most effective when it focuses on teaching technology skills as they are needed by students and teachers, rather than a "what if we need to do this" approach. People retain knowledge when they learn a skill to perform a task, not because they may need it sometime in the future.

[12] Maine encourages frequent "dine and discuss" sessions where teachers meet informally to share tips and tricks, successes, how-to and what-not-to-do.

PART 5: TECHNOLOGY INFRASTRUCTURE

(1) Technology Infrastructure Standards

We believe that there is a need to develop **technology standards** for school districts, with special emphasis on the technology infrastructure**.** These standards would build upon the benchmarks provided within the **Massachusetts STaR Chart** (School Technology and Readiness Chart), but provide more specific details on the optimal specifications for technology infrastructure designs and purchases. Consistent, articulated technology standards can increase interoperability, reduce costs, and improve the effectiveness of the technology put into use.

The technology infrastructure has been described as the plumbing of technology, or more humorously, "the parts of the building that don't fall out when you turn it over and shake it". Infrastructure includes things such as wire, cable, connectors, connections, racks, power, etc. As with plumbing, technology infrastructures should be uniform, can be standardized, and need to support uses, not define them. Massachusetts, as with most states, has many more codes and practices for the proper installation of sheetrock than it does for technology.

Currently there are many views of how technology infrastructures should be defined and designed and there is little consistency among architectural firms in approach and execution. School building committees, or their technology subcommittees, often make decisions on technology designs based on personal experiences and usually without a real understanding of educational technology. Schools are built to last for decades, but the infrastructure to support the building's technology is often designed in a shortsighted manner. In addition, schools need to develop approaches for maintaining technology and providing technical support once it is installed.

It is critical for Massachusetts to maximize its educational resources by insuring a **forward-looking design approach**, always trying to position schools to support teaching and learning as it will occur in the future. Ongoing support of technology infrastructure is necessary to protect data and maintain pace with advancements in technology. It is equally important to have schools build only what they can afford to support.   Technology infrastructure standards will help schools incorporate flexibility and adaptability into their designs so that they are able to adopt emerging trends when they are ready for prime time and when the school system can finally support them.

What specifically would technology infrastructure standards look like? There are many standards that could be adopted and a process for doing so is outlined herein. The following are a few areas for consideration:
- Access to cabling needs to be included in the design; building in cable trays in the ceiling could be a standard, cost effective way to provide this access;
- Proper storage of teaching devices should be included in designs; closets with venting and power strips could be a standard;
- Wiring for wireless computing needs to be included in media centers and public areas within a school, not just in classrooms;
- Electricity needs to be available where the tools will be used and accommodate reconfigurations of classrooms;
- Computing devices may need regular patching and upgrading to keep the software up to date and maximize security; having a PC on a rack that regularly searches external sites for patches and then automatically distributes them internally, without human intervention, should be a standard.

Technology and infrastructure standards can play a significant role in insuring that a consistent learning environment is available that can actively support curriculum frameworks. Standards should focus on educational need and not necessarily on specific products.

How should standards for technology infrastructure be adopted and implemented? Representatives from school districts and the Department of Education should form a working group charged with the task of consulting with organizations or persons who are expert in technology infrastructure design. The group would work with these experts to develop the initial set of standards that would then become mandatory for all new school building construction and implementations. These standards would need to be reviewed and refreshed on a regular basis, initially every six months and then yearly, at a minimum. Once the standards are in place, all pending school building projects should be reviewed and updated if necessary to insure the standards will be followed.

(2) Technology Directives for School Building Assistance

Building projects are an ideal opportunity to implement the proper technology infrastructure.   If the technology standards from subpart (1), above, have been implemented, then all school building projects should be required to implement the standards as a condition for receiving funding. All proposals for new school building construction or the renovation of existing buildings must include plans for integrating technology into instruction and management. Issues ranging from wireless infrastructure and equipment to empty conduits and electrical outlets in classrooms and other spaces must be addressed, if technology standards do not exist.

Also, proposals for school building assistance should include not more than $18 per square foot for technology hardware and wireless access. This is a change from the current model of not more than $15 per square foot for furniture, equipment and technology.

In all cases, school districts should be required to specify how the district will provide adequate technology support and how that ongoing support will be funded.

(3) Share Technology Support Resources and Costs

State of the art infrastructures require significant expertise to support properly and school districts cannot always find adequately skilled people or have enough funding to pay market rates. Leveraging economies of scale across the municipality may provide both the city/town and its school district with state of the art support capabilities. In addition, programs such as the state funded Youth Tech Entrepreneurs Program could be expanded to all communities. This program provides opportunities for students to provide some of the technical support needed by their schools.

(4) Mechanism for Major Upgrades to Technology Infrastructure

There may be times when a school or a district needs to perform major upgrades to their technology infrastructure, but they are not planning any significant building renovations or construction projects. Although ongoing support of technology should be a standard operational expense, there are occasions when the upgrades needed go beyond normal maintenance and the school district will need funding assistance. Putting off major upgrades in the technology area can often compromise educational experiences and significantly increase maintenance costs. Establishing a program – grants, low or no interest loans, or some other mechanism – that provides *supplementary* funding to a school district would insure that the technology investments and educational benefits once in place would be preserved and extended. Such a program could be included as part of the matching grant program referenced in Part 6.

PART 6: FUNDING

(1) Educational Technology Trust Fund

We believe that it is vital to re-establish and fund the concept of an **educational technology trust fund**. A trust fund was created in 2001 by Chapter 182. However, state fiscal problems resulted in its elimination. The 2001 trust fund was to have provided $55 million (over 5 years) for educational technology for K-12 schools, including the continuation of a popular **matching grant program** established in 1996. This program provided matching grants (3 to 1 (local/state)) to assist local school districts in undertaking educational technology projects and professional development in accordance with locally adopted technology plans. The matching grant program was a successful approach. The $45 million dollars in state grants funded under the program resulted in a local investment of over $150 million. A matching grant program should be established and funded through the educational technology trust fund. This program could be used to help in implementing the one-to-one wireless, portable, full featured computing program referenced in Part 3, professional development referenced in Part 4, and the program referenced in Part 5.

(2) Revenue Sources

If a system is worked out to collect sales tax from so-called "E-tailers", all, or a substantial portion, of these monies should be dedicated to the educational technology trust fund, as gas tax monies were for highways. Estimates have placed these monies at $300 million annually. This idea is one that requires further consideration.[13]

In addition, it is important to rethink how education is funded and whether there are ways to change how some education dollars are spent. The following are some suggestions:
- It is crucial to **re-evaluate spending on** static **textbook** line items and begin to **move** these resources **to dynamic**, **electronic tools** and infrastructures. The focus should no longer be on the purchase of textbooks. The content provided in textbooks can be provided in a more dynamic and updated fashion through computers;
- Persuade municipalities and school committees to seek long-range planning in the form of **multi-year leasing** of technology tools;
- **Change Chapter 70** to specifically include foundation dollars for technology;
- Strongly encourage and facilitate such measures as **bulk** or cooperative **purchasing** of computers and the like in order to ensure maximum price advantage. State and local purchasing power when joined together provides a strong base for negotiation. **Pooled** purchasing of subscriptions to online services that provide classroom teaching and learning could also provide additional cost saving opportunities;
- Solicit federal funding and private grant foundations for innovative educational technology projects;
- Encourage local businesses and chambers of commerce to support school efforts with monetary donations and underwriting some of the funding of laptops that meet project RFPs;
- Encourage local businesses and news organizations to publicize school technology activities;
- Solicit municipal leaders to consider the passing of **local bond measures** for technology as a long term investment in the community;
- Convince local economic leaders that investment in educational technology leads to a better educated workforce;
- Encourage parent groups and community members to assist school network management teams to install wireless access points and high-speed infrastructures.

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[13] Commission member Senator Jo Ann Sprague does not agree with this paragraph.

Appendix A – Components of One-To-One Wireless Computing Program

(1) Demonstration Sites and Phased Rollouts

    With Maine and other state successes as a reference, now is the time for Massachusetts to launch one-to-one computing programs in our schools. As previously indicated, for fiscal reasons we recommend a staggered rollout. **Phase One** would include the selection of middle school (grades 7 and 8) demonstration sites in up to 9 districts that are positioned to support ubiquitous technology in both the infrastructure, professional development, good modeling for teachers, administrative backing, and private sector support. Selected sites should be ones that show need based on factors such as income, dropout rates, attendance rates and test scores. There are districts ready for this challenge today. See Timeline and Structure Of Activities For Implementing One-To-One Wireless Computing in Appendix B.

(2) Geographic Dispersement

    Demonstration sites should be **geographically dispersed** and could act as regional resource centers for further state-wide deployment. The demonstration schools would receive an advanced deployment of wireless networks, and access to wireless notebook computers for all students and teachers (possibly phased in over two years to assure smooth implementation). Each targeted site should also receive extensive support and professional development.

(3) College Participation

    Local colleges and universities should play an active role in these projects as hubs for initial professional development activities and in providing student teachers who can assist in these projects. In turn, local colleges can offer more courses on technology-curriculum integration and advanced degree courses for current teachers looking for professional advancement.

(4) Professional Development Centers

    The demonstration sites are a key component of any effort to provide training and professional development to prepare teachers to use technology effectively. The early deployment sites will provide Massachusetts teachers with opportunities to observe, explore and innovate with the effects that technology has on teaching and learning in real classroom environments. The sites will demonstrate **effective integration** of technology tools in the school curriculum. They should also be able to provide professional development modeling to surrounding districts.

    As part of their commitment, demonstration schools should be open for other districts to visit for an average of one day per week, and schools would share experiences and student products with visiting teachers from their regions and at regional and county conference sessions. These demonstration sites will not simply be about the use of technology; they will be part of the larger fabric ensuring educational change and improvement in Massachusetts. By empowering the learner to research, collaborate, customize and create, personal learning technology will help transform outdated educational practices and improve student learning.

(5) Project Research

    Research needs to be conducted on program implementation. Any results should be posted on the Department of Education's website. Such research should include at least the following:

- tracking of MCAS scores;
- tracking of other student assessments (including GPA trends, honor roll percentages, other assessments);
- attendance data;
- student discipline records and behavior trends;
- student motivation;
- changes in teaching strategies and practices;
- changes in curriculum delivery methods;

- changes in classroom practices and peer relationships;
- effect on equity (socio-economic, gender, minority, etc.);
- community Internet access beyond school walls;
- documentation and dissemination of best practices;
- professional development methodologies;
- parent surveys (how families are affected);
- business surveys (how local businesses are affected);
- local government surveys (improved relationships between schools and municipalities).

Models for data analysis should refer to the following institutions and their research[14]:

- **Main Education Policy Research Institute** (data points included observations, surveys, interviews);
- **Maine Learning with Laptop Study;**
- **IITTL** (University North Texas);
- **Great Maine School Project** (funded by the Gates Foundation; data points include student surveys, teacher surveys, parent surveys);
- **Missouri eMINTS** (data points include surveys and focus groups);
- **Boston College** research studies (refer to researchers Damian Bebell and colleagues for one-to-one versus shared computing studies);
- **MCLA** (Massachusetts College of Liberal Arts) which will spearhead studies on a one-to-one laptop initiative in Berkshire County beginning 2003-2004.

(6) <u>Hardware, Software and Training Needs</u>

Costs to be included in the program:

- **Hardware**:
  - full featured devices such as laptops or comparable devices with full-size keyboards and screens and cases for each student and teacher (must include at least 3 to 4-year warranties); must support a minimum of 2 to 3 hours of battery time between re-charging;
  - devices must be fully portable (requirements for devices will include fuller details than what follows);
  - have security features such as those in Maine that guard against theft;
  - wireless cards;
  - wireless access points;
  - sufficient internal hard drive capacity for all software to reside on the local drive;
  - infrastructures to support fast, reliable Internet access;
  - projection systems (not televisions);
  - networked printers;
  - multimedia equipment (e.g. digital cameras, digital video cameras, scanners);
  - replacement parts (e.g. batteries, projection bulbs);
  - file servers and storage devices;
  - science probeware.
- **Software**: Software types listed below are for the purposes of communicating with teachers, parents, community members, experts, and students. For students these open-ended tools will help them to look up information, access online resources, write, collect and analyze data, and create projects using multimedia.
  - tools-based software—not drill;
  - word processors, including text-to-speech word processors;
  - spreadsheets;

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[14] Mike Muir, presentation given at Massachusetts College of Liberal Arts, North Adams, Massachusetts, February 5, 2004.

- o concept mapping;
- o databases;
- o conferencing and email;
- o anti-virus and anti-spam protection;
- o collaborative writing processors;
- o remote access software for network support;
- o web development tools;
- o on-line instructional and web resources;
- o multimedia software.
- **Training**:
  - o technical training for network management teams;
  - o initial and ongoing technical support from hardware/software providers;
  - o release time for professional development;
  - o on-line self-paced courses;
  - o on-going professional development activities for integrating technology into instructional practice.
- **Personnel**:
  - o project management teams;
  - o professional development coordination;
  - o curriculum-support specialists in schools;
  - o technical support specialists in schools;
  - o utilization of students support teams (modeled on iTeams in Maine, or expanded state's Youth Tech Entrepreneurs Program);
  - o help desk support.
- **Evaluation Costs**:
  - o cost of surveys;
  - o cost of assessments;
  - o cost of dissemination of best practices and faulty practices;
  - o cost of objective researchers and evaluator;
  - o cost of evaluation program administration.

Appendix B - Timeline and Structure of Activities For Implementing One-To-One Computing

Phase One: Demonstration Sites	
Year 1	**Up to nine districts for middle school demonstration sites selected to develop models for the rest of the state. Sites should collaborate to develop a *master plan* that can be tested and replicated. Criteria for selection need to include the following:** • Readiness of infrastructure (at least T-1 Internet access, including a fully functioning WAN (wide area network) and LANs (local area networks) • Network teams able to support the infusion of laptops • Readiness or ability to implement wireless technology • Proven professional development successes (emphasis should be given to successful **Lighthouse** sites or other grant recipient districts that have created exemplary, ongoing professional development programs) • Communities where business partners actively support one-to-one technology • Show needs based on income, dropout rates, attendance rates and test scores • Professional development leadership and coordination models in place • Have the ability to raise matching funds (both local school funds and through other private sector funding) • History of partnership with area colleges or universities for evaluation and student-teacher placements • Demonstration sites should be geographically scattered so that they can function as centers for sharing and research
Phase One Activities	**Phase One activities include thorough planning, procurement of hardware and software, professional development and evaluation design, and teacher rollout:** • Selection of Demonstration sites • Develop Master Plan in collaboration with Legislative leaders, DOE, and local sites • Administrator and teacher visits to Maine • Presentations from states where one-to-one programs are succeeding • Submission of grant applications to outside agencies and businesses for supplemental funds (particularly for professional development) • Development of a collective RFP process for hardware and software (it is important to develop rigorous RFPs that will include 3 to 4-year warranties on hardware, technical support, initial professional development for rollout, and as much of the software indicated in Appendix A as possible) • Begin wireless engineering and installation • Procurement of computers for teachers • Rollout of computers for teachers • Procurement of mobile carts for lesson modeling and in anticipation of student laptop rollout • First round of professional development training for teachers (care and feeding) • Development of student iTeams or utilize Youth Tech Entrepreneurs

	Phase Two: Begin Deployment for Students
Phase Two Activities	**Phase Two activities include student rollout and full implementation and use of the technology in teaching and learning:** • Evaluation processes put into place • Continue procurement of additional grants and funding • Full-scale embedded professional development activities for teachers under way • Modeling lessons that integrate the use of technology • Provide teachers with strategies for how to teach with technology (different from session on integrating technology) • Meet regularly with stakeholders • Meet with parents and other community stakeholders to discuss rollout, responsibilities, signing of AUPs, family involvement • Procure computers for students • Continue rollout of computers for students • School year and summer content institutes with embedded technology • Collaborate with colleges and universities utilizing student teachers • Evaluation process ongoing • Ongoing collection of attendance, discipline, grade statistics • Visits from other districts as they begin their planning • Collect best practices: what works, what doesn't • Manage funding streams so that funds are available at critical junctures

	Phase Three: Research Evaluation and Adjustments
Phase Three Activities	**Evaluation and adjustment is on-going and informs improvement and change of the model.** • Begin to circulate evaluation findings • Make adjustments based on best practices and problems • Full-scale embedded professional development activities for teachers continue • Model lessons that integrate the use of technology • Meet regularly with stakeholders • Begin to publicize successes • Extend family involvement activities • Hold school year and summer content institutes with embedded technology • Continue collection of attendance, discipline, grade statistics • Begin process for scaling up state-wide • Appeal to legislators both state and local to change education funding formulas to include technology as a regular budget line item with built-in replacement plans • Amend district technology plans to reflect one-to-one goals • Amend project activities based on outside, objective research studies

Phase Four: State-Wide Rollout	
Can occur in conjunction with Phases Two and Three	**Recommend a collaborative "buddy" system whereby demonstration sites become mentor-centers and adopt neighboring school districts; local areas provide for easier sharing of experiences and resources. While electronic sharing state-wide should be encouraged, teachers need collegial and local support bases. Higher education benefits by supplying better trained teachers who have been part of the process.** • Adjust legislative funding to bring on all districts through the matching grant program • Repeat implementation above allowing for refinements and adjustments • Phase-in more and more schools as communities indicate readiness • Continue moving one-to-one technology into high schools • Move one-to-one technology to elementary grades • Redefine the technology as it evolves

Appendix C – Bibliography

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Web Resources

Bill & Melinda Gates Foundation: http://www.gatesfoundation.org/Education/

Education Development Center, Inc.: http://www.edc.org

eMINTS — enhancing Missouri's Instructional Networked Teaching Strategies: http://emints.more.net

Great Maine Schools Project: http://www.greatmaineschools.org

Maine Learning Technology Initiative (middle school laptop project): http://www.mainelearns.org

SAD 4: http://www.sad4.com

Society for Information Technology and Teacher Education, University of Texas: http://www.iittl.unt.edu/IITTL

Technology and Assessment Study Collaborative: http://www.intasc.org/

Wireless Writing Program (BC, Canada): http://www.prn.bc.ca/Wireless_Writing_Program.html

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