Leading Educational Transformation for Today's Global Society

STATE OF MICHIGAN
EDUCATIONAL TECHNOLOGY PLAN

March, 2006

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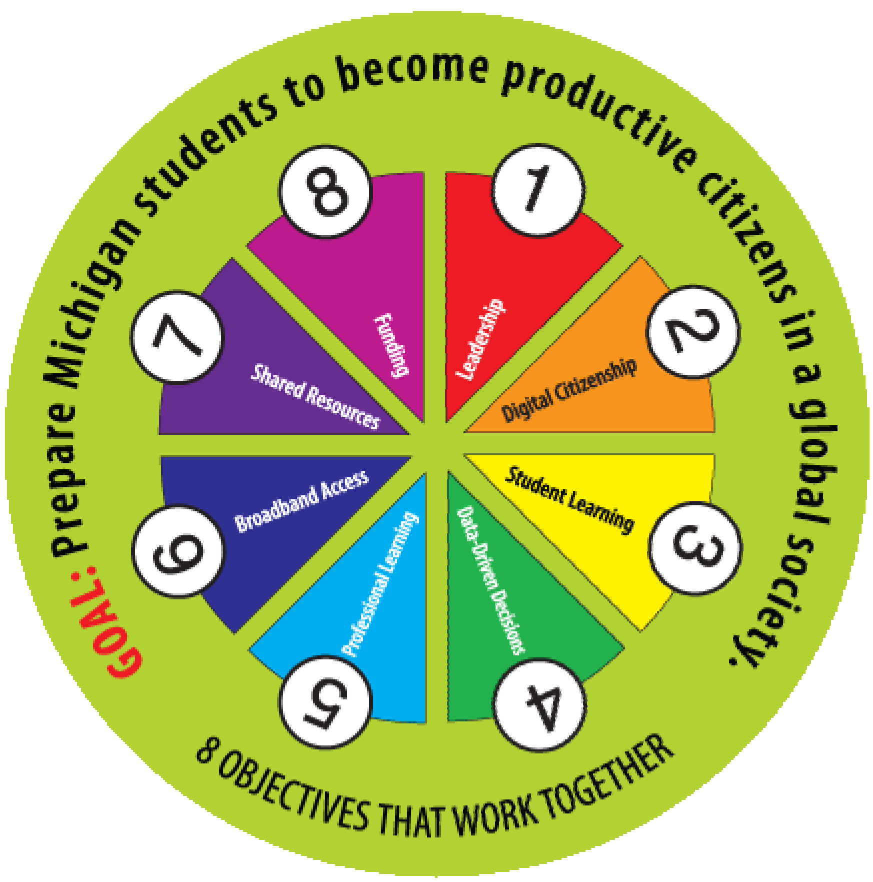

Executive Summary

Education in Michigan is currently facing a unique set of challenges and opportunities. It is imperative that we look intensely, carefully, and thoroughly at increased use of educational technology to meet these challenges and transform student learning.

Competition across the United States and the world is forcing this transformation. We must act or we will be far behind. Furthermore, technology is everywhere now, but incredibly, it will be even more pervasive in the future. Think about what the nation will be like, and what will be expected of our schools' graduates when this year's kindergarten class graduates from high school. Technology will be integral, ubiquitous, and for those not ready for the changes, disruptive.

This Plan has a single Goal:

Prepare Michigan students to become productive citizens in a global society

We have eight Objectives that represent both the balanced approach and the systemic approach; all of equal importance and necessary to accomplish this goal.

1 Leadership

Michigan will provide leadership for educational technology in order to expand and develop transformative learning environments that increase student achievement.

2 Digital Citizenship

Every Michigan student will be proficient in technology and will demonstrate the ethical use of technology as a digital citizen and lifelong learner.

3 Student Learning

Every Michigan student will have meaningful technology-enabled learning opportunities based on research and best practice that include virtual learning experiences.

4 Data-Driven Decisions

Every Michigan educator will use data effectively for classroom decision making and school improvement planning through an integrated local and statewide decision support system.

5 Professional Learning

Every Michigan educator will have the technology competencies to enable the transformation of teaching and learning to improve student achievement.

6 Broadband Access

Every Michigan classroom will have broadband Internet access to enable regular use of worldwide educational opportunities.

7 Shared Resources

Every Michigan educator and learner will have equitable and sustained access, through statewide coordination and support, to resources necessary to transform teaching and learning through educational technology.

8 Funding

Michigan will develop innovative methods of funding to transform and sustain teaching and learning through educational technology and build local, regional, and statewide capacity.

Educational technology as addressed in this plan is a powerful means of improving student learning. All our educators should be knowledgeable about the ways in which student learning can benefit from educational technology. These educators should have a supportive environment in which they can realize those opportunities. We must recognize that education cannot get there via quick solutions and initiatives; we must build a transformed educational system that is enabled by educational technology through intensive work over a period of many years.

This plan addresses statewide policies and practices, not the technology plans of individual local educational agencies (LEAs) and intermediate school districts (ISDs). It focuses on an overall framework for leadership and determining direction, one in which state-level efforts facilitate and foster access to cooperative projects, resources and professional learning in a timely, equitable, and cost-effective manner. We must implement aggressive and deliberate strategies that both maximize the return on investments in public education during a time of ongoing fiscal crisis, and exploit the potential of educational technology for improving teaching and learning.

Preface

This plan is the product of extensive online and in-person discussions and planning that began with a first meeting on March 21, 2005. The Charge to the Committee, along with the Purpose, Vision, and Mission that the Committee established for itself may be found in Appendix A. It reflects deliberations among over fifty people from across the education community in Michigan. Their names and affiliations are in Appendix B. Much of the discussion took place in seven distinct Working Groups, and among the Chairs of those Working Groups and the Facilitator of the Committee's work. The Working Groups were established to align in large measure with the organization of the National Education Technology Plan 2004, *Toward a New Golden Age in American Education (U.S. Department of Education, 2004).*

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The Context for this Plan

This plan has been written within a context of recognizing both the need to improve educational achievement of Michigan students, especially those who are under-achieving, and the parallel constraints of funding challenges facing the state and schools. This is a period in which the emphasis is on improving achievement as well as possible with tried and true methods. While this is the very difficult context we all recognize and understand, it substantially understates the challenges we face in education. A combination of globalization and technology advances are racing far ahead of our responses in education.

Racing to Keep Up With Global Competition and Society

Michigan has experienced many profound changes as a result of globalization. Michigan citizens have seen harrowing headlines about our industries and job loss in recent months and years. The pace of change is rapidly increasing, and the impact is spreading. Many of the high-skill jobs that pay well, and the associated taxable income, are going to other nations now, and education is a key factor in how this progresses. Students in many other nations perform substantially better than our students. We are being challenged for virtually every kind of industry and every kind of job.

More and More Immersed in Technology

While it seems as though technology surrounds us today, there will surely be far more by the time most of today's, let alone tomorrow's, students become adults. We now have so many ways to communicate and learn from the rest of the world, with technology as an intermediary, and much more is coming that we cannot even imagine today.

A recent report from the United States Commerce Department cites statistics that (even though a few years old-2002) show 78% of children ages 12-17 go online, and 35% of 2-5 year olds, citing the latter group as having the fastest growth in use since a previous survey. Of those in the 12-17 age group, 83% said they go online more at home than at school. Further, when students in a study were asked about the learning environment of the future, they described it as one in which every student had a computing and communications device readily available and connected to the Internet, with a substantial amount of educational content and learning assistance delivered through that device. Students' practical experience is racing ahead of what is done with educational technology in most schools.

Michigan: Historic Leader, Falling Behind

For many years, Michigan had been a leader in educational technology, with programmatic leadership from the Michigan Department of Education through Goals 2000 and Technology Literacy grants, as well as other statewide efforts through the Michigan Association for Computer Users in Learning (MACUL), the Regional Education Media Centers (REMC) Association, the Merit Network, the Michigan Virtual University (MVU), and the Michigan Virtual High School (MVHS). Major investments have been made through the Teacher Technology Initiative to equip every teacher with a computer, software, training, and Internet dial-in access. Most recently there is the Freedom to Learn one-to-one teaching and learning program. Funding for these programs has diminished in recent years, and many are now ended or being maintained but not updated. The fruits of earlier statewide efforts are still seen in the quality of work done by a number of teachers and administrators. One set of evidence about the situation in Michigan comes from a recent publication of data by *Education Week*, titled "Technology Counts 2005", where Michigan reports to have on average somewhat older computing equipment for student use.

"Educators today must prepare students for purposeful engagement in the world. We are passing from an industrial age to the age of information and innovation. To this end, technology is a powerful instructional tool and transformative force. Policy makers must assure all students equitable access to technological tools and instruction so they are prepared to participate with confidence, competence, and creativity in a global society." (Elizabeth W. Bauer, Chair, State Board of Education Task Force on Embracing the Information Age) Overall, the picture is one in which there is a lot of talent, capability, and interest across Michigan, but a great deal more needs to be done to improve student learning through educational technology**.** That strong, in-depth effort is described in this Educational Technology Plan.

Enabling Educational Transformation

Research has demonstrated that educational technology can make an important difference when it is used in the classroom to support the current mode of teaching, such as assisting in locating information, doing rote learning tasks, or communicating with others. To achieve more significant gains, the approach to teaching changes, typically allowing more individualized or project-based learning with the teacher in a more powerful but challenging role as guide and mentor. This brings the students into a more engaged, motivating relationship with their own learning, often termed a constructivist approach to signify they are learning to build their own base of knowledge and understanding. The challenge of moving to this mode of teaching and learning is significant and requires considerable time and solid support from school administrators and fellow teachers. Educational technology is not a simple solution that is quickly applied; it is not painting the walls to give a room a fresh look. Educational technology takes wisdom and perseverance.

We need leadership at all levels that can imagine and implement a fundamentally transformed educational system that is customized for each student, is data driven and technology facilitated, is readily extended beyond traditional time and space considerations, and through which professional educators markedly increase student motivation, achievement, and readiness to be productive citizens in a global society.

Plan Overview: Eight Objectives Based on One Goal

This plan is based upon a single goal that states both what is expected of students and the context in which they will be living:

Our Goal:

Prepare Michigan students to become productive citizens in a global society

This single goal makes clear that whatever is done with educational technology, the fundamental question is, "what does it do for each student?" **We must also include the use of assistive technology when appropriate to ensure that we are including ALL students**. Failures to make appropriate and effective use of educational technology must be seen as impacting the student. This plan addresses the primary areas in which statewide actions are needed, expressed with eight objectives that are of prime importance for achieving the goal.

A substantial degree of motivation for the Objectives is found in the National Educational Technology Plan (U.S. Department of Education, 2004) and in the No Child Left Behind (NCLB) Act. The Objectives are intended to focus current efforts and to utilize the limited level of available state-level resources.

1 Leadership

Michigan will provide leadership for educational technology in order to expand and develop transformative learning environments that increase student achievement.

Leadership at the state, regional, and local levels is central to the effective use of educational technology in improving and transforming education. This plan recommends strengthening state leadership through the creation of the position of Chief Educational Technology Officer within the Michigan Department of Education (MDE). A second and complementary step is the creation of a Coalition for Educational Technology to facilitate important cooperative relationships among state agencies and the many associations that exist now that support the use of educational technology such as the Consortium for Outstanding Achievement for Teaching with Technology (COATT), MACUL, and others like them throughout the state.

<u>Strategy 1</u>

Strengthen and coordinate leadership for educational technology at the state level.

Performance Indicator

The Coalition for Educational Technology and a high level Michigan Department of Education (MDE) leadership position in educational technology are in place.

Action Steps

1. MDE will establish a position of Chief Educational Technology Officer, reporting at a top level in the organization, to provide leadership in the field of educational technology.
2. MDE will create an advisory group, called the "Coalition for Educational Technology," comprised of representatives from statewide organizations, higher education, and professional associations to facilitate the coordination of technology initiatives and programs to benefit students and educators.
3. The Chief Educational Technology Officer will lead the Coalition for Educational Technology and utilize it as the key group for guiding and coordinating the implementation of this plan, including its evolution and updating throughout its stated period.
4. MDE will encourage cooperation and coordination between and among the ISDs and local districts to leverage educational technology resources.
5. The State Superintendent will examine ways to enhance communication and coordination between MDE and other state agencies to ensure effective implementation of statewide technology projects.

Strategy 2

All Michigan educators will achieve Michigan Educational Technology Standards for Teachers (METS-T) or Michigan Educational Technology Standards for Administrators (METS-A) proficiency.

Performance Indicator

All Michigan educators will demonstrate METS-T or METS-A proficiency.

Action Steps

1. The State Board of Education will adopt a set of state standards for technology literacy for teachers and administrators.
2. Professional learning activities aligned with the Michigan Educational Technology Standards will be offered across the state on a regional basis to enable educators to increase their knowledge and effective use of educational technology resources to improve achievement. A special emphasis will be placed on the knowledge and use of assistive technology and universal design.
3. MDE will develop a program to recognize exemplary educational technology leaders who model and apply technology in support of student learning and achievement.

Strategy 3

Coordinate the development of rubrics for assessing teacher use of technology delivering instruction, including the use of assistive technology and the philosophy of Universal Design for Learning (UDL), ensuring information literacy, and managing instruction to improve student achievement.

Performance Indicator

Rubrics will be established to provide degrees of proficiency for the effective teacher use of technology to deliver instruction, including assistive technology and the philosophy of Universal Design for Learning, ensuring information literacy, and managing instruction to improve student achievement.

Action Steps

1. MDE will invite representatives of statewide professional associations and organizations, and higher education to participate in the development of rubrics for assessing teacher use of technology delivering instruction, including assistive technology and the philosophy of UDL, ensuring information literacy, and managing instruction to improve student achievement.
2. MDE will identify and recognize model school districts that have implemented the rubrics to advance student achievement.
3. MDE will identify model school districts that have implemented the rubrics and whose school leaders and policy makers demonstrate their active support of information literacy skill development as key to student achievement, professional learning, enhanced productivity, and preparation for lifelong learning.

Strategy 4

Generate model processes to assist school districts in developing a knowledge base for building and sustaining their capacity for systematic technology acquisition, integration, and replacement.

Performance Indicator

Model processes will exist to enable school districts to develop a knowledge base for building and sustaining their capacity for systematic technology acquisition, integration, and replacement.

Action Steps

1. The Coalition will develop model processes to assist school districts to systematically acquire, integrate, and replace educational technology.
2. The Coalition will identify and design professional learning opportunities to help school board members understand the importance of utilizing educational technology as a tool for student learning and to administer school districts.

2 Digital Citizenship

Every Michigan student will be proficient in technology and will demonstrate the ethical use of technology as a digital citizen and lifelong learner.

As the world moves ahead with increasing global competition and our lives are ever more deeply impacted by technology, it is imperative that our students become both knowledgeable about technology and develop an understanding of the ethical use of technology. We are moving beyond technology literacy into a world in which students must comprehend how to work with technology as an intermediary, how to function in virtual environments, and how to behave ethically in such a new and rapidly changing world. Students need to develop *Digital Citizenship.* We already see that by 11^{th} and 12^{th} grade over 94% of students use the Internet. The vast majority of teenagers go online at home rather than at school. Instant messaging is preferred over email. Indeed, basic technology fluency is not as much of an issue for students as it once was; youngsters are quickly adopting and using it.

Strategy 1

Develop for students a digital citizenship definition and curriculum for state-wide use that are aligned with Michigan Curriculum Framework (MCF) benchmarks, Grade Level Content Expectations (GLCEs) and Michigan Educational Technology Standards (METS).

Performance Indicator

All students will demonstrate proficiency in digital citizenship and ethical use of technology and information allowing them to become lifelong learners.

Action Steps

1. MDE will establish an advisory group to meet by fall 2006 to identify traits of a Michigan citizen living in a global digital environment. This group will include educators and others representing a wide range of interests, including those addressing special needs of students. This group should include various stakeholders (such as curriculum, special education, technology, media specialists, colleges and universities, students, and workforce development agencies) to create a model curriculum which fully integrates the use of technology as part of the learning process.
2. Michigan Digital Citizenship Curriculum will be developed supporting the delivery of the Michigan Curriculum Frameworks (MCF), and the Grade Level Content Expectations (GLCEs).
3. The Michigan Digital Curriculum will be evaluated and adjusted annually.
4. The Michigan Digital Citizenship Curriculum should embody a broad awareness of other cultures from a global perspective.

3 Student Learning

Every Michigan student will have meaningful technology-enabled learning opportunities based on research and best practice that include virtual learning experiences.

Educational technology should be playing a major role in improving student learning throughout the curriculum. The teacher's role shifts in many ways, such as from lecturer to supporting mentor. Students are often more motivated, engaged, and learn better if their teacher uses educational technology to expand the learning experience. Insightful use of educational technology begins with facilitating student performance in areas such as gathering information and writing. It invites them to explore new means of learning such as virtual classes, video-based content, and the use of simulations to study a concept or process. Students with special needs are served more easily and equitably through the use of assistive technology.

Strategy 1

Identify and disseminate meaningful technology-enabled strategies to improve student achievement and learning in a global society.

Performance Indicator

All students are provided meaningful technology-enabled learning opportunities.

Action Steps

1. MDE will identify and disseminate best practices in technology-enabled teaching and learning environments that will include the use of assistive technology and Universal Design for Learning.
2. MDE will encourage research and evaluation to produce data that focuses on the growing use of Internet-based teaching and learning environments by educators and students.
3. The Coalition will identify areas where technology demonstrates promise in increasing or improving student achievement through the effective and efficient use of data.
4. MDE and the Coalition will work with Michigan colleges and universities in partnerships with classroom teachers to research and explore a variety of customized and individualized delivery systems, including e-learning, virtual schools, simulations, and action game delivery systems.
5. The Coalition will bring together groups that will work collaboratively in identifying technology-based test preparation tools that integrate student assessments, self-paced instructional content and educator resources aligned to state standards and content expectations.

Strategy 2

Provide the necessary resources for a meaningful technology-enabled learning environment for all students.

Performance Indicator

All students will have ubiquitous access to technology, assistive technology, and information resources throughout their learning day.

Action Step

1. MDE will support the development of a plan to enable ubiquitous student and teacher access to technology, assistive technology, and information resources by identifying and utilizing state, national, and international best practices in technology-enabled learning environments and UDL.

2. MDE will emphasize the infusion of educational technology, including assistive technology devices and services, throughout the newly required high school curriculum recommended by the State Board of Education.

Strategy 3

All students will have the opportunity to participate in real-life experiences associated with technology-related careers.

Performance Indicator

Students will be provided opportunities to develop technical expertise to compete in a global marketplace.

Action Steps

1. MDE, in partnership with other agencies, will develop and support technology mentorship programs to empower students in real-life experiences and provide community/school service credit.
2. The Coalition will work with ISDs and Regional Educational Service Agencies (RESAs) to develop mentoring programs for students that offer technology related certifications.

Strategy 4

Promote and support the expectation that every student in Michigan, including students with special needs, be provided with the opportunity to learn in a virtual environment as a strategy to build 21st century learning skills.

Performance Indicator

Prior to graduation from high school, every Michigan student will benefit from learning and using technology-based virtual tools and resources such as those required to complete an online course for credit or non-credit or complete an online learning experience.

Action Steps

1. MDE, MVHS and other providers, MACUL, the REMC Association, and others will actively promote the value of virtual learning environments to educators, parents, students, and policy makers.
2. The Coalition will prepare a feasibility study to determine the value of developing an online international academy to foster global international and educational opportunities, including language and cultural experiences, for Michigan's students.

3. As recommended by the State Board of Education, every Michigan student will complete at least one on-line credit or non-credit course or learning experience in order to graduate.
4. MDE will adopt and implement flexible policies that facilitate the role of the MVHS and other providers to deliver Michigan-based as well as global online learning opportunities for Michigan's schools.
5. MDE, working in collaboration with MVHS and other statewide organizations, will provide and coordinate state, national, and global distance learning opportunities.

4 Data-Driven Decisions

Every Michigan educator will use data effectively for classroom decision making and school improvement planning through an integrated local and statewide decision support system.

Every educator needs to make decisions that are well-informed. A key component of NCLB is the use of a decision support system based on longitudinal data. The data must be connected across various sources over time and then delivered back to educators through meaningful reports that can be used for data-driven decision making. Timeliness of access to data supported by high data quality and increased ability to link and combine data elements must be emphasized. These recommendations are important to all of Michigan, and especially critical to assuring that we meet the requirements of NCLB and maintain full funding from that source.

Strategy 1

Simplify the process of data collection for compliance and decision support at all levels, from the classroom to the state.

Performance Indicator

ISD, LEA, and PSA staff members will be able to log on to a secure online system and submit data to the state through an easy-to-use environment.

Action Steps

1. The Center for Educational Performance and Information (CEPI) will work with local school districts and other state agencies to identify duplicative sources of data collection.
2. CEPI will work with local districts and state agencies to integrate multiple data source systems and align data collection calendars to streamline the data collection process and reduce duplicative data reporting.
3. CEPI will work with state agencies and local districts to extend unique identification codes for student and educational personnel across educational data source systems, including pre-kindergarten through university/college/adult education students, and use these identification codes to track data longitudinally over time.

4. CEPI, state agencies, and local districts will work together to exchange data to pre-populate data collection source systems to help eliminate duplicative data entry.
5. CEPI will provide role-based, secure access to appropriate data from a single web site for specific users such as teachers, parents, and administrators.
6. CEPI will collaborate with ISDs to ensure system interoperability by creating common formats of data elements shared at the federal, state, and district levels.
7. CEPI, with vendors, ISDs, and the Department of Information Technology (DIT), will collaborate to automate connections between databases to replace manual updates by 2008.

Strategy 2

Identify, connect, and combine educational data elements in meaningful ways across various sources (e.g., personnel, financial, crime and safety, schools/facilities, and student data including assessment information and results) and longitudinally over time so that administrators and educators have the information they need to increase efficiency and improve student learning.

Performance Indicator

A collaboration of State of Michigan agencies, led by CEPI, will plan and implement a comprehensive educational data management and Decision Support System (DSS) that will meet federal and state reporting requirements and timelines.

Action Steps

1. CEPI will establish a plan to integrate the data systems necessary to educational decision support so that administrators and educators have the information they need to increase efficiency and improve student learning.
2. CEPI will gather requirements from stakeholders to identify and include data elements that should be connected and stored longitudinally, as well as the data outputs and reports that are critical to data driven decision making to set policy and ensure appropriate resource allocation to improve student achievement.
3. CEPI, in collaboration with ISDs, will secure funding for a state-level longitudinal educational Decision Support System (DSS) that will provide primary DSS functionality for districts and ISDs that do not have local systems.
4. CEPI, in collaboration with ISDs, will ensure that there is vertical integration between the state and local DSS implemented by ISD and LEA districts.
5. CEPI, in collaboration with other state agencies, will connect and combine student assessment data in the state-level DSS to meet the 2007 NCLB longitudinal assessment requirements.
6. CEPI, in collaboration with other state agencies, will connect and combine Single Record Student Database (SRSD) data to enable the calculation of a four-year cohort graduation and dropout rate to meet Michigan's NCLB accountability timeline for 2007.
7. CEPI, in collaboration with state agencies and ISDs, LEAs, and PSAs, will revise existing educational personnel data systems to support the collection and reporting

to ensure that highly qualified teachers are in Michigan's classrooms to meet NCLB requirements.

8. CEPI, in collaboration with ISDs, LEAs, PSAs, Michigan's teacher preparation institutions, and other state agencies (e.g., Office of Retirement Services) will work to integrate data sources that can be used to assess teacher supply and demand.

Strategy 3

Provide timely return of "connected" data to all educational stakeholders as well as professional learning opportunities to help them understand how to use the data to improve student achievement.

Performance Indicator

Every educator and educational stakeholder will have access to high quality, timely data and use that data effectively for classroom decision making and the allocation of resources across schools/facilities, districts, and the state for the purpose of improving teaching, learning, and setting educational policy.

Action Steps

1. CEPI will work collaboratively with other state agencies, ISDs, REMCs, education associations, and grant-funded projects to develop and provide professional learning opportunities for MDE staff and educators on how to use data effectively for classroom decision making and school improvement planning.
2. Educators will use assessment results in determining needs for differentiating student instruction.
3. CEPI and other state agencies will work with educational stakeholder associations to develop and provide professional learning opportunities for Michigan administrators for using data from both administrative and instructional systems to understand relationships between decisions, allocation of resources, and student achievement.
4. CEPI will collaborate with districts and educational associations to develop and implement processes to "build a culture of quality data" at the local level. A culture of quality data includes processes that ensure the accuracy, timeliness, security, and utility of educational data.
5. CEPI, MDE, and other state agencies will collaborate with educational stakeholders including parents, policymakers, and the general public to build data tools and reports to help them understand available educational data and the relationship between decisions, allocation of resources, and student achievement.

5 Professional Learning

Every Michigan educator will have the technology competencies to enable the transformation of teaching and learning to improve student achievement.

The application of educational technology requires not only that each teacher understand the use of the technology, but they must understand how it impacts their classroom practice. The greatest gains have been seen in research and in practice where educational technology is used to teach in ways that were not practical before. Teachers, and the methods each uses, are the keys to progress with student learning. Similarly, it is highly important that school administrators understand and can provide effective leadership about the application of educational technology. This means the competency of all educators must be addressed through professional learning. The professional learning must be an ongoing process of reflective practice, a shared effort among the educators within each school, aligned with state and national standards, and tied to curriculum objectives. This is a long-term process, with each educator continuously building their skills and knowledge, increasing the benefits to student learning. This career commitment should be seen both among current educators and in the pre-service work taking place in our universities.

Strategy 1

Provide professional learning opportunities for all educators related to integrating technology, focusing on improving student learning and meeting the Michigan Educational Technology Standards for Teachers (METS-T) and the No Child Left Behind requirements.

Performance Indicator

All educators are trained to routinely use a core body of technologies that align with standards (METS-T) that support student learning, and technology systems for analysis of data to make data-driven decisions which enhance student learning.

Action Steps

1. Educational technology should be infused in all professional learning activities whenever appropriate.
2. Under the leadership of MDE and the Coalition, a needs assessment will be developed/identified regarding technology competencies of teachers and administrators based on the METS. Funding will be sought to implement a state-wide assessment.
3. The Coalition will advocate for a revision of the Michigan School Code to include a portion of the required professional development for teachers and administrators be dedicated to developing and enhancing technology integration competencies for improving student learning.
4. A representative from the Coalition will serve on the MDE Professional Development Strategic Planning Committee.
5. MDE will provide for educators an electronic "Individualized Professional Learning Portfolio" including educational technology activities (e.g. Michigan LearnPort).
6. MDE will collaborate with statewide groups in the development of ongoing professional development in technology proficiency and curriculum integration.
7. MDE will provide professional learning opportunities relating to the collection and use of student data for decision-making related to student achievement.
8. The Coalition will develop a technology mentoring infrastructure with educators mentoring educators in supporting the utilization of technology and troubleshooting technology in the classroom.

9. MDE will pursue policies that foster the expansion of online professional learning opportunities for all educators and support personnel through online portals such as Michigan LearnPort.
10. Funding for the continuation of Michigan Teacher Network will be provided.
11. Educators will use technology resources that are identified and included on the Michigan Teacher Network as supported and aligned with the Michigan Curriculum Framework (MCF), METS, and the Grade Level Curriculum Expectations (GLCE).

Strategy 2

Provide administrators with ongoing professional learning opportunities that will meet the Michigan Educational Technology Standards for Administrators (METS-A).

Performance Indicator

Administrators and other curriculum/instructional leaders demonstrate skill in assisting and supporting teachers to integrate technology that maximizes student learning.

Action Steps

1. MDE, in collaboration with ISDs, REMCs, colleges, universities, and professional organizations, will create and deliver professional learning opportunities for administrators that will be based on the METS-A.
2. The Coalition will advocate for leadership for technology integration supporting improved student learning within administrator preparation programs.
3. Members of the Coalition will meet with deans and directors of schools of higher education to urge them to enhance the technology preparation of school leaders.
4. Members of the Coalition will work with administrative professional associations to coordinate sessions at their annual conferences and regional learning forums.

Strategy 3

Ensure that teacher preparation institutions are preparing all teacher candidates to successfully utilize technology to improve student learning through mastery of the Entry Level Standards for Michigan Teachers (7th Standard).

Performance Indicator

All teacher candidates demonstrate skills in utilizing technology, including assistive technology, to improve student learning prior to certification.

Action Steps

1. MDE and the Consortium for Outstanding Achievement for Teaching with Technology (COATT) will develop models for effective implementation of the 7th Standard in teacher preparation programs and methods to evaluate the technology integration skills of teacher candidates.
2. MDE will work with state teacher preparation institutions to integrate online learning in their programs and to prepare their graduates to understand online learning.
3. MDE will provide funding for the continuation of COATT.

4. The State Board of Education will require institutions of higher education that prepare teachers to ensure that all graduates are proficient in the use of assistive technology and the theory of Universal Design for Learning to meet the learning needs of all students.

Strategy 4

Provide professional learning activities for Michigan Department of Education staff relating to technology integration.

Performance Indicator

MDE staff attends technology integration professional learning activities.

Action Steps

1. Members of the Coalition will provide a series of monthly (beginning 2006-2007 school year) "Lunch and Learn" technology presentations inviting all MDE staff.
2. During the 2007-2008 and 2008-2009 school years, the Coalition will facilitate workshops on specific technology integration topics for the MDE staff.
3. The Coalition will provide ongoing consultation and assistance for key MDE staff.

6 Broadband Access

Every Michigan classroom will have broadband Internet access to enable regular use of worldwide educational opportunities.

Teachers can do much to shape how educational technology is applied in their classroom, but a fundamental component that must be consistently available to every educator and student is broadband Internet access, delivered in a reliable manner, to every computing device. Every teacher and every educational activity must be able to assume this. Current reports on school access to the Internet suggest a high level of availability; these are often overly optimistic figures, not representing the true level of teacher and student access. This plan recommends that access be provided in every classroom, with broadband performance available to every computer in that classroom. Further, it is important to recognize that a great deal of Internet access occurs outside school, especially from home. Even so, such access is not sufficiently widespread that it can be assumed by teachers in making assignments. The plan recommends efforts that assure students also have broadband access outside school. This is important not only for student learning, but also for school administration and parental communication and involvement. The importance of the recommended access in classrooms means that efforts to obtain eRate funding should be re-emphasized.

Strategy 1

Provide broadband access to all classrooms by creating partnerships with state organizations, educational agencies, and providers, and expand outreach efforts to schools encouraging them to apply for eRate funding.

Performance Indicator

Every classroom has a minimum of 1.5MB connectivity to each computer device.

Action Steps

1. The Coalition, in conjunction with various State of Michigan agencies, will encourage providers to offer local school districts equitable and affordable broadband access to each building and classroom.
2. MDE will establish partnerships with the appropriate state and local agencies to acquire grants and private and federal resources for narrowband schools to expand access to and use of broadband technology.
3. MDE will collaborate with REMCs and ISDs on outreach to schools, informing them of eRate opportunities.

Strategy 2

Provide broadband access to global resources for students after school.

Performance Indicator

Every student will have access to broadband Internet through multiple locations.

Action Steps

1. The Coalition will encourage ISDs and local districts and governments to create partnerships with Internet service providers to provide students and educators either free or low cost access in the community to Internet resources in an effort to support the classroom activities occurring during the instructional day. Community wireless projects are meant to supplement, not replace, the school's secure infrastructure.
2. The Coalition will encourage ISDs and local districts to create partnerships with higher education, libraries, and community centers to provide students/educators Internet access in the community.

7 Shared Resources

Every Michigan educator and learner will have equitable and sustained access, through statewide coordination and support, to resources necessary to transform teaching and learning through educational technology.

Teachers and students must have access to a wide range of online resources, including information, reading materials, course content, video, data, communication with others, and resources designed to support instruction. Access to resources is fostered and efficiencies gained through statewide purchase programs. There are many Web-based resources where statewide agreements have proven beneficial to all educators and students. Video streaming (to the classroom) and videoconferencing (two-way, interactive) are increasingly valuable classroom resources that benefit from statewide facilitation and coordination. Virtual schooling and e-learning offer new opportunities. Attention to emerging applications of educational technology, such as online video resources or formative assessments, should be integral to statewide leadership efforts. At the core of technology support, it should be recognized that the majority of all basic technical questions are handled by each teacher or by assistance from other teachers, and that the statewide technical support resources for these teachers can bring important gains in more effective use of educational technology.

Strategy 1

Provide statewide access to educational technology resources for the purpose of transforming teaching and learning.

Performance Indicator

All educators and learners access and routinely use high quality online resources as part of the teaching and learning process.

Action Steps

1. MDE will work with the REMC Association and other state agencies to provide Michigan schools with universal access to high quality digital instructional content by negotiating statewide licensing agreements.
2. The Coalition and relevant stakeholders will work to establish and maintain a statewide multipoint, interactive video conferencing system.
3. The Coalition will work to establish a web portal that supports all educators in the transformation of education through technology. The portal will be easily accessible and support such items as: curriculum and lesson materials, professional development, research to support educational technology, and technology resources correlated to the Michigan Curriculum Framework and Grade Level Content Expectations, (e.g., LearnPort and Michigan Teacher Network).
4. MDE, MVU, and the Michigan Department of Labor and Economic Growth will work collaboratively with Michigan's education community to design and develop an online General Educational Development (GED) program.

Strategy 2

Coordinate and provide statewide resources for technology support so that teaching and learning can be transformed seamlessly.

Performance Indicator

All educators have access to and regularly use technology support, including local and statewide resources.

Action Steps

1. The Coalition in collaboration with vendors will provide access to online resources to provide effective and efficient means to resolve technical issues on commonly used software and hardware packages.
2. The Coalition will review and update the Technical Staffing Guidelines to support innovative educational opportunities in the classroom while still maintaining established educational technology programs.

8 Funding $

Michigan will develop innovative methods of funding to transform and sustain teaching and learning through educational technology and build local, regional, and statewide capacity.

There is a need to find alternate sources of funding and mechanisms to reallocate current resources. These considerations should be addressed in the context of understanding that reallocations of federal support have taken place in recent years, as a part of NCLB, resulting in reductions of general statewide funding for educational technology. Furthermore, the state-based component of statewide funding for educational technology is now only about 0.04% of all state education funding. At a time when Michigan needs to increase the effectiveness of overall expenditures, we have lost important sources of leverage for doing that and appropriate action must be taken. This plan emphasizes cooperative efforts, statewide guidelines and standards, assistance in accessing alternative sources of funding, and mechanisms that address cases where modest state funds enable significant savings for LEAs and ISDs. Our recommendations are organized to distinguish between support for innovation, for adoption of best practices, and for long-term investments. Taken in concert with all of the recommendations in this plan, these provide the level of effort needed to sustain the advancement and transformation of education at the state, regional, and local levels within Michigan.

Strategy 1

The Michigan Department of Education (MDE) will provide seed money for developing innovative technology enhanced programs.

Performance Indicator

Funding from the Michigan Department of Education is provided to develop and disseminate information on innovative educational programs that demonstrate impact on student learning.

Action Steps

1. MDE will secure funding for a statewide web portal that supports curriculum, lesson materials, professional learning, and research.
2. State funds will be identified to support educational technology grants that develop new initiatives, and support innovative programs and professional learning opportunities.
3. State funds will be identified to support grants for educational technology that develop new initiatives through a "revolving loan program," which would allow districts to borrow state money to purchase technologies for innovative educational programs.
4. MDE and the Coalition will work to foster innovative projects aligned with the plan and utilizing educational technology by establishing partnerships with educators, university/college researchers, and corporate advocates of educational technology to propose and carry out projects with grant funding from federal agencies and/or private foundations.

Strategy 2

Provide funding to help schools identify, adopt, and begin sustainable exceptional educational technology practices and communicate these findings to all state educators.

Performance Indicator

Schools will be able to identify, adopt, and sustain exceptional programs that use technology that can be funded by long-term resources.

Action Steps

1. MDE will assist districts in securing funding to sustain proven innovative projects.
2. MDE and the Coalition will identify funding for the continued development of existing professional learning opportunities that use technology.
3. The Coalition will identify training and leadership to assist local schools seeking funding for large-scale transitions of educational technology by: identifying possible funding sources, determining implementation costs, and developing a plan for the long-term support of their educational technology program.

Strategy 3

Provide funding to sustain innovation, maintain state and local technology infrastructure, and support effective leadership for proven educational technology programs.

Performance Indicator

Funding is identified to enhance the infrastructure at the state, ISDs/RESA/REMCs and local school district level.

Action Steps

1. MDE will identify state and federal appropriations for statewide projects that have proven to be successful but require ongoing fiscal support.
2. The Coalition will assist in the identification and formation of partnerships with business and industry that can help fund educational technology programs in the state.
3. The Coalition will work with the legislature to develop a revenue producing vehicle that incorporates the state funding of bonds and other revenue producing means.
4. The MDE will work with stakeholders to develop and implement a statewide Educational Technology Foundation to fund technology programs.
5. MDE will encourage, assist, and train all ISDs/RESAs and local school districts to file appropriate eRate forms to receive reimbursements available through this national program.
6. MDE will encourage local school districts and ISDs to continue to utilize cooperative purchasing programs for equipment, supplies, and services.
7. MDE will work with the Governor and the State Legislature to establish state-level funding for leadership in educational technology at MDE, including both staff support and funds for grants to ISDs, RESAs, and LEAs and other investments as described in

this plan, including the above three funding strategies and associated action steps, to be at least double the current state-level funding from all sources. MDE will seek the input of the Coalition for Educational Technology in identifying priorities for this funding.

Appendix A: Committee Charge, Purpose, Vision, Mission Statements

The Committee Charge (excerpts)

…The new State Educational Technology Plan will influence the direction and planning of Michigan's educational technology goals for students and teachers in the coming years.

Our goal is to write a usable, educational technology plan that incorporates the guidance found in the National Education Technology Plan 2004, *Toward a New Golden Age in American Education*, January 2005, and meets the needs of our state as we move forward. …

"The State Board of Education and Michigan Department of Education believe that all children can learn at high levels, and that a complete education helps all of our children become participating citizens who are creative, caring, and critical thinkers, and to accomplish this, the State Board of Education and Michigan Department of Education must work in collaboration with the Governor, the Legislature, and the community of stakeholders to achieve the Vision." (Michigan State Board of Education /Department of Education Strategic Plan, 2005-2010.)

Please keep the above quote from the Michigan Department of Education and the State Board of Education in mind as we write our new State Educational Technology Plan. We believe that all students have the ability to learn and technology can assist them in this goal. Laying out a vision and a direction can help us to achieve our goals.

Signed March 21, 2005 by

Jeremy M. Hughes, Interim Superintendent
Carol Wolenberg, Deputy Superintendent

The Purpose Established by the Committee

The purpose of the 2006 State Educational Technology Plan is to serve as a framework document that communicates and describes the priorities and strategies for the state in the area of educational technology. The plan is designed to guide educators, policy makers and relevant stakeholders in providing leadership for the development and implementation of technology enriched learning opportunities that enable students to become 21st Century citizens in a global economy.

The Vision Established by the Committee

- All students will be self-directed learners, able to make appropriate use of suitable technology in order to function in a knowledge-based society.
- Michigan will be a leader in providing technology-supported and enhanced learning environments.
- The state will be a driving force to create learning environments that maximize use of what teachers and students need to be successful in the 21st Century knowledge economy.

The Mission Established by the Committee

We are to inform, challenge, motivate. We are to identify for state leadership the core elements, the best practices, and the innovative approaches that provide the impetus for Michigan to truly take advantage of technology integration to advance the education of our students.

Appendix B: Committee Acknowledgements, Membership

We acknowledge with great appreciation the support for the work on this plan that was provided through a grant from the NCRTEC, Learning Point Associates, under the management of Lisa Palacios. That support made a crucial difference in our ability to undertake this work.

MIEM, the Michigan Institute for Education Management, administered the grant to support the planning work for the Michigan Department of Education. Dan Pappas managed this grant, enabling this very important effort of so many people.

The Committee members are listed below, first according to the Working Groups they each joined, and then individually with their affiliations. These people provided the insights and energy that has driven this plan. The guidance and support of many people at the Michigan Department of Education should be recognized, including that of Carol Wolenberg, Mary Ann Chartrand, Fran Loose, Louis Burgess, Barbara Fardell, Ron Faulds, Dwight Sinila, Jane Schmitt, and Wanda Shunk. The interviews and reporting for the individual profiles and the summaries of research reports were done by Patricia Morgenstern and Betty Van Dam. Careful reading and editing was done by Marie Zuk and Jane Perzyk. Kate DeFuccio and David Frankel are responsible for the graphics used throughout this document. Greg Marks has been the facilitator of the process, is responsible for the background materials, and brought all the input together in this document.

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- Professional Learning - Marie Zuk, Chair
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- Infrastructure - Mike Oswalt, Chair
  Jennifer Hensley, Jeannene Hurley, Janine Lim, Linda Pung, Debbie Roeske
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- Information Management - Meg Ropp, Chair
  Roger Ashley, Jim Hogan, Lisa Palacios
- Funding - David Frankel, Chair
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- Leadership - Sam LoPresto, Chair
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Educator Profile Excerpts (See Appendix C for Complete Stories)

Bob Attee: Salinas Middle School, Dearborn

To address failing 5th grade Science MEAP scores at Salinas Middle School, technology projects were designed and integrated into the curriculum. MEAP scores improved from 12.7% in 2000 to 81% in 2003. "Technology is a powerful tool that can both motivate students to want to learn more and make it fun in the process. Having a clear focus of what we wanted to see happen resulted in the increase in achievement." Students loved seeing Newton's Laws come to life with Hyperstack animations. "The kids were so excited, they did all three laws instead of just choosing one as we originally intended."

Phyllis Bartosiewicz: Curriculum Integration Workshop with Broad Benefits

Bartosiewicz was one of 48 educators who attended the MDE's "Integrating Technology into the Curriculum" workshop in the summer of 2005. The goal of the workshop was to create technology-enhanced lesson plans that aligned to the METS, the MCF, and the GLCEs. "As a model for professional development," says Bartosiewicz, "this was outstanding." She feels districts could adapt this model using curriculum teams, technology staff, and others such as media specialists. "You need to have someone with technology proficiency along with those who have curriculum and standards expertise." She goes on to say that such a team model provides technology staff with a more in-depth knowledge of curriculum standards and at the same time can awaken teachers' eyes to what's available through technology. "Professional learning tied to relevancy is much more enduring."

Clyde Bell: Flint Northern High School

What impact has professional learning had on the staff of Flint Northern? "Our teachers are doing more than they've ever done with technology," says Bell. "They're no longer afraid of technology." He also sees a change in student attitude about learning. "It started slow, but the students now look forward to going to the labs." He says students are eager to look up online materials and use clip art to create projects. The latest technological addition to the school includes equipped Smart carts for teachers to use in their teaching, and wireless laptop labs. The programs at Flint Northern reflect Principal Bell's philosophy that "through technology all students can learn and achieve, and that's what we're doing here at Flint Northern."

Russell Columbus: Interactive Video/Handheld Technologies Inspire

In addition to his regular coursework, Columbus teaches a forensic science class via interactive video. He broadcasts twice a week from the Monroe ISD, where there is a group of students with him, to three other high school locations throughout the county. The course is entirely lab-based. "There's no lecturing," says Columbus. "It's all hands-on." Students study evidence-gathering techniques and develop problem solving and critical thinking skills based on scientific analysis. Students break into groups, each devising a crime scene for another team to investigate. All work is done online. At the end of the course, students present the results of their investigation to a mock jury, where their analysis is critiqued. Columbus notes that "interest is incredible. We're having trouble meeting the demand for the class."

Bud Ellis: Addison High School

Biology teacher Bud Ellis doesn't want his students to study science. He wants them to be scientists. Using probes and graphing calculators, "students learn to look at data, think it through and analyze it." Students report his classes "made them think like a scientist and understand what science is all about." Ellis would like to see more handheld technology available for basic science classes. "Students could be turned on to science if there was enough equipment for all of them. They love it. They love real data." "Handheld technology would give all students the opportunity to do higher level science in a way that kids would enjoy."

Amanda Reed Harthun: Bear Lake Schools

How did one Bear Lake teacher help her students make significant gains in their MEAP scores, when every student had a laptop computer? "We read, analyzed, and wrote around as many themes as we could. We also looked at graded samples, and the students and I dissected what a 5, 4, 3, 2, 1 paper contained. From there, we generated our own, kid-friendly rubric that I used to grade all of their papers. We shared this with parents at conferences, and I tried to grade closely to how I believed the state would grade their papers." …"We worked on character motivations, traits, inferences and author's tone and purpose. I asked them questions like, how and why do you know, and asked them to prove nearly every statement they made to me with evidence from the text. In 7th grade, we tied everything together with a theme. Our [MEAP] scores for those students (who were 33% just 2 years previous) came in as 75% Reading, 76% Writing, 75% ELA."

Sally Irons: Ring Lardner Middle School, Niles

As a learning strategist working with special education students, Sally Irons uses technology to help bring out the best in her students. "The students have a flood of ideas, but they're all bottlenecked inside. Technology allows them to get their ideas out – to get those ideas onto paper or into a Power Point presentation or a video." Using handhelds with Spell Check, Thesaurus & Word Complete allow students to succeed in writing assignments. "The great thing is that technology takes away the anxiety of 'how' so that students can focus on the content." Students take pride in their work. "They really like being able to take home their videotape to play for their families". In 2004 the district began using some innovative online programs with special education students. They saw 7th and 8th grade MEAP scores rise in all content areas from the previous year.

Julie Myrmel: Building Learning Communities with Video-conferencing

When Julie Myrmel's third grade students enter her classroom each school day at Bauer Elementary in Hudsonville, they are enthused about learning. Why? In part, because of the instructional tools that Myrmel has available to help her teach. Myrmel's classroom has four Internet connected desktop computers, a projector, and sound system. In addition, through grants that Myrmel has written, she has a digital still camera, a digital video camera, document camera, and two-way interactive videoconferencing equipment.

"Video conferencing made a big impact because I can get resources that I couldn't get otherwise" explains Myrmel. "With the interactive videoconferencing equipment, I can connect to authors, illustrators, zoos, museums, and other classrooms through programs like Read Across America."

Joe Ribarchik: Technology Instruction in "Real Life" Contexts

Students in Ribarchik's computer classes must choose a unit of practice from one of their core subject areas and build an online Jeopardy game to be used by other students. "The kids building the game get really excited," says Ribarchik. "They didn't know they knew as much (as they did) about their subject." Their understanding and critical thinking is reinforced when they have to discuss how they came to determine the correct answer for a given question. "It isn't just a matter of copy and paste from a textbook." Students are inspired by this activity, and Ribarchik notes that special education students have completed some of the best projects.

Joan Sawyer: Freedom-to-Learn (FTL) Program Supported by Professional Development

[Sawyer introduces teachers to software they] can use to create online lessons and assessments, and Discourse, a tool which allows teachers to create questions to which all students respond via their laptops. This will give all students the opportunity to express themselves and demonstrate their understanding. Sawyer will work with teachers to break down existing lessons into Grade Level Content Expectations so that they can use the FTL tools. They will be looking at every component of a lesson and identifying how they can use the laptops throughout by inserting the use of film clips, Excel, or other software. "The teachers are in the process of immersing themselves in the seamless use of technology," says Sawyer. "Professional development is key to the success of the program."

Extended Section of Appendices

The Appendices following this page are not in the primary Educational Technology Plan document, but they are referenced by that document. The Table of Contents shows what is in Appendices C through W. These Appendices contain supporting information and references that expand upon the discussion and recommendations of that basic document. The full version may be downloaded from http://techplan.org/.

Appendix C: Success Stories in Teaching and Learning

Elementary Education

Bob Attee: Technology Helps Bilingual Students Improve Science MEAP Scores
Amanda Reed Harthun: Improving MEAP scores with One-on-One Computing
Julie Myrmel: Building Learning Communities with Video-conferencing

Secondary Education

Russell Columbus: Interactive Video/Handheld Technologies Inspire
Bud Ellis: Technology Turns Science Students into Scientists
Sally Irons: Special Education Uses Technology to Improve MEAP Scores
Joe Ribarchek: Technology Instruction in “Real Life” Contexts

Professional Learning

Phyllis Bartosiewicz: Curriculum Integration Workshop with Broad Benefits
J Clyde Bell: Strong Professional Development Program Empowers Teachers
Joan Sawyer: Freedom-to-Learn Program Supported by Professional Development

Bob Attee: Technology Helps Bilingual Students Improve Science MEAP Scores

With only 12.7% of students passing the 5th grade science MEAP tests in 2000, Dearborn's Salina Intermediate School faced the challenge of improving those scores in a student population that is primarily bilingual. The school's principal, Irene Stanko, brought together Science and Technology Resource Teacher, Bob Attee, and resource teacher, Glenn Maleyko, to plan and implement a program that would use technology projects with 18 third through fifth grade teachers to do just that.

The team began by implementing "curriculum mapping" and identifying areas where they could integrate technology into the curriculum. Using the backwards design process, they asked what areas of science were most difficult for students and created various technology-infused projects based on those concepts. Attee notes that "having a clear focus of what we wanted to see happen resulted in the increase in achievement."

Over a four-year period, they used a variety of software, adding one or two programs a year. Software used included Hyperstudio, Appleworks, Inspiration, Kidspiration, MediaBlender, PowerPoint, and iMovie. They also took advantage of digital and video cameras available in the Media Center. Additionally, Attee created a web page for assignments and links to resources for the grade levels.

Attee says Newton's Laws of Motion were particularly difficult for many students to grasp. To address these concepts, students were paired up to work on a "challenge question" based on one of the laws and had to make a HyperStudio stack to demonstrate the law in action. As the laws came to life in the animations, Attee says "the kids were so excited, they all did all three laws instead of just choosing one as we originally intended."

Teachers did ongoing assessment by developing a series of pre and post-tests that aligned with MI Curriculum Framework benchmarks. The format was similar to the MEAP, which Attee feels also helped prepare the students for the more formal testing. The MEAP results were striking. In 2001, scores improved to 19.6%, then to 35.4% in 2002, and again to 81% in 2003. Students who began the program as third graders were showing the multiple year benefits. "Technology is a powerful tool," says Attee, "that can both motivate students to want to learn more and make it fun in the process."

Professional development for staff was another key piece of the picture. The school's technology team obtained a Governor's Next Day Grant for professional development, which included a visit to Willow Bend School near Chicago to observe how their students were using technology. Salina teachers were trained in the new software that was added each year. Now their school operates an annual Tech Camp in the spring that is open to teachers across the state. Teachers demonstrate the ways they're using technology and hold instructional sessions on multi-media tools. Students are also used as trainers. Attee says this "reinforces the skills of our teachers and inspires them to want to do more. It builds confidence, and they learn from the questions and discussions with other teachers." He says their experience shows that "with enough time, professional development opportunities, and practice even the most skeptical can come to appreciate its value."

Amanda Reed Harthun: Improving MEAP scores with One-on-One Computing

How did one Bear Lake teacher help her students make significant gains in their MEAP scores? She attributes these gains to hard work and the use of laptop computers. Amanda Reed Harthun explains, "I was hired as a teacher in Bear Lake in the fall of 2000. I was put into the 4th grade, and I became the 4th/5th grade language arts teacher for two years. In 2001 my now 5th grade students took the ELA MEAP and scored 33% proficient in writing. The reading scores were higher."

Harthun continues, "I then followed those students up to middle school and was their math teacher for one year. During that year (as 6th graders), they went through three English teachers. They are a large group (average from 44-46 students) for our district with a reputation of being handfuls. They are very diverse, with a large special education population. Of the 44 students, fewer than ten students still live at home with married parents. It was also during this year that they received the Freedom to Learn laptops."

"The following year, I took over the middle school language arts job," Harthun continues. "We read, analyzed, and wrote around as many themes as we could. We also looked at graded samples, and the students and I dissected what a 5, 4, 3, 2, 1 paper contained. From there, we generated our own, kid-friendly rubric that I used to grade all of their papers. We shared this with parents at conferences, and I tried to grade closely to how I believed the state would grade their papers."

"With the laptops, the students were able to give me more quantity because they can type faster than they can write, and they were more likely to edit since they didn't have to rewrite the entire paper. I also started receiving higher quality of work because I could sit down with a student at his/her laptop and talk about the mechanics of the paper. We especially worked on flow and cohesiveness."

Harthun explains, "We worked on character motivations, traits, inferences and author's tone and purpose. I asked them questions like, how and why do you know, and asked them to prove nearly every statement they made to me with evidence from the text. In 7th grade, we tied everything together with a theme. Our [MEAP] scores for those students (who were 33% just 2 years previous) came in as 75% Reading, 76% Writing, 75% ELA."

"The following year (2005) we had a particularly bright group of students who as 5th graders scored 65% on the ELA test. They came into my class with a background in dissecting text and supporting themselves with evidence," says Harthun. She used her pedagogical approach once again. The results were MEAP scores of 88% Reading, 75% Writing, and 88% ELA.

Julie Myrmel: Building Learning Communities with Video-conferencing

When Julie Myrmel's third grade students enter her classroom each school day at Bauer Elementary in Hudsonville, they are enthused about learning. Why? In part, because of the instructional tools that Myrmel has available to help her teach. Myrmel's classroom has four Internet connected desktop computers, a projector, and sound system. In addition, through grants that Myrmel has written, she has a digital still camera, a digital video camera, document camera, and two-way interactive videoconferencing equipment.

"Video conferencing made a big impact because I can get resources that I couldn't get otherwise" explains Myrmel. "With the interactive videoconferencing equipment, I can connect to authors, illustrators, zoos, museums, and other classrooms through programs like Read Across America." For example, students were able to ask questions and receive drawing lessons from a well-known illustrator. "The kids would hold up the things that they drew and then talk about it," explains Myrmel. Myrmel's students were also able to connect with a class in Paris, Texas, and share learning experiences. "Students watched plays, read poems, and told about things in their community," adds Myrmel.

"With the Internet, I use programs like Journey North to look for lesson plans and gain ideas from sites like Marco Polo. I also use sites like Tech4Learning for lesson ideas, rubrics, mapping templates, and copyright free images. We use Inspiration software, and it helps the students organize their thoughts, see map and outline views, set up paragraph writing, and take notes for reports," Myrmel continues.

When asked how technology has impacted student learning, Myrmel quickly adds, "It provides an authentic audience for student work. They really care about the quality of their work. They are proud of it. The kids take more ownership in their work, and it's of higher quality than if I am the only audience. Grandmas and grandpas can look at their work as well," Myrmel adds. Students showcase their work on the class website, through videoconferencing and the school's Spring Technology Night. "Parents are wowed!" says Myrmel.

"Using technology really adds enthusiasm to the student's learning. They learn to plan and work in a team, present to a variety of audiences, and begin to explore their strengths in the area of technology and visual literacy. Using technology sometimes means success to a student who struggles in the more traditional learning situations. I can meet the special needs of the learners in my class by scheduling two way interactive videoconferences, using a document camera connected to a television, having the students use a sound system to speak to the class, encouraging them to use digital still and video cameras, and clay animation software. The Mimeo is used for students who need help with note taking, or work more slowly than the rest of the class."

"Kids who may be less successful otherwise seem to have a real knack with technology and then they can be the people other kids turn to and have the opportunity to be an expert. They get to be the smart guy. It builds self-esteem for some kids."

Russell Columbus: Interactive Video/Handheld Technologies Inspire

While you can find most high school teachers in their classrooms, that isn't the case for Russell Columbus, science teacher for Monroe Public Schools. This year, as part of an NSF grant with Wayne State University, he will be teaching his ninth grade biology course from the Bolles Harbor Math & Science Center. Small groups will be working on projects that will test the water conditions in the local river watershed. They will be using such tools as Hach spectrophotometers, digital titrators, and ArcView GIS software to show the physical site. Data will be recorded in a spreadsheet, with eventual plans for a searchable database.

Whatever Columbus is teaching, he's using technology to enhance the learning experience. Along with interactive web sites and discussion boards, he uses handheld technologies such as probes for data collection and graphing calculators. Using probes connected to light sensors, his astronomy students measure the light intensity of glow sticks and compare that to temperature. By doing this, Columbus says they are able to grasp the concept of the relationship between a star's brightness and its temperature. Using a graphing calculator, students are able to create a graph of star temperatures.

Graphing calculators are a staple for Columbus, who says they "simplify tedious tasks so that students can get to the meat and potatoes of the content areas." Using graphing calculators in conjunction with probes set up to record data at given intervals, such as every half hour overnight, students have access to data they couldn't collect otherwise.

His students have participated in GLOBE, a world-wide hands-on science education program. Students take measurements, report their data via the Internet, and collaborate with students and scientists around the world. Last year, his classes took soil samples from a local prairie restoration project and shared this data via GLOBE. They could view similar soil analysis data taken by students around the world. They shared information on nutrients needed to support the growth of prairie plants with the restoration project.

In addition to his regular coursework, Columbus teaches a forensic science class via interactive video. He broadcasts twice a week from the Monroe ISD, where there is a group of students with him, to three other high school locations throughout the county. The course is entirely lab-based. "There's no lecturing" says Columbus. "It's all hands-on." Students study evidence-gathering techniques and develop problem solving and critical thinking skills based on scientific analysis. Students break into groups, each devising a crime scene for another team to investigate. All work is done online. At the end of the course, students present the results of their investigation to a mock jury, where their analysis is critiqued. Columbus notes that "interest is incredible. We're having trouble meeting the demand for the class."

Interactive video is an emerging technology that Columbus hopes will get increased use. "It provides opportunities that otherwise wouldn't be available." This year, he's looking forward to broadcasting from the NOAA research vessel on Lake Erie as part of the NSF TITiC grant.

Bud Ellis: Technology Turns Science Students into Scientists

How does one earn the title of Michigan's Outstanding Biology Teacher from the National Association of Biology Teachers? Bud Ellis, science chair and teacher at Addison High School, credits his use of technology to engage students as a key factor in being recognized for this award.

Ellis teaches college prep biology, research biology, honors science, and chemistry courses. In these classes his students don't just learn about science; they are given the opportunity to be scientists. He primarily uses probes and graphing calculators to gather and interpret data. "Science is gathering and interpreting data." says Ellis. "Technology is key for my kids because it gives good data."

In Biology I, students are introduced to the use of probes and graphing calculators. In one experiment, Ellis demonstrates the use of the probe to measure carbon dioxide produced by crickets under varying environmental circumstances. Students use the graphing calculators to analyze the data. "In Biology I, I want to get students to see the power of a calculator." says Ellis. "By the time they get to Biology II (research biology), they are very excited about using the tool for more advanced research."

With his research biology class, Ellis uses graphing calculators and probes to test the water in local Bean Creek. Students take samples 2 – 3 times a week for several weeks. They then compare their data to that collected by students in previous years and write a scientific research paper. In addition to the Bean Creek site, student research must include data from an independent site. According to Ellis, "Students learn to look at data, think it through and analyze it. Having the graphing calculators allows students to develop mathematical models without struggling with the math." After taking the course, students report that it "made them think like a scientist and understand what science is all about."

Ellis credits professional development experiences as far back as ten years ago at Lenawee ISD with inspiring his use of technology with students. The workshops devoted two full days to learning how to use the calculators, after which Ellis says "I was hooked." He says this in-depth training is important when being introduced to complex technology. Also critical was receiving a calculator as part of the training. "If you don't have access to the technology once you've been trained to use it, the training will go to waste."

Ellis would like to see more handheld technology available to basic science classes. He laments that technology dollars are spent in the technology department rather than within curriculum areas, making it difficult to expose all students to handheld technologies. "I think students could be turned on to science if there was enough equipment for all of them." says Ellis. "They love it. They love real data." Having the technology would enable students to "do the science instead of filling out worksheets." He believes that "handheld technology would give all students the opportunity to do higher level science in a way that kids would enjoy."

Sally Irons: Special Education Uses Technology to Improve MEAP Scores

In a small rural district with 17% special education students, there are many challenges, including showing adequate yearly progress and improving MEAP scores. Learning Strategist Sally Irons, who has a caseload of eighth grade special education students at Ring Lardner Middle School, says the Niles School District is meeting that challenge through the use of some innovative programs.

The first of these is PassKey, a core area enrichment program. The program provides diagnostics and tutorials ranging from third through twelfth grade. Special education and "bubble" students in grades 7-8 spend 45 minutes a day in a special computer lab using the program. They begin each session with a diagnostic test, and are then given a specialized online tutorial based on areas of weakness. Teachers can monitor student access on a daily basis and provide additional one-on-one instruction as needed. Bringing up the competency level of these students is reflected in the school's MEAP scores. At Ring Lardner, language arts scores (seventh grade) improved to 70% proficiency in 2005 from 50% proficiency in 2004. Math (eighth grade) went from 62% to 68%; science went from 69% to 74%, and social studies went from 17% to 24%. All 2005 levels were above the state average except social studies.

This, along with the district's use of the Northwest Evaluation Association (NWEA) online assessment program, is given much of the credit for the improvement in MEAP scores from 2003/04 to 2004/05.

In addition to these district-wide programs, Irons and the other special education teachers use a variety of technologies to bring out the best in their special education students. According to Irons, "The students have a flood of ideas, but they are all bottlenecked inside. Technology allows them to get their ideas out – to get those ideas onto paper or into a Power Point presentation or a video."

A cornerstone of Irons' strategy is her laptop with a video converter. After a writing assignment, she will take her students aside, and display Inspiration using the video converter. As a group, they go through the thought process of how to develop their papers. For large writing projects, her students use Dream Writers, portable keyboards that they can take home to work on assignments. After the assignment is complete, the students upload their work to a classroom computer for teacher review. Writing personal journals can be a real challenge, so Irons' students use handhelds with Word Complete, Spell Check, and Thesaurus to help them get their thoughts out more easily without getting stuck by spelling dilemmas. "The great thing" says Irons, "is that technology takes away the anxiety of 'how' so that students can focus on the content."

Students love to use a digital camera to enhance their reports or PowerPoint presentations. They use Irons' video converter to put their PowerPoint presentations into VHS format. This provides a way for her students to share their work in the classroom and with their parents. The kids take pride in their work. "They really like being able to take home their videotape to play for their families."

Joe Ribarchik: Technology Instruction in "Real Life" Contexts

At Meridian High School, Joe Ribarchik's computer classes do more than teach basic computer skills – they enhance the learning taking place in core subject areas and prepare students for real-life experiences. In a school where 44% of the students are economically disadvantaged, Ribarchik feels it's important that what they learn in his classes will help them succeed as students and future employees.

His online Jeopardy game project has earned Ribarchik one of MACUL's *Technology for Authentic Problem Solving* (TAPS) awards for 2005. Students in Ribarchik's computer classes must choose a unit of practice from one of their core subject areas and build an online Jeopardy game to be used by other students. "The kids building the game get really excited," says Ribarchik. "They didn't know they knew as much (as they did) about their subject." Their understanding and critical thinking is reinforced when they have to discuss how they came to determine the correct answer for a given question. "It isn't just a matter of copy and paste from a textbook." Students are inspired by this activity, and Ribarchik notes that special education students have completed some of the best projects.

All of Ribarchik's technology instruction is done in the context of something from "real life." For example, desktop publishing skills are put to use making flyers and brochures for school and athletic events. Ribarchik belongs to the Midland County Tech Consortium, comprised of representatives from universities, businesses and K-12 education. Here he gets insights as to what students need to get jobs or to succeed in college.

In his advanced computer classes, which Ribarchik describes as having more of a business-like structure, students build web pages using such tools as MacroMedia Dreamweaver, Flash and Fireworks. "My students create their own clipart, scrolls, banners, and backgrounds – they don't rely on the Internet." Ribarchik finds local businesses that are in need of a website, newsletter, logo or flyer and has teams of students gather information from the businesses and create options for them. The business then chooses student-created documents to use for their business. "I try to give them the background to go into the technology field," says Ribarchik. He notes that some of his students have been able to get work maintaining and creating websites for local businesses after taking his classes.

Ribarchik's students are involved in a variety of tutoring activities, ranging from helping fifth grade students at the adjacent elementary school with a PowerPoint project to assisting college students in creating online portfolios. Ribarchik notes that the Meridian School District is very supportive of professional learning activities for its teachers. As a result of participating in district-sponsored programs, teachers came to Ribarchik with questions about things they wanted to do with their students. The result was SAETT: Students Assisting Employers and Teachers with Technology. His students help other students and teachers with projects, such as creating their own Jeopardy game. His students have been showcased at the 2003 and 2004 AT&T Student Showcases at the Michigan capitol and the 2004 and 2005 MACUL Conferences. "It demonstrates their learning" says Ribarchik "that they understand well enough to teach others, even adults from other districts."

Phyllis Bartosiewicz: Curriculum Integration Workshop with Broad Benefits

It’s often difficult to provide a rewarding professional learning experience for educators who are already savvy technology users. Phyllis Bartosiewicz, who teaches computer courses and information literacy at Galesburg-Augusta Middle School, had just such an experience this summer.

Bartosiewicz was one of 48 educators who attended the Michigan Department of Education’s “Integrating Technology into the Curriculum” workshop in the summer of 2005. The goal of the workshop was to create technology-enhanced lesson plans that aligned to the Michigan Educational Technology standards, the Michigan Curriculum Framework, and the Grade Level Content Expectations. The lessons will be posted at the MDE web site for all teachers to access and use.

Forty-eight participants were placed in 12 collaborative groups corresponding to various grade levels and content areas. They were asked to look at Grade Level Content Expectations and the Michigan Educational Technology Standards side-by-side, with an eye to where technology would be a “natural fit.” Over a six day period, they designed lesson plans that reflected these opportunities for learning through technology.

Bartosiewicz is no novice to technology use. In addition to teaching her classes, she supports other teachers with technology integration and does district technology workshops to share her expertise. She collaborated with social studies teacher Cheryl Butler to develop her information literacy course, and found the MDE Workshop to be an extension of that type of experience. She says the opportunity to work collaboratively with content experts and others from throughout the state was professionally stimulating, and she was able to explore more innovative ways to use basic software. She’s very excited about her group’s data gathering exercise that uses the Internet and Excel’s interactive table and graph features. Their third grade data-gathering lesson plan contains a link to the graph created by Bartosiewicz so that other teachers can use it without having to re-create it from scratch.

Bartosiewicz looks forward to sharing the outcomes of the workshop with other educators. Once lessons are posted, she’ll make sure others in her district are aware of them. She hopes to do workshops familiarizing teachers with the lessons and the technology embedded in them.

“As a model for professional development,” says Bartosiewicz, “this was outstanding.” She feels districts could adapt this model using curriculum teams, technology staff, and others such as media specialists. “You need to have someone with technology proficiency along with those who have curriculum and standards expertise.” She goes on to say that such a team model provides technology staff with a more in-depth knowledge of curriculum standards and at the same time can awaken teachers’ eyes to what’s available through technology. “Professional learning tied to relevancy is much more enduring.”

Clyde Bell: Strong Professional Development Program Empowers Teachers

Clyde Bell, Principal at Flint Northern High School, was originally approached four years ago by two of his teachers and the media specialist to join them as a team to attend the ATA Technology Academy that summer. Their argument was that they could not go without him (the program requires that a principal is a team member) and they were one of the last Flint schools not to have attended. Not to be outdone by the other schools, Clyde agreed. That was the program that so affected Bell as to the importance of technology integration that he decided then and there to do all he could to promote technology use by his teachers.

Principal Bell then set a goal of moving the school forward by taking better advantage of educational technology. This was a challenge in an urban school with a population that is 96% African-American and a staff with an average age over 45. With teachers established in their ways of teaching, Bell says the main challenge was "getting teachers to come around to using technology." With the support of district Instructional Technologist Shawn Massey and Flint Northern Media Specialist Kay Hall, Bell has provided professional learning opportunities for his staff for the past several years. In order to increase his own skills, Clyde has attended LEADing the Future training.

A cornerstone of their professional learning continues to be ATA. Flint Northern continues to send teams to the Academy and individuals to ATA Plus. This has helped them develop a strategy for professional learning and technology implementation for their school. Their "ATA team" continues to have monthly meetings, which are open to all staff. In 2003, through a SBC Excelerator grant ATA had received, Bell arranged for every teacher to attend a half-day integration workshop held at the school and led by an ATA trainer. Clyde even popped into the workshops to serve as a training assistant.

In addition, partnerships with universities have been established. Northern and two of its feeder middle schools have participated in the GEAR-UP program with Central Michigan University, providing computer labs after school to any student who wants to improve their study skills with the goal of going to college. In a corresponding program, "The College Club," students from the University of Michigan Flint tutor Flint Northern students on computer use and building web pages.

What impact has this professional learning had on the staff of Flint Northern? "Our teachers are doing more than they've ever done with technology," says Bell. "They're no longer afraid of technology." He also sees a change in student attitude about learning. "It started slow, but the students now look forward to going to the labs." He says students are eager to look up online materials and use clip art to create projects. The latest technological addition to the school includes equipped Smart carts for teachers to use in their teaching, and wireless laptop labs.

The programs at Flint Northern reflect Principal Bell's philosophy that "through technology all students can learn and achieve, and that's what we're doing here at Flint Northern."

Joan Sawyer: Freedom-to-Learn Program Supported by Professional Development

Otto Middle School in the Lansing School District became a Freedom-to-Learn School last year, which means each of their 850 students and 70 teachers now have laptop computers. For Media Specialist Joan Sawyer, this means a big change in how she and the media center serve staff and students. "Freedom-to-Learn brings a different dimension to the learning experience."

Change is not new to Sawyer, who has guided her school's evolution from library to media center. In her 30 years, she's seen her role changed a lot. "It's been a very exciting place to be." She says that one of the biggest advantages technology has brought is access to information. Sawyer makes sure teachers and students are aware of the various online databases and resources to enhance learning. She notes that students quickly learn to use a database such as the Michigan Electronic Library (MeL) or the Student Resource Center, a purchased program with resources for student research. Also available to students is the Follett Web Path Express, an online service that finds web sites appropriate for various grade levels and is connected to the school's card catalogue.

Sawyer sees collaboration with teachers, always an integral part of her work, as changing with Freedom-to-Learn (FTL). While she will continue helping teachers map out project timelines including the number of days needed for research, showing them resources, and using concept maps to design the project, she expects that much of the work that was done in the Media Center will now be done on their laptops. For example, a current sixth grade science project on inventors has students begin by doing a WebQuest in the computer lab adjacent to the Media Center to gather information on inventions and inventors. The next phase is a science lesson, presented at the Media Center, where students are given the name of a scientist and a focused set of questions to research. The project ends with each student delivering a PowerPoint presentation on his or her scientist. Sawyer expects that now she will do the preliminary work with the teacher and research skills with the students, but much of the online work will be done on laptops.

The professional development Sawyer does for her building and for the district is also changing. Each year she does orientation training for new teachers, showing them the various programs they have access to at the Media Center and informing them of what training sessions will be provided throughout the school year. This year, Sawyer says training will center on the specific software provided by the FTL program. This will include Class Server, which teachers can use to create online lessons and assessments, and Discourse, a tool which allows teachers to create questions to which all students respond via their laptops. This will give all students the opportunity to express themselves and demonstrate their understanding. Sawyer will work with teachers to break down existing lessons into Grade Level Content Expectations so that they can use the FTL tools. They will be looking at every component of a lesson and identifying how they can use the laptops throughout by inserting the use of film clips, Excel, or other software. "The teachers are in the process of immersing themselves in the seamless use of technology," says Sawyer. "Professional development is key to the success of the program."

Appendix D: Educational Impact –Selected Reports and Research

Barnett, H. (2003). Investing in Technology: The payoff in student learning. *ERIC Digests, ED479843.*

Barnett Identified Several Conditions Under which the use of Computers in the Classroom is Most Likely to Impact Student Learning: Access, Integration, Broad-based Reform, Long term, Professional Development, Teaching Style, Balance, and Vision. Barnett stated, "Technology is one piece of the puzzle that can support educational change, but technology will have little impact without accompanying reform at the classroom, school, and district level."

Bransford, J.D., Brown, A.L., & Cocking, R.R. (2000). *How People Learn: Brain, Mind, Experience, and School.* Washington D.C.: National Academy Press. Retrieved August 1, 2005 from http://www.nap.edu/openbook/0309070368/html/

A classic. Perhaps the most widely cited summary of research on the science of learning.

Brown, C.G., Rocha, E., Sharkey, A., Hadley, E., Handley, C., & Kronley, R.A. (2005). *Getting Smarter, Becoming Fairer: A Progressive Education Agenda for a Stronger Nation.* Center for American Progress and Institute for America's Future. Retrieved on September 15, 2005 from http://www.ourfuture.org/docUploads/gsbf_popup.html

This report portrays the needs of Americans with many elements similar to this plan, although the report is not about educational technology as such.

Cradler, J., McNabb, M., Freeman, M., & Burchett, R. (2002, May). How does technology influence student learning? *Learning & Leading with Technology,* 29 (8): 46-56. Retrieved August 1, 2005 from
http://caret.iste.org/caretadmin/news_documents/StudentLearning.pdf

Cradler, McNabb, Freeman, and Burchett examined research and evaluation studies gathered by the Center for Applied Research in Educational Technology. The authors stated, "First and foremost, research reminds us that technology generally improves performance when the application directly supports the curriculum standards being assessed." The authors' review also found that ". . . technology tools for constructing artifacts and electronic information and communication resources support the development of higher-order thinking skills." Cradler, et al concluded that collaborative activities and formative feedback are essential instructional strategies necessary for effective technology implementation.

Digital Divide Network. Retrieved September 15, 2005 from http://www.digitaldivide.net/

This is a project of the Education Development Center, focused on the issues and strategies of overcoming the digital divide. This is an evolving and rich resource for addressing these issues.

Edwards, M. (2003, April). The Lap of Learning. *School Administrator,* 60(4): 6-8, 10-12. Retrieved August 1, 2005 from http://static.highbeam.com/s/schooladministrator/april012003/thelapoflearninghenricocountysdistrictwideuseofwir/

In Henrico County VA, laptop computers were given to 25,000 students in grades 6-12 to support the school's one-to-one, seven-day-a-week laptop initiative. Teachers were given a plethora of professional development opportunities. Anecdotal evidence from teachers suggested that "hands-on learning and teaming that accompany constructive projects and inquiry-based learning activities foster interactive student-teacher and student-student relationships."

Furthermore, according to Mark Edwards, Superintendent of Henrico County Public Schools, students' scores improved on 9 of the 11 core curricular areas on the state's Standards of Learning test. In addition, the greatest achievement gains on the end-of-course tests came in the content areas where laptops were used the most—history, reading, and writing. Edwards also stated that during the laptop program Henrico County had its "lowest-ever dropout rate."

Glenn, J. (2000). *Before It's Too Late: A Report to the Nation from the National Commission on Mathematics and Science Teaching for the 21st Century.* Washington, D.C.: The National Commission on Mathematics and Science Teaching for the 21st Century Commission. Retrieved August 1, 2005 from http://www.ed.gov/inits/Math/glenn/toc.html

This report eloquently stated the issues with global competition and the quality of education in the U.S. a half-decade ago. The message has become even clearer since its publication.

Kleiman, G.M. (2004). Myths and realities about technology in k-12 schools: five years later. *Contemporary Issues in Technology and Teacher Education* [Online serial], 4(2). Retrieved on September 15, 2005 from http://www.citejournal.org/vol4/iss2/seminal/article2.cfm

A fine, short review. An example: "We continue to see computers used in ways that are peripheral, rather than central, to the curriculum and important learning goals. And we continue to see technology plans and programs developed separate from school improvement, curriculum reform, professional development, and special education plans. Although progress has been made in equity of access to technology in schools, serious inequities remain in terms of ways those computers are used in classrooms and the level [of] preparation for teachers to use them effectively. Unfortunately, in much of the country little progress has been made toward fulfilling the educational potential of information and communications technologies."

Knauth, S. (2004). *Technology in Education: Ideas for Transformation.* Naperville, Ill: Learning Point Associates. Retrieved on August 1, 2005 from http://www.ncrel.org/tech/netc/2004/report.pdf

From the Overview: 'The central theme of this vision is technology transformation, not technology integration. Technology should be used to do fundamentally different things in education rather than enhance what is already happening in the classroom. In some cases, technology will drive the transformation while in others it will facilitate long-standing ideas. Conference participant Larry Lipsitz (e-mail survey) wrote, "Technology is likely to become a seemingly natural, seamless part of genuine and long-lasing systemic educational reform. Indeed, it is difficult to envision major change without technology playing a role."' (p. 1)

Lowther, D., Ross, S., & Morrison, G. (2003). When each one has one: The influences on teaching strategies and student achievement of using laptops in the classroom. *Educational Technology Research and Development,* 51(3): 23-44. Retrieved August 1, 2005 from http://courses.lib.odu.edu/eci/roverbau/idtsemf04/Assets/Readings/morrison/When_each_one_has_one.pdf

Lowther, Ross, and Morrison examined the impact of one-to-one laptop computers on fifth, sixth, and seventh grade classroom activities and on student use of technology on their writing and problem-solving skills at Walled Lake Consolidated Schools. Specifically, the school district's Writing Scoring Guide was used as an assessment instrument. After comparing the control group and the laptop group, Lowther, et al stated, "Clearly the laptop students were demonstrating superior writing skills." In addition, a problem-solving task was designed and scoring rubric developed for the study. The researchers concluded, "Results on the problem-solving test were further suggestive of the laptop program's positive impact on student achievement."

National Research Council. (2002). *Improving Learning with Information Technology: Report of a Workshop.* Steering Committee on Improving Learning with Information Technology. G.E. Pritchard (Ed.), Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press. Retrieved on August 1, 2005 from http://www.nap.edu/books/030908413X/html

This report is in most ways a window into a conversation, one taking place between university researchers who are involved with the advances in the science of learning, K-12 educators who understand the realities of today's students and classrooms, and leaders from the information technology businesses that provide the hardware and software used in education. When the energies of all three groups come into alignment, much can be accomplished. This report is both a source of insight about why that alignment is challenging to achieve, and the potential benefits of accomplishing it.

Rockman, S. (2004). A Study in Learning: What does the latest research on mobile computing tell us about teachers, students, and testing? Getting Results with Laptops. *Tech-Learning.* Retrieved August 13, 2005 from http://www.techlearning.com/story/showArticle.jhtml?articleID=49901145

Concluding a four-year investigation, Rockman found "increased use of project-based learning, increased student motivation and experimentation, and higher rates of peer mentoring" when laptops are used in the school environment. Improvements on standardized achievement tests were not evident, but Rockman suggested, "Much of what teachers are asking students to do is not closely linked to what's assessed on the standardized tests used today." The author identified these instructional activities as "searching for information on the Internet, organizing it, writing and making presentations, communication with others, and collaborating in producing a product." He noted that these skills are "desirable in the world of work but difficult to measure in cost-efficient ways."

Schunn, C., Millar, T., Lauffer D., & SCALE Immersion Design Team (2004). *Immersing All K-12 Students in Extended Inquiry Science and Design.* (SCALE Goal 2 Concept Paper). Madison, WI: Wisconsin Center for Education Research. Retrieved on September 1, 2005 from http://www.wcer.wisc.edu/scalemsp/research/Products/SchunnEtal_ExtendedInquiryScienceDesignGoal2ConceptPaper.pdf

This paper reflects a wealth of experience with adopting an inquiry-based approach to learning. A range of factors are considered, with the pros and cons for each choice concisely described. This is an excellent article for anyone in the process of making the educational concepts a reality for students. This paper does not discuss educational technology, but it covers an important range of opportunities and issues that anyone seeking to take full advantage of educational technology will likely encounter.

Siegle, D., & Foster, T. (2001). Laptop computers and multimedia and presentation software: Their effects on student achievement in anatomy and physiology. *Journal of Research on Technology in Education.* 34(1): 29-37.

During the course of one school year, the authors examined two groups of high school students who used laptop computers with multimedia and presentation software. The outcome was improved course grades. The authors concluded, "This study demonstrated that students in a high school anatomy and physiology class benefited from full-time access to laptop computers, exposure to multimedia software, and creation of projects with presentation software."

Sweet, J.R., Rasher, S.P., Abromitis, B.S., & Johnson, E.M. (2004). *Case Studies of High-performing, High-technology Schools: Final Research Report on Schools with Predominantly Low-income, African-American, or Latino Student Populations.* North Central Educational Laboratory. Retrieved on August 1, 2005 from http://www.ncrel.org/tech/hpht/

This is an in-depth study of the factors in 19 carefully selected schools, aimed at understanding their success. Discussion of the characteristics of the schools is organized along six dimensions: (1) challenging and cohesive learning environment, (2) coherent instructional program, (3) professional community of teachers, (4) effective school leadership, (5) emphasis on improvement, and (6) parent and community involvement. An example of the discussion is that they find about half of these schools experience difficulties with funding, but most have found ways to work around these problems and to put their emphasis on using technology for school improvement and student achievement. They use technology to collect data for the identification of specific achievement gaps, or they use it to improve curriculum, including more attention to individualized instruction.

Tinker, R. (2005). *Perspective: Throwing Away the Technological Advantage.* The Concord Consortium online newsletter. Retrieved on September 15, 2005 from http://www.concord.org/publications/newsletter/2005-spring/perspective.html

From the opening paragraphs: "The United States is letting its educational system decay. As the world gets "flatter," not only are call centers and light manufacturing being outsourced, so too are jobs that require advanced education: medical diagnostics, advertising, and even research. If the nation expects to compete in this flat world, it needs education that is deep and strong. It cannot afford to continue to be far behind Singapore, Taiwan, Korea, Hong Kong, Japan, Hungary, or most of Europe. … Current national policy will not significantly improve education. It is based on trying to extract better performance through coercion, while withdrawing support for innovation and improvement that could result in fundamental, lasting gains. This is nowhere more apparent than in support for educational technology."

Valdez, G. (2004). *Critical issue: Technology Leadership: Enhancing Positive Educational Change.* North Central Regional Educational Laboratory. Retrieved on August 1, 2005 from http://www.ncrel.org/sdrs/areas/issues/educatrs/leadrshp/le700.htm

This article provides many insights about the planning and implementation of educational change and the role of educational technology in fostering it. One brief example: "Technology use, if it is to be successful, needs to be implemented systemically rather than in isolation. Failure to tie technology use to the required

curriculum may result in technology being perceived as an instructional add-on. Teachers may be frustrated when they realize that to use technology effectively, they will need not only to learn technology use and integration but also to modify their instructional and assessment practices. Administrators need to share the change process, beginning with why the change is necessary, what the benefits expected are likely to be, and what the consequences are of not making any changes, with respect to the emphasis on providing a full education to all students."

Appendix E: Facing the Global Challenge in Achievement

Michigan has already experienced change resulting from decades of globalization of the economy. Manufacturing jobs that used to be in Michigan have disappeared as a result, along with the tax base they represent. We now face a situation where the departure of jobs is not simply because of lower wage structures in other regions and nations. It is increasingly the case that there are large numbers of well educated and motivated people at work in other nations, in places such as South Korea, China, and India. Further, radical changes in communication such as the worldwide Internet and better access in other nations are a major factor enabling work to be moved overseas. Another is an expanding foundation of experience in foreign companies supporting the supply chains for U.S. and global markets. This has been building over time, with many successes when service jobs are off-shored to India and other nations. These all come together to raise the question of which well-paying jobs will remain in the U.S.

Two authors have written books that tell this story in dramatic terms, making the case that we should act now to adjust to the rapid changes underway. One of these authors is Thomas L. Friedman, of the *New York Times*, whose book is *The World is Flat* (Friedman, 2005). He quotes an information systems architect who works with talented people across the world:

> "Low education means low-paying jobs, plain and simple, and this is where more and more Americans are finding themselves. Many Americans can't believe they aren't qualified for high-paying jobs. I call this the '*American Idol* problem'. If you've seen the reaction of contestants when Simon Crowell tells them they have no talent, they look at him in total disbelief." (p 262)

It is not that U.S. educational outcomes are getting worse; it is that the rest of the world is accelerating away from us, in very large numbers.

> The [National Science Board] report found that the number of American 18 - 24 year-olds who receive science degrees has fallen to 17th in the world, whereas we ranked third three decades ago. It said of the 2.8 million first university degrees (what we call bachelor's degrees) in science and engineering granted worldwide in 2003, 1.2 million were earned by Asian students in Asian universities, 830,000 were granted in Europe, and 400,000 in the United States. In engineering specifically, universities in Asian countries now produce eight times as many bachelor's degrees as the United States. (p 257)

The number of students deciding to go into science and engineering starts years earlier, in K-12 schools. The TIMSS (TIMSS, 2003) and PISA (PISA, 2003) studies compare U.S. students to those of many other nations. The U.S. is well below the best, and the best are often in Asia.

A second author is Clyde Prestowitz, who was in the Commerce Department in the Reagan administration; his book is *Three Billion New Capitalists: the Great Shift of Wealth and Power to the East* (Prestowitz, 2005) He puts our plight more starkly than Friedman:

> Although America has not yet caught on, its relative superiority and power are rapidly slipping away. Far from leading the world on a global march to freedom, the United States could find itself hard-pressed to maintain a reasonable standard of living and defend its vital interests. (p 255)
>
> It has long been assumed that as manufacturing jobs disappeared, the service industries would provide secure, high-paying jobs to compensate for the loss of manufacturing. That view, however, is pre-Internet and pre-third wave. It may not be sustainable in the world of 3 billion new capitalists all online. (p 19)
>
> The view that the uniquely inventive U.S. economy will always maintain economic leadership by doing the next new thing no longer necessarily holds. U.S. spending on research and development has declined in critical areas, and its technology infrastructure is deteriorating. Other countries are graduating more scientists and engineers, while America graduates fewer and fewer. Most important, the leading U.S. venture capitalists and technology firms are taking R&D and new start-up company development to Asia as fast as possible. (p 19)

How does our present K-12 educational system prepare students for a world that is changing that much? How does Michigan remain competitive with a well-educated workforce and prosperous business community?

Appendix F: Successful Nations Incorporating Educational Technology

The importance of greatly improved student learning is clear. A key question for this plan is how educational technology can contribute to this goal. Appendix M on Enabling Educational Transformation addresses some of this. Another way of examining how technology can improve student learning is to look beyond the United States, to look globally. Two nations are examined here, Singapore and Finland. While relatively small, they are similar in size to Michigan. More important, they are nations that have high levels of student achievement in international science and mathematics assessments, and they both have addressed education as a key ingredient in building vibrant economies. Singapore scores highest in the world on the TIMSS international comparison of students in different nations, while Finland scores highest in the world on the PISA international tests. Neither takes the other assessment; the United States takes both. The PISA tests in particular provide strong evidence of problem-solving ability, and hence are a positive measure of the educational system. Here we have two of the leading educational systems in the world, and as we will describe, they are both heavily committed to educational technology.

Measure	Singapore	Finland	Michigan
Population	4.3 million	5.2 million	10 million
2002 GDP	US$ 87 billion	US$ 132 billion	US$ 347 billion
UNDP 2001 technology achievement index	10	1	Not Available
GDP per capita, adjusted for cost of living parity	US$ 24,040	US$ 26,190	(US is $35,750)
TIMSS 2003, 4th grade math	1st in the world score of 594		(US was 518)
TIMSS 2003, 4th grade science	1st in the world score of 565		(US was 536)
TIMSS 2003, 8th grade math	1st in the world score of 605		(US was 504)
TIMSS 2003, 8th grade science	1st in the world score of 578		(US was 527)
PISA 2003, 15 year olds, average math literacy		1st in world score of 544	(US was 483)
PISA 2003, 15 year olds, average reading & science		1st in world score of 543	(US was 495)

(Bureau of Economic Analysis, 2005; TIMSS, 2003; PISA, 2003)

The manner in which these two nations approached educational technology can be appreciated from quotes from their own materials. The Singapore effort started with a master plan for transforming education through technology, beginning in 1997, eight years ago. The following illustrates the level of professional development effort:

> The IT Training programme was implemented in primary and secondary schools in three phases from 1997 to 2000. Training took various forms such as face-to-face workshops for the core subjects (e.g. Languages, Humanities, Mathematics and Science), sharing sessions for non-core subjects (e.g. Art, Design & Technology, Home Economics, Music) and dialogue sessions for the exchange of ideas and experiences amongst Heads of Departments.
>
> Most teachers completed eight to ten core modules over 30 to 50 training hours. The training aimed to help them integrate IT effectively into the curriculum. Hence, they were introduced to various types of IT resources, and learned to evaluate and select appropriate IT resources for their teaching. They were also introduced to appropriate teaching and learning strategies, including thinking skills and co-operative learning strategies. Furthermore, in line with the move towards project work, teachers were shown how IT could be integrated in the various stages of project work. These included using IT resources to research, organize, analyze, and present information. (Singapore Ministry of Education, 2004)

The most startling aspect of their program is that in order to provide the additional time for educational technology, Singapore cut other curriculum coverage by 10 to 30%. (Kozma, 2005) This is not a recommendation of the Michigan plan, but it is noted as indicating how seriously Singapore addressed educational technology. As a companion step, for university admission Singapore added a requirement that an electronic portfolio of student work had to be submitted.

In Finland, the level of sophistication about educational technology can be seen in this segment of Information Society Programme for Education, Training, and Research 2004-2006 (Ministry of Education, Finland, 2004). The following are their aims for 2007 (ICT refers to Information and Communications Technologies):

- Finland is an open and secure, networked society with high-level information society knowledge.
- All citizens have opportunities and the basic capabilities to use electronic services (eServices) and content.
- Appropriate use of ICT in learning and in teaching is part of everyday school life.
- ICT is used widely and appropriately in research.
- Electronic materials are of a high quality, pedagogically justified, serve different user groups and are available openly.
- Also, electronic materials are comprehensively available for science and research.
- The programme actions are evaluated on a continual basis with a view to development.

Furthermore, in both nations there is strong history of successfully pursuing economic progress. Singapore’s GDP grew at the rate of 3.8% from 1990-2002, and Finland’s at

2.5%, compared to the U.S. at 2.0%. (Kozma, 2005) Similar stories about investments in educational technology may be seen in nations such as South Korea, Australia, and Taiwan (CoSN, 2004; Education Week, 2004; UNESCO). While this level of focus has not yet happened in China and India, these smaller states are plausible reference points for these much larger nations in shaping their own education policies to support economic development.

Appendix G: Preparing Students for a World of Change, Technology

While there are often jokes about how fast technology is changing, we don't often stop to reflect on just how different the world of, for example, 20 years from now will be. We cannot predict the details, but we can be sure that technology will be almost everywhere. But the technology itself is a trivial change compared to how it will be infused in our lives. Possibilities to consider:

- Most products and even individual parts will have an internal ID device that can inform a computer about what it is, when it was made, perhaps even its current operating condition.
- People may even have an internal ID tag, to assist in thwarting terrorism.
- Communication will be everywhere, for voice, video, Internet access, and probably some new form of communication will emerge that we can't imagine now.
- Those communications will be readily and routinely conducted to any place in the world.
- Those communication devices may have a GPS built in, so location is known at all times.
- Personal privacy will be very different from now, with improved security, but with increased government observation.
- Virtually everyone will have at least one mobile computing device, and many will have several.
- It will be relatively easy and inexpensive to monitor many facets of our health, exercise, and diet.
- Medicines will likely be tailored to our particular genetic makeup. We'll each carry a chip that provides the pharmacist our genetic information.
- Science, engineering, and biomedical research will be largely done on computers using models and simulations of the real world. (oops, already true.)
- Automobile traffic on major roads will have some level of automated control.
- Home energy use will be controlled and monitored for maximum efficiency, and possibly allocated so that each family gets a fair share of a limited resource.
- The workplace will assuredly have far more technology, much of which will replace the more routine jobs while the best paying jobs will require extraordinary skills, because the ordinary ones will likely be done by someone remotely, someplace else on the planet.
- Automatic language translation will be used for a range of routine business transactions, with English and Chinese as the core languages with the richest ability to translate back and forth to any other language.

Another way to think about this is to reflect on how much has changed in the last 20 years. Only a few people had a personal computer for word processing, spreadsheets, email, or playing computer games then. There were no cell phones. There was no Internet, no Web browsers, only a limited form of online chat rooms, no eBay, no Amazon.com, no Google. There was no GPS for finding your location. Wal-Mart had not really started data mining to understand product demand. Overseas communications were too expensive for common use in business transactions, so having employees close was a strong advantage. Many products were simpler to operate then, because there were no computers to imbed, ranging from cars, to appliances, to home stereo and television systems. Think too about how most of the electronics you bought were made in the U.S. then, but are not now.

How can our students be prepared for this world? Not just as consumers of products and services, but as those working in these industries, with the knowledge base to be well paid. The changes in the world and changes in technology are all intertwined and moving very rapidly. We have decades of experience that tell us the rate of change in achievement in the current system is modest compared to the demands before us. We have the opportunity to be more progressive in our use of educational technology in our schools; we must do that. And as further motivation, because we’re heading to a world where technology is omnipresent, students need to experience and learn with technology both at school and at home.

Appendix H: Student Views of Educational Technology in Schools

Not surprisingly, in parallel with changes in the world that have been described, students' approach to education is taking new forms as well. A recent report titled "The Digital Disconnect: The Widening Gap Between Internet Savvy Students and Their Schools," from the Pew Internet and American Life Project (Pew, 2002), finds that our students are rapidly moving ahead of our schools in technology use. Further, this student input is from late 2001 through early 2002, and students are likely to have advanced further since then. A summary from the report:

> Students are frustrated and increasingly dissatisfied by the digital disconnect they are experiencing at school. They cannot conceive of doing schoolwork without Internet access and yet they are not being given many opportunities in school to take advantage of the Internet. (p v)

Another summary finds the following:

> Internet-savvy students rely on the Internet to help them do their schoolwork—and for good reason. Students told us they complete their schoolwork more quickly; they are less likely to get stymied by material they don't understand; their papers and projects are more likely to draw upon up-to-date sources and state-of-the-art knowledge; and, they are better at juggling their school assignments and extracurricular activities when they use the Internet. In essence, they told us that the Internet helps them navigate their way through school and spend more time learning in depth about what is most important to them personally. (p ii)

The students' perceptions of the challenges at their schools:

- School administrators—and not teachers—set the tone for Internet use at school.
- Even inside the most well connected schools, there is wide variation in teacher policies about Internet use by students in and for class.
- While students relate examples of both engaging and poor instructional uses of the Internet assigned by their teachers, students say that the not-so-engaging uses are the more typical of their assignments.
- The single greatest barrier to Internet use at school is the quality of access to the Internet.
- Since not every student has access to the Internet outside of school, the vast majority of students report that their teachers do not make homework assignments that require the use of the Internet.

The bottom line is student motivation to learn:

> In our conversations with students about the quality and nature of their Internet-based assignments, they repeatedly told us that they wanted to be assigned more—and more engaging—Internet activities that were relevant to their lives. Indeed, many asserted that this would significantly improve their attitude toward school and learning. (p 18)

Appendix I: Students are Engaged with Technology

A U.S. Commerce Department report titled "Visions 2020.2" (U.S. Department of Commerce, 2005), which is also featured by the U.S. Department of Education as part of educational technology planning, begins with this characterization:

> In 2002, 83 percent of family households reported computer ownership, with 78 percent having Internet access. In the fall of 2002, 99 percent of public schools in the United States had access to the Internet, and had expanded Internet access into 92 percent of instructional rooms. Taking advantage of these digital tools, 90 percent of children between ages 5 and 17 use computers, and 65 percent of American children ages 2-17 use the Internet from home, school, or some other location. Internet usage is growing fast among the very young, with parents reporting that 35 percent of children ages 2-5 went on-line, growing from a usage rate of six percent just two years earlier in 2000. Seventy-eight percent of children between the ages of 12 and 17 go on-line. (p 7)

And the following:

> Despite the availability of computers and Internet access in school, the use of digital tools by students is more home-based than school-based. For example, among students ages 12-17 that go on-line from more than one location, 83 percent say they go on-line most frequently from home, and while only 11 percent say they go on-line most frequently from school.
>
> Computers and the Internet are not the only digital technologies that children use routinely. Of those students answering the NetDay questionnaires, 81 percent in grades 6-12 had at least one e-mail address, and 38 percent in grades 3-5 and 19 percent in grades K-3 had an e-mail address. Seventy-five percent in grades 6-12 had at least one instant message screen name, as did 34 percent in grades 3-5. Sixty percent in grades 6-12 reported that they e-mailed or "instant messaged" adults such as family members, teachers or coaches on a weekly basis. Fifty-eight percent in grades 6-12 have a cell phone. In a survey for the Pew Internet in American Life Project, 41 percent of online teens say they use e-mail and instant messaging to contact teachers or classmates about schoolwork. (p 8)

The students participating in the study (more than 160,000 participated, 38 percent in K-6, 62 percent in grades 6-12) articulated an image of the learning environment they would like to see in the future, and the authors summarized the result:

> Every student would use a small, handheld wireless computer that is voice activated. The computer would offer high-speed access to a kid-friendly Internet, populated with websites that are safe, designed specifically for use by students, with no pop-up ads. Using this device, students would complete most of their in-school work and homework, as well as take online classes both at school and at home. Students would use the small computer to play mathematics-learning games and read interactive e-textbooks. In completing their schoolwork, students would work closely

and routinely with an intelligent digital tutor, and tap a knowledge utility to obtain factual answers to questions they pose. In their history studies, students could participate in 3-D virtual reality-based historic reenactments. (p 6)

Appendix J: Overview of the Michigan Situation

Historically, Michigan has been a leader in educational technology use in our schools. One vital indicator of that is MACUL, the largest professional organization for teachers involved in educational technology in Michigan, founded in 1975. It has long had the largest membership of any such state-based organization (recently being passed by Texas); today MACUL has about 4,000 members. In the past decade, Michigan schools have been leaders in making use of the Internet, with a special impetus coming in the Michigan Bell Rebate Case in 1995, through which many schools acquired direct connections, as well as a statewide dial-in network for teacher use established by Merit Network.

Video has been actively used in education in Michigan for years. The REMC Association was initially primarily active in this area, but then expanded to support Internet and other computer-based services, and has a State Buy Program that makes discounted prices on many items available to schools across Michigan.

Video-based distance education programs have had a strong history, such as in the Upper Peninsula, to deliver courses that would otherwise not be available to remote schools. Two-way video conferences have been used in classroom to classroom activities and in virtual field trips; the TWICE organization has served as a clearinghouse for information about such trips to locations all over the nation and beyond. Most recently a series of projects, fostered by the REMC Association, have made on-demand video available in teacher’s classrooms that cover many educational subjects. MI StreamNet is another service of the REMCs, offering a means of wide distribution of video-based presentations, such as MDE information sessions for educators across the state.

Teacher support and professional development have been addressed by a number of statewide programs, including the Michigan Technology Implementation Project, Ameritech Technology Academy, Teach For Tomorrow, Intel’s Teach to the Future, and Michigan Teacher Network. There has been a major program for administrators, LEADing the Future, with Gates Foundation funding.

Much of the funding for these activities came from federal grants such as Goals 2000, Technology Literacy Challenge Fund, or Preparing Tomorrow's Teachers To Use Technology (PT3) (sources that are no longer available), as well as corporate and private foundation sources.

In the late 1990’s other sources of funding emerged. The federal eRate program has been a major source of support for network infrastructure for schools that meet the economic need criteria. This has provided almost $150 million since program inception in 1998, supporting the operating costs of advanced networking. Governor John Engler established the Michigan Virtual University and within it the Virtual High School. In addition, Governor Engler created a program known as the Teacher Technology Initiative (TTI) that provided every teacher the opportunity to have a computer. About 90,000 educators were provided with computers, software, online training and dial-in Internet services under this program, representing a total investment by the state of $106 million plus additional funding through the local support provided for these teachers by the schools and ISDs. Most recently the Freedom to Learn student laptop initiative was funded with a mixture of NCLB funds and state monies, in a program initiated by former Michigan House Speaker Rick Johnson.

With the state budget facing very serious problems, the funding picture is now much more difficult. At the federal level, the eRate program has many strong supporters, but it also faces several challenging financial issues.

The combination of all the above activities, and many others taking place in individual schools or ISDs, meant that for a number of years Michigan was one of the leading states in the nation in the use of educational technology.

Today, Michigan has lost its momentum and is no longer among the leaders. A number of the statewide programs have ceased in the last few years or are in a state of minimal maintenance. The level of development of new educational resources in statewide projects, for teachers or students, is much less than it was.

The specific information provided above about educational technology in Michigan should be considered in the broader context of the major challenges facing the state, some of which were described earlier in this report. One important public planning effort of the recent past has been the Cherry Commission on Higher Education and Economic Growth. (Cherry Commission, 2004) The Commission's report reinforces the imperative need for dramatic improvements in education in Michigan.

> Michigan is at a moment of decision. Having established the standard of economic success in the industrial economy of the twentieth century, Michigan is today precariously balanced between that era and the changing economy of a new century. Michigan's residents, businesses, and governments can either move forward to a future of prosperity and growth fueled by the knowledge and skills of the nation's best-educated population or they can drift backward to a future characterized by ever-diminishing economic opportunity, decaying cities, and population flight – a stagnant backwater in a dynamic world economy. (p 3)

If anything, the Commission's report understates the importance of technology in general, and the impact that the continuing rapid pace of change will have on Michigan. For example, if the nation and the world face serious issues with energy costs and consumption, or with environmental degradation, how will Michigan's automobile-based economy respond to such critical issues? Michigan is in a race to improve education at all levels: K-12, higher education, and adult education.

Appendix K: Comparing Michigan to Other States

Each year, the publication *Education Week* publishes a special issue titled "Technology Counts", which provides comparative data on the programs in each state. In the May 5, 2005 issue (Education Week, 2005), Michigan ranks near the bottom, 41 out of 51 states and the District of Columbia. Specific data items from this survey:

Item	Value	MI rank from best	Number of states reporting	Percent that are above MI	National Average
1. Students per instructional computer, statewide	3.9	35	50	68 %	3.8
2. Students per instructional computer, high-poverty schools	4.1	32	44	70 %	3.9
3. Students per instructional computer, located in classrooms	9.4	43	50	84 %	7.6
4. Students per instructional computer, located in computer lab	10.0	14	50	26 %	12.1
5. Percent of instructional computers that run Windows XP, NT, 2000	42	36	50	70 %	47
6. Students per Internet-connected computer	4.1	29	50	56 %	4.1
7. Students per Internet-connected computer, high-poverty schools	5.1	36	44	80 %	4.5
8. Students per Internet-connected computer, located in classroom	9.8	43	50	84 %	8.0
9. Percent of schools with Internet-connected computers in one or more classrooms	89	38	50	74 %	91
10. Percent of instructional computers with high-speed Internet access	88	29	50	56 %	87

The specific items reinforce the picture of Michigan being below about 75% of the other states. Note in addition that item 5 indicates that even of the computers to which students have access, a disproportionate number in Michigan are older machines with less capable operating systems, posing problems in terms of reliability and capacity to run the latest software. Another point worth noting is seen in item 4, where Michigan ranks fairly high in terms of access to computers in a lab; when coupled with item 3 which shows relatively low access in the classroom, we see that Michigan schools seem to have made decisions shaped by economic constraints to focus their investment and operating expenditures on computer labs at a level higher than the vast majority of other states.

An important question is whether the data used by *Education Week* is of sufficiently high quality. One way of assessing the quality of the data is to compare with data collected by the federal government. The data reported by *Education Week* corresponds reasonably closely to data collected by the National Center for Education Statistics, in terms of data reported for the nation as a whole. Note the trend from 1998 to 2003 (NCES, 2005).

U.S. in total	1998	1999	2000	2001	2002	2003
Students per instructional computers	12.1	9.1	6.6	5.4	4.8	4.4
% change from previous year		25 %	27 %	18 %	11 %	8 %

These data reveal another point of interest. This trend line for the nation as a whole, while reflecting the economic slowdown of recent years, shows the level of investment in increased numbers of computers, not just replacements for existing equipment, has been remarkably high.

Appendix L: Definition of Assistive Technology and Universal Design for Learning

Assistive technology is any item that is *required by* a student to increase functional capabilities. This is determined by the student's individualized education plan team (IEPT). The continuum of assistive technology is very broad and includes no/low-tech (pencil grips, reading guides, etc.), moderate-tech (portable word processor, talking spell checkers, etc.) and high-tech (computers, software, augmentative & alternative communication (AAC) devices, etc.)

Universal Design for Learning (UDL) is a philosophy that embraces the diversity of learning characteristics and student needs that educators face in today's classrooms. As we strive to educate all students, including but not limited to those with learning disabilities, emotional or behavioral impairments, physical disabilities, or simply those who have a history of school failure to meet high standards, we need to offer responsive and flexible instruction that will allow this diverse mix of students to succeed not only in school but in life. UDL challenges us to think about the diverse needs of learners during the design of instruction so that we build multiple, flexible approaches (versus a "one-size-fits-all") to challenge and engage a wide range of students, including those with disabilities. A good example of universal design is the curb cut. It not only benefits individuals with physical or visual disabilities, it helps parents pushing a stroller, a bike or skateboard rider, travelers rolling a suitcase along the sidewalk, and others. Inclusion/mainstreaming may have provided the physical access to the general education classroom for students with disabilities; however, access to the curriculum may remain a challenge. UDL provides multiple ways to acquire and demonstrate knowledge while also engaging students who may not otherwise succeed. Digital media allows for much greater flexibility in teaching and learning, making universal design more feasible in today's classrooms. When content is digital, the level of difficulty can be rescaled to accommodate the learner; visual media can expand upon or substitute for textual information; print can be converted to audio and read aloud while highlighting. In addition, many low-mid tech tools can improve access to the curriculum, including highlighter tape, pencil grips, talking spell checkers, portable word processors, etc. These are but a few of the literally thousands of assistive technology options available. In order to capitalize on these tools, adequate leadership, technical support, access, and professional development must be available to educators.

Appendix M: Survey Results from Michigan Educators

This is a preliminary summary of survey results. This will be updated as analysis continues and any last respondents complete the survey.

Michigan's IDEA Partnership was created to help transform adult learning to support implementation of the Individuals with Disabilities Education Act (IDEA) and improve student achievement (IDEA Partnership, 2005). As one of its activities, the IDEA Partnership conducted an online survey of Michigan educators beginning on August 15, 2005. The purpose of the Michigan IDEA Partnership survey was to guide professional development offerings around the state related to how:

1. School personnel can use technology to do their work efficiently and effectively
2. Students can use technology to enhance their learning
3. School personnel prefer to incorporate distance learning into their professional development plans

There were two versions of the survey, with one addressing building principals, other administrators, and higher education faculty (henceforth termed the "administrators' survey") and the second addressing service providers such as teachers, paraprofessionals, and speech, language, and occupational therapy specialists (henceforth termed the "service provider survey"). As of September 15, 2005, there are 668 respondents in the first group and 2,411 respondents in the second group, for a total of 3,079. These individuals represented more than 300 Michigan school districts. Most work with school-age students, although some serve birth to five year olds and/or 19-26 year old students with disabilities. All content areas were represented. The survey was taken via the Internet, using the Zoomerang survey system. Broad notice of the survey was distributed throughout the education community.

Michigan IDEA Partnership Assistive Technology Survey: Exemplary Uses and Barriers to Further Uses of Assistive Technology in Michigan's Schools

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Introduction

Assistive technology (AT) is an important part of special education services for students with disabilities in preschool, K-12, and postsecondary settings. However, the extent and usage of AT in American education is not fully documented. Challenges in determining how teachers and students use AT include the very broad manner in which AT is defined, the lack of a nationwide (or even, in most states, a statewide) system of tracking educational accommodations, and the variety of AT delivery systems and personnel who provide AT services.

What is Assistive Technology?

> "Any item, piece of equipment, or system, whether acquired commercially, modified, or customized, that is commonly used to increase, maintain, or improve functional capabilities of individuals with disabilities."

This above definition was initially established in the Technology-Related Assistance for Individuals with Disabilities Act of 1988 (The Tech Act), amended in 1994. In 1998, that act was repealed and replaced with the Assistive Technology Act of 1998 (AT Act), but the definition has remained unchanged.

Generally speaking, the definition of assistive technology (AT) is very broad. The inclusiveness of the definition has advantage in that many different items and services can be provided under the AT umbrella. Adaptive pencil grips are considered AT, as are standing wheelchairs, and the most sophisticated scan-and-read software systems. When used in a customized or specified manner, so is spell-check in a word-processing program, a specific choice of a pen, or a change in the color of paper used for communication with a student. Educational uses of AT include both low-tech and high-tech, (for example, pencil grips vs. computers), remedial uses and accommodation (phonetic training software vs. augmentative communication devices), and even universal design and individually prescribed applications (classroom sound field systems or the IBM Liberated Learning system vs. a computer adaptation for one student). AT also includes solutions that can be installed everywhere and used by anyone (whether that be curb-cuts and building entry ramps or built-in text-to-speech in an internet browser), as well as solutions that must be specifically installed and must accompany the student from place to place (such as a Braille computer display).

However, the way in which AT is defined makes it difficult to document AT uses, because it is not always clear whether or not a specific item or service should be considered AT. Many teachers clearly utilize many adaptive systems and strategies without classifying them as technology. However, in educational practice, these technology solutions are usually distributed based on one of two models: systems are put in place to cover the needs of a generally defined disability (a scan-and-read software program is installed on some of a school's computers) or a system is developed based on an individual student's needs for the completion of a specific task.

***How is AT Used in Special Education*?**

Technological interventions for special needs students have changed and grown dramatically. In 1994 text-readers, screen magnifiers, Braille displays, voice-to-text technology and keyboard alternatives were in a state of developmental infancy. Extensive use of high-tech solutions, especially for students with visual impairments and other print disabilities, required top-of-the-line personal computers equipped with extra memory, special sound cards, and specialized connection systems. A dozen years later, even five-year-old computers will run most AT systems successfully, and on newer computers USB connection systems and the built-in support of operating systems such as Windows2000 and Windows XP have dramatically simplified the use of AT devices. Meanwhile, AT software (or software that can be used as such) has continually improved and, in general, had its cost reduced, becoming free in some instances. Unfortunately, these changes have created complex tensions. For example, though software can now do much more for more students, educational practitioners and administrators, even those with pre-service training in these systems, are unlikely to know, or have experience with, the most current hardware and software.

Best estimates suggest that AT is underutilized in today's schools. Researchers have reported that educators need more preservice education and professional development in order to integrate technology into their curriculum in meaningful ways. Other barriers to more widespread use of AT include lack of funding, difficulties obtaining hardware and software, limited technical support, little time to explore possible and available AT solutions, and complexity of device use (Derer et al., 1996; Judge, 2001; Wehmeyer, 1988). Furthermore, families of children with disabilities need more information regarding AT devices and services, training, and funding options (Behrmann, 1995; Kemp & Parette, 2000; Parette et al., 1996). It seems that many students with disabilities who want or could benefit from AT devices don't have access to them (Wehmeyer, 1999).

The *Technology Subcommittee of the Michigan IDEA Partnership* was charged with the task of looking at issues surrounding AT use in the state, the lack of specific and reliable information became immediately apparent. What AT applications were being used in the state? How were they used? How were AT decisions made? What barriers did service providers and administrators encounter in their attempts to use AT? These were a few of the questions that the subcommittee sought to address through its 2005 AT survey.

Method

Survey Development

Michigan's IDEA Partnership was formed "to help transform adult learning to support implementation of the Individuals with Disabilities Education Act (IDEA) and improve student achievement." The target audiences for adult learning are educators, administrators, parents, and other service providers who work or interact with children with disabilities. Individuals involved in the partnership include Michigan administrators, advocates, higher education faculty members, organizations, parents, policy makers, and service providers. There are about 60 members of the partnership, with about 20 of these individuals involved in ongoing planning and an additional 15 serving on one of 6 study groups or action teams.

The primary goal of the survey was to ascertain both a state baseline and identify islands of excellence in AT usage. To accomplish this, educators were asked questions about personal and educational use of technologies, specifically about exemplary uses of AT in their programs, and the barriers to increased or more effective use.

Two separate but related surveys were administered: one addressing building principals, other administrators, and higher education faculty (henceforth termed the *Administrator Survey*) and the second addressing service providers such as teachers, paraprofessionals, and speech, language, and occupational therapy specialists, which we will call *Service Provider Survey* in the remainder of this report.

Previous surveys of AT use have used a variety of formats for collecting responses about a variety of issues. Many studies have utilized internet-based surveys, but this method limits participation to those who have the access and knowledge needed to respond to online surveys. Some studies have attempted to look at only AT use, while others have broached the wider range of educational technology applications and even personal comfort with technology (FitzGibbon, Johnston, Oldham, & Loxley, 2004). There are surveys with open-reply questions, surveys in which respondents rate their knowledge or experience, and surveys which offer comparative descriptions to detail best practices (BECTA, 2005).

The IDEA Technology Survey used a combination of these techniques. Both practitioners and administrators were asked to respond to items about competencies and knowledge regarding both AT and general educational technology applications. They were asked to respond on rating scales to some questions, and also had an opportunity to use their own words in open-ended questions. The survey also asked both practitioners and administrators to describe barriers to effective educational use of both technology, in general, and AT, in particular. Again, both rating scales and open-ended questions were utilized. Some questions were common across the administrator and practitioner surveys, and others were specific to that respondent group.

The Technology Subcommittee developed the surveys over a period of approximately six months. The group met on at least five occasions to draft and revise questions, which were piloted with a small sample of service providers and administrators. A set of questions about technology competencies that were administered to a similar sample in 2000 were included to examine changes in educators' knowledge and competency over time. Responses to these questions are not included in this report.

Survey Administration

The surveys were administered via the Internet, using the Zoomerang survey system. Broad notice of the survey was distributed through the education community by Partnership members, mailing lists, listservs, and other means. The surveys were made available in August, 2005, and were closed around mid-November, 2005. When interpreting the results, the reader should keep in mind that individuals responding were those who had access to the Internet and who were motivated to respond to an online survey. Thus, each sample may represent a rather unrepresentative sample of the general practitioner and administrator population.

Data Analysis

Two teams of doctoral students in a doctoral seminar titled Technology and Human Ability *at Michigan State University analyzed a random sample of 10% of the responses to open-ended questions on the Service Provider and Administrator surveys. The data analyzed were drawn from all surveys submitted as of September 12, 2005. The two open-ended questions were:*

- What is exemplary in your school or building relative to the use of technology? (Administrator Survey Question #7, Service Provider Question #10)
- What are the two or three problems that you need the most help with to effectively serve all of your students, particularly students with special needs (think in terms of technology resources)? (Administrator Survey Question #16, Service Provider Question #19)

The authors used an open coding procedure (Strauss & Corbin, 1998) to inductively develop a codebook that captured the major themes reported in responses to these questions. One team of five researchers read through a random sample of both administrator and service provider responses to the Exemplary Practices question, another team of four researchers read through a random sample of administrator and service provider responses to the Needs question. In each case, individuals on each research team coded about 10% of their sample of responses, developed preliminary categories, and then discussed these categories among themselves. Categories were then applied to an additional 10% of the sample drawn for this analysis, and inconsistencies were resolved and categories refined. Finally, team members analyzed the remainder of the sample responses.

In the remainder of this report, we discuss results to these open-ended questions, as well as results to any forced-choice questions that asked participants to describe exemplary practices and barriers in using technology with students who have disabilities.

Results Administrator Survey

Respondents. Seven hundred and five individuals completed the survey designed for building principals, other administrators, and higher education faculty. Of the 705 respondents, 35% identified themselves as building administrators, 24% as central office administrators (e.g., special education directors, curriculum directors), and 21% considered themselves in some other position, including superintendent, technology director, school board members, and higher education faculty. In addition, the majority of respondents indicated that their primary responsibility was at the building level (51%), whereas 33% indicated the local district level, and 15% the ISD/RESA/RESD[1] level. The average length of time a respondent to the Administrator Survey had worked in the field of education was

[1] ISD stands for the Intermediate School District, whereas RESA stands for the Regional Education School Association, and RESD stands for the Regional Educational School District.

22.2 years and most responded that they worked with a range of age/grade levels (i.e. kindergarten through 12th grade).

The overwhelming majority (96%) of respondents lived in the Lower Peninsula of Michigan. Of those in the Lower Peninsula, respondents primarily were spread across the central (30%), west (26%), and metro portions of the state (33%). The majority of respondents also indicated that they lived in a rural setting (47%), followed by suburban (43%), and then urban (21%).

When asked about their use of the Internet, the overwhelming majority indicated that they used it for activities including gathering information (99%), communication (96%), obtaining instructional resources (84%), and participation in professional learning (59%).

Exemplary use of technology. Respondents answered an open-ended question about exemplary use of technology in their school or school district. Responses to this question could be categorized into 11 different categories. Table 1 describes these 11 categories—which were used to code both administrator and service provider surveys.

Table 1: Categories for Coding Question about Exemplary Uses of Technology

Coding Category	Operational Definition	Examples
Technology Support/ Personnel	References to school/school district technology support or personnel	"Our technology director is a hard worker" "The technology support staff"
Assistive Technology	References to assistive technology, AT, specific references to AT devices or services	"Our staff investigates new assistive technology and work to put it into our students hands." "Touch Screen and switch activated computers for students with severe disabilities."
Up-to-date	References to up-to-date or current technologies or specific examples of up-to-date technologies	"The up to date technology for music instruction and creation." "we are pretty much state of the art, having a special countywide millage designated to technology in the schools."
Access	References to availability, access to hardware (i.e. computers), software, Internet, or other technologies	"Everyone has access and support" "Using Handhelds with staff and students" "High Speed Internet throughout the building"
Communication Tool	References to communication tools (i.e. e-mail) or communication with parents, school personnel, or the community	"We communicate with parents by email." "Communication with staff"
Integration	References to integration through the curriculum or integration into content area	"We use technology throughout the curriculum." "Technology is infused into all aspects of our general education curriculum."
Professional Development	References to professional development or training	"Opportunities for Professional Development". "Frequent training opportunities"
Teachers	References to teachers, staff, or the attitude of service providers	"A friendly staff" "We have excellent staff who are willing to teach a variety of skills to students. They are continually finding new ways to improve our internet usage at the building level."

Administrators	References to administrators, their attitudes, encouragement, or support	"Our Administrators encourage the staff to use it." "Our district has strong leadership and a deep understanding of the purposes for integrating technology."
Nothing (N/A)	References to nothing, N/A	"Nothing" "?"
Ambiguous/ Other	References to things not covered by the other coding categories or references that were not understood or clear	"NCA support" "Data collection "Distance education"

Nearly one-third (32%) of the responses could be categorized as *access to technology*. Responses that fell into this category included access to software, hardware, Internet, and other technologies and included responses such as the following: "we have a full lab of laptops with high speed Internet access", "each teacher has at least five computers in each classroom," "using handhelds with staff and students."

The second highest response *technology support or technology personnel* (21%), followed by *ambiguous responses* (19%), and *up-to-date technology* (16%). The response occurring least frequently, with only 2% of the respondents mentioning it, was *assistive technology*.

Barriers affecting access to technology. Administrators were asked to respond to two questions regarding barriers to the use of technology. The first question asked administrators to indicate which factors in a list of limitations or barriers affected their access to technology in their building. Respondents noted that all factors applied to their situation, albeit to varying degrees. The most frequent response was *insufficient funding*, indicated by 36% of respondents. This was followed by *no barriers* (31%), *firewall/Internet security* (28%), *inability to install software applications independently* [without prior approval] (26%), and *insufficient professional learning opportunities regarding use of technology* (23%).

In the second question, respondents were asked the following open-ended question regarding barriers impacting access to technology: "What are two or three problems that you need the most help with to effectively serve all of your students, particularly students with special needs." Table 2 displays the category system developed to code these responses.

Table 2: Responses to Open-Ended Question about Barriers to Use of Technology

Coding Category	Operational Definition	Examples
District and/ or Building Level Technology Infrastructure	References to internet access (or lack of internet access), loading software on network server, obtaining permission to load software on classroom computers, network capabilities and storage space	"Need more wireless technology." "There are times when the computers are not accessible due to the server being down." "Proper installation and use on our network."
Money	References to the need for funding.	"Funding has to be increased to make this happen."
Time	References to the need for additional time for any purpose related to technology.	Time for training. More time in the computer lab.
Building issues in implementing technology/AT	References to staffing issues, class size, integration of computer and AT devices into the curriculum, space for labs or storage of equipment, building technology support staff to maintain and upgrade hardware and software	"Need full-time assistance in each building." "Training for staff on integration instead of looking at the technology as an add on." "Class size - the ability to effectively troubleshoot is limited when you are in a lab with 30 students!"
Computer and AT devices and services	References to hardware, software, other assistive technology devices, availability of equipment, a lending library for software and AT for trial use, equipment that is working	"More computers in each classroom for student use." "More availability of flexible technology (wireless and portable)." "Being able to try out new assistive technology w/o having to buy it first." "I would like to have access to and training for various types of assistive technology."

Developing and enhancing knowledge, comfort, and attitude of service providers and /or administration toward technology and AT	References to professional development and ongoing support, support within the building to answer questions about AT use, building-based PD based on teacher-identified needs, knowledge of what AT devices are available and how to use those devices, willingness to use AT with students, and regular education participation and support of AT use in classroom	"No training for staff that I am aware of." "Additional professional development in AT is needed." "Autistic students remain a challenge; need help identifying technological helps for them" "We have a simplistic understanding of AT." "Knowledge of what is available, what is best per student, and how to acquire it and use / teach it."
Direct service to students	References to assessment of students' AT needs, matching students with appropriate AT devices, teaching students to use AT devices, and assessing students' use of AT devices	"Time to be able to train staff, students, and family members to utilize the technology."
Community and family resources	References to access to hardware and software, connectivity issues, and knowledge of how to use IT/AT	"Lack of access at home." "Lack of parent knowledge."
Miscellaneous	Reference to anything that did not fit any other category	"Impulse control issues" "low academic performance" "It is unfortunate that we have so many state goals to try to cover." "Need to have a district technology / AT plan in place."
No response	No response	
Positive Remarks	Any positive response	"I can't think of any problems." "Technology resources are readily available for the special needs student in our district."

Forty percent of the respondents did not answer the question. More than 1 in 5 respondents (23%) indicated a need to increase the *knowledge, comfort, and attitude of service providers and administrators toward computer and AT* (23%). Responses in this category included the need for the categories of professional development and ongoing support, improved attitude toward AT, and increased knowledge of AT devices and services. The third most frequent response related to the *need for technology and/or AT devices and service*s (17%) including hardware, software, and equipment. The fourth category was *funding* (13%), and the fifth most frequent response was a miscellaneous collection of responses that did not fit into other categories. The sixth most common response was *infrastructure issues*, including personnel, space, and curriculum integration of technology and AT.

Assistive technology. When specifically questioned about AT, just under half of all respondents indicated that they had minimal training or experience with AT (44%), whereas 28% indicated they had none. On the other end of the continuum, 23% indicated they were knowledgeable or fluent with AT, and 5% indicated that they were able to teach others.

When asked about decision-making regarding AT, fewer than half the respondents (39%) agreed that decisions were made through a systematic, data-driven, multidisciplinary team process. Nearly one-third (30%) responded that they had no experience with AT decisions. Similar results occurred when respondents were asked if AT decisions actively involved the student and his/her family. Only 38% checked "yes" and 31% stated they had no experience with AT decisions.

In another item, respondents were provided with 11 choices from which to identify barriers that limited effective student use of AT. The most frequent response, chosen by 46% of the respondents, was *staff training*. The second most common response was *don't know*, with 37% of the respondents unable to identify specific barriers. Other top responses included: *training for family* (35%), *training for students* (33%), *staff dependence on others to use AT* (28%), and *student dependence on others to use AT* (28%).

Service Provider Survey

Participants. Two thousand five hundred and sixty individuals completed the survey designed for service providers. Of the 2,560 respondents, 74% identified themselves as teachers, 10% as related service providers (e.g., speech and language, occupational therapy), 10% as other, 4% as paraprofessionals, and 1% as school related personnel (e.g., food services, custodial, transportation). The majority of respondents indicated that their primary responsibility was at the building level (87%), whereas 7% indicated the local district level, 5% the ISD/RESA/RESD level, and 1% state level. The average length of time a service provider had worked in the field of education was 15.9 years and there existed a relatively equal distribution of service providers across K-12 grade levels (range of 23% to 36%).

The overwhelming majority (97%) of respondents lived in the Lower Peninsula of Michigan. Of those in the Lower Peninsula, they were primarily spread across the metro (43%), west (24%), and central regions of the state (24%). The majority of service providers indicated that they lived in a suburban setting (50%), followed by rural (37%), and then urban (22%).

When questioned about their use of the Internet, the majority indicated that they used the Internet, and engaged in activities such as: gathering information (99%), communication (96%), obtaining instructional resources (93%), and participation in professional learning (56%).

Exemplary use of technology. Service provider respondents also replied to an open-ended question about the exemplary use of technology in their school or school district. These open-ended responses were categorized into the same categories used for administrators (see Table 1): technology support/personnel, assistive technology, up-to-date, access, communication, integration, professional development, teachers, administrative support, nothing or N/A, and unknown or other.

The most frequent response to this question was *access*, described by 40% of the respondents. As previously discussed, *access* was operationally defined as access to software, hardware, Internet, and other technologies and encompassed such responses as "we have a full lab of laptops with high speed Internet access", "each teacher has at least five computers in each classroom," "using handhelds with staff and students." The second most frequent response, indicated by 21% of the respondents, was a miscellaneous collection of responses that didn't fall into other categories or couldn't be interpreted by the coders (i.e., *other*). This was followed by *technology support or technology personnel* (18%), and *up-to-date technology* (9%). AT was mentioned by only 2% of the respondents.

Barriers affecting access to technology. As in the administrator survey, service providers also described barriers or limitations that affected their access to technology by responding to a list of potential barriers and constructing responses to an open-ended question. On the close-ended question, respondents most often selected the responses *insufficient funding* and *inability to install software applications independently* [without prior approval], each of which were chosen by 44% of the respondents. Other common responses were *insufficient number of computers in my classroom* (42%), *computer access in lab or media center at specific times during the day or week* (37%), and *outdated or unreliable hardware/software* (35%).

Service providers also responded to the open-ended question: *What are two or three problems that you need the most help with to effectively serve all of your students particularly students with special needs*? Fifty percent of the respondents did not answer the question. The second most frequent response was *AT devices and services* (21%). Lack of *knowledge, comfort and attitude of service providers/administrators toward technology and/or AT* (19%) was the third highest category. The following three categories each were chosen by 8% of the respondents: *funding*, *infrastructure*, and *other*.

Assistive technology. When questioned specifically about AT, just under half of these respondents (43%) indicated that they had *minimal training or experience* with AT, whereas 35% indicated they had *none*, 18% indicated they were *knowledgeable or fluent with assistive technology*, and 4% indicated that they were *able to teach others*. In an item asking about decision-making for AT, while 44% indicated that these decisions were determined through a systematic, data-driven, multidisciplinary team process, 50% of service providers responded that they had no experience with AT decisions. A similar pattern of responses was found when service providers were asked if AT decisions actively involved the student and his/her family (32% *yes* or *sometimes*, 52% *no experience with AT decisions*).

In another item, respondents chose barriers that limited effective student use of AT from a possible 11 choices. The largest response category, chosen by nearly ¾ of the respondents (73%) was *training for staff*. This was followed by a need for *student training* (50%). Other top responses included: *training for family* (45%), an *effective system to borrow AT for trial use* (39%), and *staff dependence on others to use AT* (35%).

When asked to choose from a list of AT used in respondents' schools, the largest category of use chosen by 48% of the service providers was *low-tech options*, (e.g., pencil grips, specialized highlighted tape). This was followed by *portable word processors* (e.g. AlphaSmarts) (47%) and *alternative format books* (e.g. electronic, audio) (31%).

Comparisons between Administrators' and Service Providers' Responses

Participants. There was a clear difference between the number of administrators and service providers responding to this survey. Nearly 4 times as many service providers (2,560) responded to the survey than did administrators (705). A larger sample of service providers might be expected, given that the majority of the audience to which this survey was sent would consist of service providers. However, other differences existed between these two groups. First, respondents to the service provider survey were predominantly teachers (74%), whereas respondents to the administrator survey were more diverse (35% building administrators, 24% central office administrators, and 21% other), which may result in a more diverse perspective among the administrator group. Furthermore, while the overwhelming majority of respondents to both surveys live in the Lower Peninsula of Michigan, slightly more administrators (30%) lived in the central portion of the state than did service providers (24%), and more administrators than service providers lived in rural settings (47% vs. 37%).

Despite these demographic differences, the groups were similar along many dimensions measured by the survey. One was Internet use. Specifically, approximately the same percentage indicated that they used the Internet, and did so for gathering information (99% for both), communication (96% for both), obtaining instructional resources (93% for service providers, 84% for administrators), and participating in professional learning (59% for administrators, 56% for service providers).

Exemplary uses of technology. Respondents to open-ended questions on both surveys indicated that *access* was the most exemplary aspect of technology use in their schools or school districts (40% for service providers, 32% for administrators). Similarly, 21% of administrators selected *support/personnel* as exemplary, as did 18% of service providers. Both groups very rarely perceived AT to be an exemplary practice, given that this category was selected by only 2% of each group. Finally, nearly 1 in 5 (18%) of the service providers chose *none* when asked to specify an exemplary practice. Furthermore, administrators rated some categories higher than service providers, including *communication* (11% vs. 6%), *integration* (12% vs. 6%), and *up-to-date* (16% vs. 9%).

Barriers affecting access to technology. There also were some commonalities in responses to the open-ended question about barriers. Specifically, both respondent groups failed to give a response for this question at high frequencies (40% for administrators, 50% for service providers). In fact, this was the most frequent response for both groups. Despite the reversal in order, administrators and service providers indicated that *knowledge, comfort, and attitude towards technology and/or AT* (23% for administrators, 19% for service provider) and *technology and/or AT devices* (17% for administrators, 21% for service providers) were the second and third most frequent responses.

Assistive Technology. Responses to close-ended questions from both administrators and service providers indicated that administrators and service providers had relatively equal preparation to use AT (44% administrators, 43% service providers). However, more administrators indicated that they were knowledgeable or fluent with AT than service providers (23% vs. 18%). Similarly, more administrators had experience in making AT decisions than service providers (75% vs. 50%).

While administrators and service providers appeared to be more similar than different in regard to AT training, differences emerged among the respondents on the close-ended question about barriers to AT use. While the largest identified barrier was the same for both groups (*staff training*), it was chosen at different frequencies (46% of administrators vs. 73% of service providers) (see Table 5). However, overall, service providers responded with greater frequency than administrators for 10 of the 11 items. The second most frequent response for service providers was *student training* (50%), followed by *training family* (45%), *student dependence on other for AT assistance* (40%), and *an effective AT borrowing system* (39%). The second most frequent response for administrators was *don't know* (37%), followed by *training family* (35%), *training students* (33%), and *student dependence and staff dependence on others for use of AT* (28%).

Conclusions and Recommendations

A large sample of Michigan administrators and service providers, who had some presumed involvement in special education within the state, responded to this survey. The survey was administered via the Internet, which suggests that some people without regular Internet access may have been unable to respond. Furthermore, the vast majority of the respondents were from Lower Michigan, and hence other sections of Michigan appear to be underrepresented. Thus, the reader should be aware that results of this survey might not be representative of Michigan educators, as a whole.

Also, the use of open-ended questions offered both advantages and disadvantages. This option allowed for a demonstration of personal opinion but suffered from the limitations brought on by a lack of common definition. Is the use of *Microsoft PowerPoint* an exemplary practice? Is a pencil grip *assistive technology*? Does *great access* mean ten computers in a classroom or one? Thus, respondents' discussions of exemplary practices are best considered expressions of personal opinion, rather than an assessment of established standards that are being met or unmet.

In general, responses to the questions reviewed in this report indicate that technology could be more fully integrated into instruction in Michigan schools and classes. When asked about exemplary uses of technology, the most frequent response of both administrator and service providers was *access*. This is a very general response, indicating not much more than the fact that technology was available to respondents. About 20% of the administrators and service providers described technical support as exemplary. No other clear or frequent patterns of responses emerged. Notably absent were responses that described specific instructional practices using technology. Although over 90% of the respondents reported using the Internet for gathering information and communicating, and, among service providers, for obtaining instructional resources, very few of the respondents described ways in which technology was used to enhance or support instruction in schools or classroom. Perhaps respondents did not take the time to discuss these practices in detail on the survey, or perhaps technology was not being used in ways that respondents consider exemplary.

Respondents' opinions about barriers that affected the use of technology were quite diverse. Although lack of funding was a common response, this was perceived as a problem by fewer than half of the respondents. Service providers and administrators disagreed on other factors affecting technology use. Service providers were much more likely to find fault with number of computers in the classroom, currency and reliability of technology, and scheduling for computer use than were administrators. And nearly half of the service providers found that limitations on installing software independently (without authorization or approval) affected their use of technology. However, nearly one-third of the administrators believed there were no barriers to technology use.

Responses to questions that specifically addressed AT use in schools strongly suggest that it is underutilized. Only 2% of respondents in either group mentioned AT in their descriptions of exemplary practices. When service providers were asked about the AT devices they used in their classrooms, the most common response was low-tech options, such as pencil grips. The vast majority of respondents stated they had no or minimal training to use AT, and about one-third stated they were not involved in AT decision-making. In fact, responses to questions about the manner in which AT decisions were made suggested that, in the majority of cases, schools did not follow a systematic, data-driven process. Staff training was identified most frequently as a barrier to AT use in the schools. Respondents also indicated the need for training for families and students. In an open-ended question asking service providers to discuss problems in using AT, only about half the respondents provided an answer. Among those who answered, service providers described the need for more devices and for more knowledge about AT use.

In conclusion, the responses to these survey questions indicate that further professional development is the most pressing need for Michigan educators interested in promoting the use of technology to address the needs of students with disabilities. Educators need more knowledge and experiences related to uses of technology, in general, and to applications of AT, in particular. Educators could benefit from models and pilot programs in which technology is more fully integrated into the curriculum. Furthermore, models of AT decision making, and investigations of the impact and feasibility of various models, would be of potential benefit in stimulating more widespread and effective use of AT. Given discrepancies between administrators and service providers related to the ease and reliability of technology use, services providers' perceptions and needs should be fully considered in the design of future professional learning opportunities.

In addition, there is little evidence to suggest that AT is a consistent part of pre-service teacher preparation in Michigan. AT competencies are not required in state requirements for certification or endorsement, and it is not known to what degree information about AT is included in various pre-service and in-service teacher education programs throughout the state. The Michigan Department of Education could play a leadership role in requiring such competencies to be a component of every special education teacher preparation program.

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Appendix N: Enabling Educational Transformation

We see an imposing set of challenges ahead. We are not sanguine about the possibility that educational technology can easily solve the achievement issues we face. But we do believe that the evidence is clear that educational technology can make a major difference, if it is approached with sufficient care and wisdom.

What can educational technology offer? When it is applied within a classroom to support the current mode of teaching, for example, to access information, for rote learning, or for communication with others outside the school, it can make an important difference. Even greater changes have been achieved when teachers use technology as enabling more fundamental changes in what they teach or how they teach it. The key in all instances is that the technology allows teachers to do something they wanted to do all along, in some cases more effectively, in other cases making it practical to do at all.

An example of such a transformative effort to improve achievement, especially among low-income and special education students, is the eMINTS program initiated in Missouri (eMINTS, 2005). This program encompasses grades three to eight. It has been carefully assessed and shows improvements in many areas, and is being adopted in other states.

To help make the above comments more concrete, there are profiles of teachers in Appendix C to provide specific illustrations of what is possible. As further supporting information, there are reports and research publications cited in Appendix D that portray the potential for change.

The caution we must add is that effective incorporation of educational technology in the curriculum is far more complex than many understand. Most important is that each teacher has a meaningful level of professional learning opportunity, so each is well prepared to use the new resources. This is a process that takes years. While there are immediate gains when educational technology is first introduced, the full depth of change does not emerge until after several years of experience. Given the evolving array of possibilities with educational technology and the deepening understanding of curriculum materials and pedagogy, it is safest to assume that this really means a continual learning process for each teacher for the foreseeable future.

This emphasizes that there are no quick solutions to utilizing educational technology. To improve education through the use of educational technology, we must think of it as a long-term process of forming the truly effective learning environment. We see enabling educational transformation as a process that requires concerted work on multiple fronts, with a long-term plan being as aggressive as our resources and knowledge allow at each stage, building year after year.

Appendix O: Supporting Information for Leadership

1 Leadership

Michigan will provide leadership for educational technology in order to expand and develop transformative learning environments that increase student achievement.

The National Educational Technology Plan (U.S. Department of Education, 2004) includes leadership as one of its seven prime areas where action should be taken. The plan's summary statement:

> For public education to benefit from the rapidly evolving development of information and communication technology, leaders at every level – school, district, and state – must not only supervise, but provide informed, creative, and ultimately transformative leadership for systemic change. (p. 39)

We believe that everyone in a leadership role in education in Michigan should be performing as the national plan recommends. There are well-informed and visionary educational leaders in Michigan who have a rich and insightful understanding of what educational technology offers for all aspects of education, and for student learning in particular. But they are too few in number, and they are not able to operate in an educational culture in which educational technology is understood as a source of meaningful solutions to many challenges, especially as a core element in elevating the quality of education. We recommend four strategies be pursued at the statewide level to meet the leadership objective of this plan.

Our first action is strengthening our state leadership. One element of this is a recommendation to elevate the level of the person leading educational technology within the Michigan Department of Education to be at the table and a partner in the overall leadership of that crucial organization. We suggest this be a position of Chief Educational Technology Officer, reporting at the top level, following the model of similar positions that have been widely adopted by major businesses, universities, and governmental agencies. The development of deep understanding of the value and use of educational technology on the part of all educational leaders is an on-going process that will be continually evolving, including within MDE. Just as there are experts in curriculum, in professional learning, in the array of funding programs and regulations, in special education, and in other areas that interact closely with each other in establishing statewide policies and programs, expertise in educational technology must be a constant, trusted, peer-level presence in these interactions. Anything less poses the too-frequent prospect that the opportunities and issues involving educational technology are not considered or are treated as an afterthought.

A suggested second, complementary action in strengthening state leadership is the creation of mechanisms for communication, cooperation, and coordination among the multiple agencies and organizations that operate on a statewide basis. We term this the Coalition for Education Technology. One specific purpose of this Coalition would be to guide the implementation of this plan, including coordinating the work of multiple groups noted in the suggested Action Steps, and in reviewing and guiding the evolution of the plan. We suggest that MDE's Chief Educational Technology Officer be the head of this Coalition.

These two complementary actions provide an appropriate level of attention and balance for carrying forward this Educational Technology Plan. This Committee has reviewed past technology plans (see Appendix V) and found that implementation has invariably been a challenge; we therefore have provided specific actions to address this.

Two additional points about the Chief Educational Technology Officer position warrant mention. One is that this person should not be directly responsible for any day-to-day operational aspects of information technology for MDE; the talents of this person must be entirely focused on educational outcomes for the state as a whole. Secondly, the level of this position should be considered relative to the magnitude of educational technology activities for the state as a whole and not in the context of just budget level or headcount within MDE. This is a position of leadership that, through the Coalition, addresses a much broader spectrum.

Another aspect of leadership in educational technology is the depth of understanding that all educators, both administrators and teachers, possess. As statewide policy, we recommend that standards be established based on national references and that professional learning aligned to those standards be available. This would establish a baseline of individual proficiency that should be assumed of all educators. In turn, it is recommended that recognition be given to those who demonstrate exceptional performance in this area.

As assistance to all educational leaders, we recommend the creation of rubrics for assessing and managing the effective use of educational technology. This is a part of both developing a shared understanding within the educational community of what is appropriate and expected, and also facilitating consistent application across the state.

In an allied effort, we recommend establishment of model processes for building and sustaining educational technology integration in the curriculum and in the operation of our schools. This would include a coordinated development of these models through professional associations, a mentoring process, and professional learning opportunities for educational technology relevant to school board members.

The intent of the these recommendations is that Michigan have the leadership that can address the magnitude of challenges that must be faced, as identified in the background information for this plan and evident beyond what has been stated here. We believe that "technology integration" while a pertinent concept, has fallen well short of what its advocates have desired. The real purpose must be to look at ways to improve education, especially student achievement and learning in more general terms, and utilize educational technology to foster improvements that are as effective as possible. As the national educational technology plan states, what we seek is that:

> … leaders at every level … provide informed, creative, and ultimately transformative leadership for systemic change (p.39)

Appendix P: Supporting Information for Digital Citizenship

2 Digital Citizenship

Every Michigan student will be proficient in technology and will demonstrate the ethical use of technology as a digital citizen and lifelong learner.

Broadly speaking, technology is put in schools for two inter-related purposes, one reflected in the above objective and the other in the objective stated in the next section concerning overall student learning; these two are:

- to develop technology literacy in students so that they can function in a society where technology plays an increasingly important role
- to improve the achievement of students in traditional academic subjects such as math, science, social studies, and language arts

These two purposes have been in place for decades, but we now need to examine them in the context of the dramatic changes in technology and substantial lessons we have learned about technology and education over the past decade. The most relevant changes for a discussion of technology and learning are availability of access and integration of online activities.

Over the past ten years, student access to technology has changed significantly. In school alone, access to modern information technology has become much more common, according to some recent statistics. Appendix K provides detailed information on access within our schools. There has been rapid progress on this, and at least the same pace is plausible for the future.

The second change is in the integration of technology in student lives, as has already been discussed in Appendices H and I. Today students spend significantly more time online and engage in more activities in other technologically mediated activities than ten years ago. Virtual life has become part of students' real life, according to a study of the Pew Internet and American Life Project entitled "Teens and Technology: Youth are Leading the Transition to a Fully Wired and Mobile Nation" (Pew, 2005). This study, conducted in late 2004, reports the following:

- **Close to nine in ten teens are Internet users.**
  The vast majority of teens in the United States, 87% of those aged 12 to 17, now use the internet. Not only has the wired share of the teenage population grown, but teens' use of the internet has intensified. Teenagers now use the internet more often and in a greater variety of ways than they did in 2000. There are now approximately 11 million teens who go online daily, compared to about 7 million in 2000. Those teens who remain offline are clearly defined by lower levels of income and limited access to technology. They are also disproportionately likely to be African-American.

- **Teens are technology rich and enveloped by a wired world.**
  An overwhelming majority of all teenagers, 84%, report owning at least one personal media device: a desktop or laptop computer, a cell phone or a Personal Digital Assistant (PDA). 44% say they have two or more devices, while 12% have three and 2% report having all four of those types of devices. Only 16% of all teens report that they do not have any of these devices at all.

- **Email is still a fixture in teens' lives, but IM is preferred.**
  For many years, email has been the most popular application on the internet—a popular and "sticky" communications feature that keeps users coming back day after day. But email may be at the beginning of a slow decline as online teens begin to express a preference for instant messaging (IM). 75% of online teens - or about two-thirds of all teenagers - use instant messaging. Compared to 42% of online adults, 48% of teens who use instant messaging say they exchange IMs at least once everyday.

- **Half of families with teens have broadband.**
  Families with teens, like much of the rest of online America, are evenly divided between households with broadband and households with dial-up. While families with teens are more likely than other Americans to use the internet, they are no more likely than other Americans to have broadband connections.

- **Most teens use shared computers at home and growing numbers log on from libraries, school, and other locations.**
  Though teenagers are prone to log on wherever there is an internet connection—whether at home, at school or at a friend's house—the vast majority of teens go online most frequently from home. And while one-quarter of wired teens have private access in an area like a bedroom, almost three-quarters use computers located in open family areas that are shared with others in the family.

- **The size of the wired teen population surges at the seventh grade mark.**
  Going to junior high seems to be the tipping point when many teens who were not previously online get connected. While about 60% of the sixth graders in our sample reported using the internet, by seventh grade, it jumps to 82% who are online. From there, the percent of users in the teen population for each grade climbs steadily before topping out at 94% for eleventh and twelfth graders. Much of the lag among sixth graders appears to come from boys. Fewer than half (44%) of sixth grade boys report going online, compared to 79% of sixth grade girls.

- **Older girls are power communicators and information seekers.**
  Older teenage girls (aged 15-17) have driven the growth in many of the communication and information-seeking categories since our last survey. Older teenage girls have a much higher level of engagement with a wide array of these activities than do either boys of the same age or younger boys and girls (aged 12-14). They are more likely to use email, text messaging, search for information about prospective schools, seek health and religious information, and visit entertainment-related websites.

What Lessons Does Experience Teach Us?

Much research has been conducted with regard to technology and learning over the past decade. Experience provides important guidance for this objective, the next one, and the entire plan. Examples of actual educator experience in Michigan are in Appendix C and selected research studies are cited in Appendix D. Past research and practices suggest the following:

- Technology holds great potential to improve student learning.
- Technology has not been used as extensively and effectively as expected, thus the realized benefits of technology do not match the level of investment.
- Technology does get used when it naturally fits and is understood as a tool for specific educational strategies. For example, PowerPoint has become a popular tool for many teachers as a presentation tool and the Internet has been commonly used by teachers and students to search for information.
- Online learning/virtual courses have grown significantly.
- However, many potentially powerful uses of technology have not been realized.

From Computer Literacy to Digital Citizenship: Redefining Technology Proficiency

The content of technology education has historically changed many times, from computer repair/service as part of vocational education to computer programming to help develop logic thinking skills, from computer appreciation to computer applications, from information literacy to technology literacy over the past few decades. Currently Michigan and many other states use the definition of technology literacy developed by a national association, the State Educational Technology Directors Association (SETDA, 2003):

> "The ability to responsibly use appropriate technology to communicate, solve problems, and access, manage, integrate, evaluate, and create information to improve learning in all subject areas and to acquire lifelong knowledge and skills in the 21st century."

This definition does not adequately reflect the changes in technology access and student activities with technology for a number of reasons, including:

1. It does not recognize that technology has already created a new world of living for students. This virtual world (enabled by online activities, cell phones, and video games) is a new way of living and learning. This world is governed by new rules and procedures. This world is part of and connected with the real physical world and is as real to the students psychologically as the real physical one. Thus students need to learn how to live in this world and how to best connect the virtual and real world. Failure to do so can result in serious developmental and psychological consequences.

2. Knowledge and skills to operate the technology are no longer of prime importance because many students have acquired them elsewhere, and if not, the technology has become more user-friendly than before and thus students can learn to use it more quickly. What is important, however, are the fundamental concepts of digital

technology or Fluency with Information Technology - FITness as defined by the National Research Council (NRC, 1999).

Thus we propose to expand beyond technology literacy to *digital citizenship*, which can be described as preparing students to be productive citizens in a digital world (Honey, 2005; Lazarus, 2005). They should have the knowledge and ability to fully and responsibly participate in a new world created by digital technologies. They should have the ability to appreciate the similarities and differences between the real and the virtual as well as the physical and the simulated. They should have the ability to live, lead, and prosper in a world that is increasingly supported by digital technologies. They should have the cognitive ability to learn and manipulate new technology tools on their own and the ability to quickly discern the benefits and negative consequences of new technologies and their associated uses.

Technology literacy remains of crucial importance, of course, even while we move to a broader concept in digital citizenship. At the national level, student learning is most specifically addressed in the No Child Left Behind (NCLB) requirement for 2006 that all eighth grade students be designated technologically literate. The Michigan Department of Education has established the Michigan Educational Technology Standards (METS, 2005) for students in kindergarten through grade eight to assist districts in preparing for the NCLB requirement.

Appendix Q: Supporting Information for Student Learning

3 Student Learning

Every student will have meaningful technology-enabled learning opportunities based on research and best practice that include virtual learning experiences.

The discussion of the Digital Citizenship objective focused on proficiency, literacy, and ethical use of technology. This companion objective shifts the focus to educational technology as a facilitator of learning in all subjects, all grades, for all students.

The phrase "technology integration" has been used increasingly in the last decade to indicate that educational technology should become an integral part of education. Unfortunately, this was all too often taken to mean that the technology was to be "pushed into" the existing learning context, rather than being seen as an opportunity to increase the effectiveness and quality, and in particular to take advantage of technology to change how learning takes place, for the better.

We must adopt an approach in which we view every aspect of the process of student learning with the intent of improving it with educational technology. This is a journey, one upon which many educators have already embarked, but which for many others will appear challenging and even in conflict with their own perceptions of priorities for learning. It is a journey because we know there are few "do it once and forget it" answers, few short-cut solutions. The journey will be one of continual learning on the part of educators all across Michigan.

This plan covers many of the facets of what needs to be done, with many inter-related elements that should each be moved forward. The core message here is that educational technology offers important opportunities for improved learning for every student, in every grade, and every course. We are not urging that it all be done at once; we are recommending that everyone in education look thoughtfully and knowledgeably at every opportunity and move much more rapidly in building the layer after layer of advantages for students.

An enormous range of opportunities is available to improve student learning. Some of the possibilities can be seen by reviewing the Teacher Profiles in Appendix C. These are just a sampling of what has already been accomplished by talented, foresighted teachers. The following are several general characterizations that are useful "trail guides" for the journey:

- Educational technology is of value in enabling more effective performance of existing tasks, such as students preparing papers with word processing or using the Web to locate information. This approach can be of real value in existing classroom settings and builds understanding and skills for more encompassing applications of educational technology.

- There is great benefit in using educational technology for assessment, both formative and summative, and for data-driven decision making. Educational technology can make it easier to collect the information, such as when doing it invisibly as a by-product of normal learning activities. Educational technology can facilitate more rapid access to the information, especially important for teachers as they seek to address individual needs.

- Virtual learning should be encouraged as a way to extend access to high quality learning resources to students that may not otherwise have access. This may be in such forms as online, virtual classes and schools; field trips to remote locations or discussions with distant individuals; or use of simulations to explore a model of some process or concept.

- Educational technology may allow more individualized instruction, with students working at their own pace and focused on their must crucial issues. At the same time this may provide teachers with more time to address individual student needs, barriers, and opportunities for progress.

- The accessibility of learning materials may be expanded to serve a broader range of students, such as those with some forms of disabilities. When considering how educational technology can enhance or transform learning, take advantage of collaborative activities such as the Michigan's Assistive Technology Resource (MATR) and the Regional Assistive Technology groups.

- Educators have talked about transforming education for many years, have looked at systemic change, and have sought mechanisms for reshaping what happens in the classroom and beyond. For example, educational technology can allow teachers to follow a constructivist approach in ways that are otherwise all but impossible. Project-based learning can become a stronger focus. Cross-disciplinary projects are often more readily fostered when educational technology is used to facilitate the process. When we look at these approaches to transformation, an intimately related discussion is whether and how the desired transformation can be fostered and supported by educational technology.

- Communication among students, their parents, and teachers may be strengthened with educational technology, through such means as email, class information on Web sites, and projects being more engaging and visible to parents.

- The world of work is often more visible through technology and increasingly infused with technology. The ability to create learning experiences that assist students in understanding careers is extremely powerful, such as through direct experience with scientists in a project that addresses a real-world issue, or working with an automotive engineer to modify the mathematics and logic of an engine computer, or working with a local government agency on an online survey of local residents' needs.

- Educational technology is an excellent vehicle for developing students' skills in working with each other. Students working in pairs or larger groups often learn more effectively, and learn how to collaborate, how to work in teams, and how to be better communicators. These are especially important skills for the world ahead, including the ability to work together and communicate with technology as an intermediary.

- The ability to pursue each of the above is greatly enhanced as access to educational technology increases. As students have more constant, individual access to the equipment, the software, the network, the information, and the communications, they can pursue both more individualized learning and be more active participants in shared or collaborative learning, and each teacher can take a more transformative approach to the learning process. We know that ubiquitous access is in every person's future; key questions involve how soon this happens in our schools and how we manage that transition so that we take maximal advantage of it.

- An extension of having ready access whenever needed in school is recognition that today much of student access to educational technology takes place outside school, primarily at home as well as libraries, and during evenings, weekends, and the summer. Many opportunities for learning exist outside of school, and while it means addressing how to make out-of-school access available to all students and overcoming issues of the digital divide, such access will expand learning and set the habits of a life of learning.

Another aspect of the journey is our own learning about how to improve what we as educators do. As we move into the second half of the decade, preparing students for digital citizenship and a global work environment, we believe that increasing academic achievement through the implementation of educational technology stands out as a focus area for continued improvement. At the same time, in the current situation it is difficult to compare the results of the many isolated projects that have been developed on a stand-alone basis. The struggle to assess student progress in technology literacy and subject area application is ongoing while the analysis of data gathered to determine progress is not currently done in a systematic manner with outcomes that can be applied to consecutive improvement projects. While some progress has been made, we would benefit by being more deliberate and working to build the integrated information resources on the research findings as districts raise the bar toward 21st Century skill development.

Appendix R: Supporting Information, Data-Driven Decisions

4 Data-Driven Decisions

Every educator will use data effectively for classroom decision making and school improvement planning through an integrated local and statewide decision support system.

All states and territories are struggling to meet the challenges of collecting and connecting vast amounts of educational data and leveraging the opportunities for creating meaning out of data through emerging technologies. While the process of collecting educational data is not new, connecting that data into meaningful patterns for use in data driven decision making is the single greatest challenge in the field of educational data and information management in the new millennium. The three primary components of the lifecycle of educational data are:

- collecting educational data
- connecting multiple data sets over time and
- providing meaningful reports that can be used to improve schools and education policy

This three-part framework guides what we call an educational decision support system that comprises state, local district, and school-building levels. Decision support is a system enabled by information technology that facilitates data driven decision making by educators, policy makers, and other educational stakeholders.

To enable schools and policy makers to use data to improve schools and policy, the state must develop a statewide educational data management system and provide stakeholders with the data, tools, and knowledge to use it. Educational stakeholders include students, educators, administrators, state administrators, policy makers, parents, and the public. Educational information management is a collaborative effort among these stakeholders and depends upon the ability for local and state information systems to exchange data through common standards. While local educational entities currently provide compliance data to the state, the state must transform that data into timely and useful information that will make a difference in the educational experiences of students.

The infrastructure supporting an educational decision support system will be successful only if users of the system build the processes that ensure a “Culture of Quality Data” throughout all three stages of the educational data lifecyle (National Forum on Education Statistics, 2004). According to the “Forum Guide to Building a Culture of Quality Data,” when schools, districts, and state agencies embrace a Culture of Quality Data, they show concern in the following major areas:

- Accuracy: the information must be correct and complete. Data entry procedures must be reliable to ensure that a report will have the same information regardless of who fills it out.
- Security. The confidentiality of student and staff records must be ensured, and data must be safe.
- Utility. The data have to provide the right information to answer the question that is asked.
- Timeliness. Deadlines are discussed and data are entered in a timely manner.

Both infrastructure and data processes must come together to achieve the goal of information management that will help to prepare students in Michigan to become productive citizens in a global society.

The No Child Left Behind (NCLB) Act requires states to publish annual achievement, attendance, and graduation data for students in grades three through eight and high school, along with a full set of demographic information. Schools and districts are additionally required to use these data to inform continuous improvement decisions at the local level. The good news is: federal policy has resulted in the creation of truly robust state-level data sets for the first time. The bad news is: many states, including our own, are ill-equipped to manage the data and facilitate effective decision-making for school improvement.

The Michigan View: The scope of work for a comprehensive decision support system in Michigan is complex and spans multiple state agencies. The following section details the limitations of Michigan's current capacity, including findings from the Decision Support Architecture Consortium (DSAC, 2005) review of the state conducted in the spring of 2005:

- Michigan has over 820 intermediate, local, and public school academy districts, which presents challenges for comprehensive statewide support and assistance.
- Michigan has recently added objectives for tracking students from pre-kindergarten through 20 education, which adds greater complexity to an already complex undertaking of educational information management for the K-12 setting.
- Although Michigan has been collecting data through separate source systems in the last few years, the state has not yet begun connecting data sets longitudinally over time as required by NCLB and the Individuals with Disabilities Education Act (IDEA) and is at risk of non-compliance.
- The current data management process lacks comprehensive rules for data management, presentation, and dissemination, including clearly defined roles and responsibilities among data stewards and end users of the educational data management system.
- State and local educational data systems rely on a file transfer process and lack the interoperability to achieve efficient and secure exchange of data.
- Local and intermediate districts have begun investing in educational information decision support systems without a statewide integrated and collaborative plan that will maximize the investment of state school aid funding.

Michigan's two greatest and most immediate challenges for achieving student data compliance are:

1. Producing a four-year cohort graduation and dropout rate by 2007.
2. Tracking assessment data longitudinally by student ID for all students including the NCLB required disaggregated data for the following subgroups: low income, special education, racial/ethnic minorities, and Limited English Proficiency programs

Failure to report on NCLB will result in the withholding of Federal Title I administrative funds, hampering the state's ability to provide technical assistance to high priority schools, possibly resulting in the layoff of staff and reducing the impact of resources on student-focused activities.

While NCLB is the driver behind many of the compliance requirements of a longitudinal DSS, the language of the NCLB statutes has yet to reflect clear funding for these complex infrastructures and processes that need to be in place to meet the statutory requirements. Michigan, like other states, must engage in the challenge of finding stable funding and increasing support from this point forward to build flexible DSS systems that will expand with the needs of the continuously increasing volume of data that must be tracked longitudinally.

Appendix S: Supporting Information for Professional Learning

5 Professional Learning

Every educator will have the technology competencies to enable the transformation of teaching and learning to improve student achievement.

The National Educational Technology Plan (U.S. Department of Education, 2004) states that:

> Teachers have more resources available through technology than ever before, but have not received sufficient training in the effective use of technology to enhance learning. Teachers need access to research, examples, and innovations as well as staff development to learn best practices. (p 40)

The International Society for Technology in Education (ISTE, 2002) makes the same point and extends and expands upon it:

> Teachers must be prepared to empower students with the advantages technology can bring. Schools and classrooms, both real and virtual, must have teachers who are equipped with technology resources and skills and who can effectively teach the necessary subject matter content while incorporating technology concepts and skills. Real-world connections, primary source material, and sophisticated data-gathering and analysis tools are only a few of the resources that enable teachers to provide heretofore unimaginable opportunities for conceptual understanding.
>
> Traditional educational practices no longer provide prospective teachers with all the necessary skills for teaching students, who must be able to survive economically in today's workplace. Teachers must teach students to apply strategies for solving problems and to use appropriate tools for learning, collaborating, and communicating. (p 5)

Teachers have a crucial role in student learning. The following (Hawley, 1999) makes the general impact of their role clear.

> On the basis of a comprehensive review of research on alternative explanations for student achievement conducted by the U.S. Department of Education in the mid-1980's, Hawley and Rosenholtz (1984, pp. 3, 7) concluded:
>
>> In virtually every instance in which researchers have examined the factors that account for student performance, teachers prove to have a greater impact than program. This is true for average students and exceptional students, for normal classrooms and special classrooms.
>> …There is an enormous amount of evidence that teachers have a significant impact on efforts to change schools and on the nature of the student's

experience, whatever the formal policies and curricula of a school or classroom might be.

> Teachers modify curricula, intentionally or not. They keep the gates through which students must pass to gain access to the learning resources available. Teachers allocate and manage the students' time, set and communicate standards and expectations for students' performance, and in a multitude of other ways enhance or impede what students learn. It follows that the improvement of schools requires the improvement of teaching. (p 128)

The above is a general observation, confirmed by many more recent research reports, and there is every reason to believe it applies as well to teachers when the topic is their using educational technology to improve learning.

More importantly, the above may not capture the full story; there appears to be a powerful factor that mediates the above conclusion – whether the teacher has actually been able to incorporate improved teaching methods in an effective manner.

The importance of careful attention to the effectiveness of professional learning for teachers (often also called professional development) is illustrated by "The Teaching Gap" by James W. Stigler and James Hiebert (Stigler, 1999), which is an extension of the TIMSS study to look in detail at teachers' classroom practice in the U.S., Germany, and Japan. The study is based upon careful analysis of teacher practice, as captured on video, in 231 randomly selected classrooms across the three countries. The subject matter was eighth grade mathematics. We note conclusions of the authors, which seem relevant well beyond the specific subject matter:

> Although variability in competence is certainly visible in the videos we collected, such differences are dwarfed by the differences in *teaching methods* that we see across cultures.
>
> Although most U.S. teachers report trying to improve their teaching with current reform recommendations in mind, the videos show little evidence that change is occurring. Furthermore, when teachers do change their practice, it is often in only superficial ways.
>
> This will not surprise those who have worked in the field of teacher professional development. The problem of how to improve teaching on a wide scale is one that has been seriously underestimated by policy makers, reformers, and the public in this country. The American approach has been to write and distribute reform documents and ask teachers to implement the recommendations contained in such documents. Those who have worked on this problem understand that this approach simply does not work. (p. 12)

The TIMSS study (see page 50) provides an important context for understanding teacher impact, because it gives U.S. students a relatively low ranking on achievement compared to other nations. We need to understand why that is. Here we have evidence in one key subject matter area that a key difference is in teaching methods, and that in turn is at least partly a result of the ineffectiveness of specific approaches used in professional development.

Further commentary on professional development (Hawley, 1999):

> …Collinson (1996) sees eight shifting aspects of staff development, all of which would promote teacher inquiry. In the old paradigm, in-service workshops emphasize private, individual activity; are brief, often one-shot sessions; offer unrelated topics; rely on an external "expert" presenter; expect passive teacher-listeners; emphasize skill development; are atheoretical; and expect quick visible results. In contrast, in the new paradigm, staff development is a shared, public process; promotes sustained interaction; emphasizes substantive, school-related issues; relies on internal expertise; expects teachers to be active participants; emphasizes the why as well the how of teaching; articulates a theoretical research base; and anticipates that lasting change will be a slow process. (p. 134)

In recent years the statewide professional learning efforts in Michigan in educational technology have worked to overcome many of the shortcomings noted above. Most are a hybrid of face-to-face learning and online learning. Most work to have the participating teachers individually engaged with materials that are immediately relevant to each of their classrooms, addressing the combination of pedagogy and content that will make a difference. There is time given to collaborative learning. In a number of respects, the methods used in this professional learning are modeling what is possible for the teachers to do with their own students in their own classrooms.

These previous efforts are often for selected teachers from a school, rather than the entire staff. Whether the school administration is supportive or not is another major variable. We know that real progress entails a long-term process of professional learning, but for many teachers this is something they have to squeeze out time for on their own. Furthermore, peer groups of like-minded professionals can be hard to find except in the invaluable professional associations such as MACUL.

It should also be noted that there have been instances in Michigan in which technology was put before teachers with relatively little attention to the basics of its use, minimal professional learning about how it would impact teaching, and with what might be termed "cantankerous" technical support. That is ultimately a very costly way to approach any innovation, and ill-effects should not be attributed to the educational technology. It is true that a number of teachers figure out how to cope with such situations, but that does not make this a model to be replicated.

In spite of the work done on professional learning about educational technology, Michigan still has many teachers who are at a minimal skill level. The Technology Counts 2005 (Education Week, 2005) survey indicates that 22% of Michigan schools have at least 50% of their teachers who are at no better than the beginner level. (Other information is on page 61) Of the 35 states with data on this topic, about two-thirds report better levels of teacher preparation than Michigan.

Another perspective on Michigan's educators is found in Appendix L where the results from the IDEA Partnership survey are presented.

A cornerstone for meeting this objective is that professional learning for teachers is a long-term, standards-based effort that is greatly enhanced if there are statewide efforts that can be leveraged at the local level. Further, we believe that the leadership and support of administrators at the local, regional, and state level is crucial to overall progress toward the goal, and have recommended corresponding strategies. Further, it is essential that pre-service education, at our colleges and universities, be continually improved. Our recommendations are focused on the state-level policies and practices, including statewide efforts, that establish the standards, coordinate work, and create shared information that will facilitate the improvement of the overall process.

Finally, we believe that as the professional learning recommendations are put into practice, substantial benefits will be seen beyond the realm of educational technology. Many of the tools, concepts, and learning processes that we advocate have broader applicability. Most important, they inherently will focus primarily on improving learning in specific areas of the curriculum, with educational technology simply as a facilitating and supporting capability.

Appendix T: Supporting Information for Broadband Access

6 Broadband Access

Every Michigan classroom will have broadband Internet access to enable regular use of worldwide educational opportunities.

The 2004 National Technology Plan (U.S. Department of Education, 2004) gives three recommendations for states, districts, and schools regarding high speed connectivity and related support. These are all intended to emphasize that broadband should be available all the way to the end-user for data management, online and technology-based assessments, e-learning, and accessing high-quality digital content:

- Reliable infrastructure for broadband
- Broadband for educational uses
- Sustaining broadband infrastructure

We use the term "broadband" to describe connectivity that allows the user to access resources online without limits and in a manner that is affordable, convenient, and technologically neutral. In more technical terms, it means a connection speed that is 1.5 Mb/s (million bits per second) or higher to the workstation and supported by an infrastructure that allows for peak usage by all users at a level of no more than 80% saturation under normal loads.

Michigan school districts have implemented broadband through a combination of leased circuits, privately owned fiber, and wireless technologies. Often an ISD or RESA is the regional organizing point, acquiring large amounts of bandwidth and establishing the connectivity from the Internet to local school districts. In turn the districts handle the networking between and within buildings. According to *Education Week's* Technology Counts 2005, 88% of instructional computers are connected to high speed Internet Access, compared to an average of 89% nationally. We do not have independent data with which to verify those numbers. As noted earlier, Michigan has a somewhat higher proportion of student computers in central lab sites, which simplifies networking, but would indicate a relatively larger number of classrooms without broadband access. The majority of schools still lack the appropriate infrastructure needed to integrate the full-scale use of digital materials in the classroom

There continues to be a great need for sustained, discounted pricing and higher bandwidth options. In Europe and most of Asia, broadband services typically run at 20 Mb/s and higher at costs similar to what U.S. consumers pay for 3 Mb/s service. We may think the U.S. is a world leader in technology, including broadband and the Internet. But as in so many other areas today, we may be lulled into complacency if we use other parts of the U.S. as our point of comparison on networking costs and capacity. A recent report by

Thomas Bleha in *Foreign Affairs* (Bleha, 2005), which is a publication that is technology-neutral, states the following;

> [From 2000 to 2003] the United States dropped from 4th to 13th place in global rankings of broadband Internet usage. Today, most U.S. homes can access only "basic" broadband, among the slowest, most expensive, and least reliable in the developed world, and the United States has fallen even further behind in mobile-phone-based Internet access.
>
> Today, nearly all Japanese have access to "high-speed" broadband, with an average connection speed 16 times faster than in the United States -- for only about $22 a month. Even faster "ultra-high-speed" broadband, which runs through fiber-optic cable, is scheduled to be available throughout the country for $30 to $40 a month by the end of 2005. And that is to say nothing of Internet access through mobile phones, an area in which Japan is even further ahead of the United States.
>
> It is now clear that Japan and its neighbors will lead the charge in high-speed broadband over the next several years. South Korea already has the world's greatest percentage of broadband users, and last year the absolute number of broadband users in urban China surpassed that in the United States. These countries' progress will have serious economic implications. By dislodging the United States from the lead it commanded not so long ago, Japan and its neighbors have positioned themselves to be the first states to reap the benefits of the broadband era: economic growth, increased productivity, technological innovation, and an improved quality of life.

More recent data about adoption rates of broadband in leading nations (ITU, 2005) shows the U.S. has dropped to 16^{th}.

To add additional perspective, the number of broadband subscribers in the U.S. in 2003 was about 26 million, the number in Korea in 2002 was 10 million, and the number in China in 2004 was 43 million. (De Argaez, 2004) A more recent article in Telecommunications Policy (Frieden, 2005) contains the following information:

> Broadband network development does not always track closely a nation's overall wealth and economic strength. The International Telecommunication Union reported that in 2005 the five top nations for broadband network market penetration were: Korea, Hong Kong, the Netherlands, Denmark and Canada. The ITU ranked the United States sixteenth in broadband penetration.
>
> … in 2002 Japanese consumers paid $0.09 per 100 kilobits per second of broadband access compared to $3.53 in the United States.

We must keep pressing for this fundamental enabler in our schools, networking bandwidth, to be accessible to all students, through as much of the day as possible, at the lowest possible cost.

While there are many examples of high bandwidth (broadband) utilization in schools, some of which are mentioned elsewhere in this plan and as part of the discussion of the next objective, (see page 101) these instructional opportunities are not universally available to every classroom or effective for every student, due to insufficient infrastructure and support to all classrooms. Furthermore, they need to be more widely available outside school. To realize our state's objective of a connected Michigan (DIT, 2004), where "access is just a click away, where services are streamlined and secure, and where citizens have an immediate voice in an open and energetic public square" (p. 9) there should be

1. Broadband access in every classroom
2. Broadband access for students after school

These are ambitious strategies, yet necessary for the betterment of our students' educational experience. Success in following these strategies will depend heavily on the network of established statewide associations, the creation of State of Michigan Educational Technology leadership, and sustained funding through current programs such as eRate.

The eRate program is of major importance to many Michigan schools who qualify on the basis of their student population. Thanks to eRate, Michigan schools saved an estimated $148 million in telecommunication and internet access fees since the program's inception in 1998. We believe that additional resources and support should be provided to ensure that every student in Michigan will have access to appropriate educational technology.

Through high bandwidth, not only do the educational resources available to educators increase, but the tools of doing the business of education benefit. Utilizing private fiber, consortiums of school districts help consolidate resources and realize economies of scale through high bandwidth. The bandwidth afforded by private fiber enables graphical, more intuitive student, financial, and other applications to be deployed. When one entity, such as an Intermediate School District, can manage consolidated services, including hardware and technical expertise (i.e., for operating within in an Application Service Provider model), all participating school districts receive higher quality applications and better support than most/all of them could achieve independently. Several ISDs in Michigan have implemented this model of consolidated services, including but not limited to Calhoun ISD, Kalamazoo RESA, and Wayne RESA.

Appendix U: Supporting Information for Shared Resources

7 Shared Resources

Every educator and learner will have equitable and sustained access, through statewide coordination and support, to resources necessary to transform teaching and learning through educational technology.

There are many ways in which statewide efforts can improve learning through broadening access to educational technology resources. Our strategies address two general areas. First, access to an array of quality teaching and learning resources should be fostered. Second, high quality technical support should be facilitated through statewide services and appropriate service guidelines.

Teaching and learning resources

There has already been statewide investment in providing educational technology resources that are of benefit to teachers and students across Michigan. The Library of Michigan secured federal resources several years ago to create Access Michigan, which has now become MeL, the Michigan Electronic Library. This provides access to a large number of online information resources at school, in libraries, and at home. It is an example of what such a program should be and the Library of Michigan should be commended for this program. At the same time, educators throughout Michigan should recognize that it is a program that requires constant attention and support for its on-going funding; this is not just an issue for the library community.

A number of other educational technology resources have been funded on a statewide basis and warrant attention to their on-going support. Michigan Teacher Network (MTN) is one example of this, cited in recommendations elsewhere in this plan. LearnPort is yet another example. As noted in the discussion of the funding objective, these programs are often started with one-time funding from state or (as is the case with MeL and MTN) substantial federal investment. But the one-time funding must be transitioned to a base of sustaining support, as the deep value of these programmatic efforts is recognized.

Another instance of highly valuable educational technology resources has been the classroom video materials available from a variety of vendors. The REMC Association took the lead several years ago in negotiating a license for these materials with as many schools as participants as possible. Nearly two thirds of all school buildings in the state of Michigan have subscriptions to online video content. Through this content, instructional videos identified by Michigan grade level content expectations are available in the classroom. Much of the success of this type of technology in the classroom has been through the REMCs and ISDs providing cost and technologically effective solutions for schools. The limitation remains with the school buildings having access to high speed bandwidth and video projection units in all classrooms, as addressed in the last objective above.

This is the kind of effort that should be continued, and an example of the sort of work that should be expanded to even more educational materials. A further point about the negotiation of license fees, also relevant to the Funding objective below, is that a modest amount of assistance from the state with funding of the initial license would have made it possible to offer this service to many more schools and at lower cost. We need to be ready to take advantage of such opportunities to leverage purchase of services in the future.

Another very important use of video is two-way, interactive video, often termed videoconferencing. One of the biggest applications of high bandwidth educational applications used today in Michigan schools is videoconferencing. TWICE, Two Way Interactive Connections in Education, is Michigan's K-12 videoconferencing organization, involving participants from all over the state. Berrien County ISD is the home for the TWICE database of videoconference content from around the world. The content is correlated to the Michigan Curriculum Framework standards. These applications and others make videoconference technology an essential tool for curriculum based teaching and learning. According to a Fall 2004 TWICE study of videoconference access in Michigan (the terms H.320, H.323, broadband, MPEG 1, and MPEG 2 all refer to characteristics of the technology):

- 25 counties have access to H.320/H.323 videoconferencing at the ISD/RESA level
- 24 more counties have H.320/H.323 access in local districts and the ISD/RESA level
- 5 counties have broadband videoconferencing to the ISD/RESA and local districts
- 3 counties have MPEG 1 or 2 videoconferencing to the ISD/RESA and local districts

Videoconference technology is currently used in many areas of the state for many purposes:

- Areas such as the Upper Pennisula, Genesee county, and the counties serviced by St. Clair RESA share classes at the middle school and high school levels.
- The Michigan Department of Education, REMCs, MSBO, MIEM, and other organizations use videoconferences to deliver professional development content to educators throughout Michigan. Many of the ISDs with local district videoconference access deliver core content area professional development to local educators.
- ISDs with strong local use of videoconferencing such as Macomb, Saginaw, and St. Clair deliver literacy based programs such as ASK (Author Specialist Knowledge) in which K-12 students within their service area have discussions of books with the author.
- TWICE coordinates statewide projects such as Michigan Week: Exchange and Where in Michigan, as well as a national Read Across America celebration, benefiting over 350 Michigan classrooms each year.
- The REMC Association recently worked with five local museums, including Cranbrook Institute of Science and the Michigan State University Museum, to develop videoconference content to Michigan students.
- The IDEA Partnership is working with the MSDC (Michigan Staff Development Council) to deliver professional learning on the facilitation skills needed for quality videoconferencing experiences, using videoconferencing.

Virtual schooling is another area where statewide investment is having major impact. Online education has the potential to significantly impact productivity factors related to both the delivery of educational services and academic achievement results (Watkins, 2005). Policy leaders at all levels are beginning to examine new and engaging delivery systems that exploit the power of the Internet to improve teaching and learning and expand instructional opportunities for all students. Both the Lt. Governor's Commission on Higher Education and Economic Growth (Cherry Commission, 2004) and the National Education Technology Plan (U.S. Department of Education, 2004) call for fundamental changes in public education and in the preparation of the workforce for the future. The U.S. Department of Education has determined that schools may implement e-learning strategies in an effort to meet Federal No Child Left Behind (NCLB) requirements.

Michigan has played a leadership role in the U.S. by promoting the use of e-learning at the K-12 level. Public Act 230 of 2000 authorized implementation of the Michigan Virtual High School (MVHS). Since its inception, the MVHS has provided more than 20,000 online course enrollments and served more than 125,000 students with an online MEAP, ACT, SAT and/or PSAT review tool. Last year, MVHS provided online instructional services to nearly 400 high schools in Michigan. In addition, the MVHS regularly receives requests to provide online instructional services for elementary and middle school students. (MVHS, 2005; Dickson, 2005)

According to a 2004 statewide survey by the Michigan Association of Intermediate School Administrators (MAISA), virtual learning is occurring in all regions of the state. More than 200 educational leaders participated in the survey that revealed the following:

- Forty percent or less of elementary, middle, and adult education students have some form of virtual learning for direct instruction, compared to 93% of high school students who have some form of virtual learning experience.
- Sixty percent or more of those that responded felt that virtual learning for curriculum enhancement has a moderate to significant impact on student motivation, achievement, and involvement.

The possibilities for combining the just-discussed video resources, both streaming and two-way interactive, in virtual school materials is an important area in which increased, consistent access to broadband means that the developers of these course materials have additional ways in which the learning experience can be enhanced.

E-learning-based instruction can be as effective as other forms of instruction, and can help students to develop 21st century learning skills. The growth of e-learning at the K-12 level is very promising. However, no state, region, or local school district in the U.S. is currently assisting all or a large percentage of their students to become successful online learners as a targeted workforce development strategy.

The above describes existing applications that have been used in a significant number of schools in recent years; they are established as proven components for the application of educational technology to improve learning. There are also emerging applications that should be anticipated as experiencing heavy demand within the time period of this Plan.

The strategies that are recommended all anticipate such developing areas where statewide efforts will provide leverage for all educators and students. In each case there are major advantages if statewide project work establishes standard mechanisms for access, shared purchase programs if needed, and a focused effort to provide professional learning and support. Examples:

- **Remote equipment control:** many scientific, medical, engineering, and manufacturing devices may be remotely controlled. This may be useful for learning how to use the device, such as an industrial robot. This may be a scientific or engineering instrument that enables students doing scientific research, such as an electron microscope at a university.

- **Formative assessment:** There is great value when teachers quickly understand how each student is doing. Formative assessment may result from information collected while a student works at the computer or online, it may be collected by hand-held tools the teacher uses during class observation, or it may be explicit, quick testing done by the teacher – an online version of the classic pencil and paper test.

- **Geographic Information Systems (GIS):** Many events and subjects have elements in which geography plays a significant role. Systems that allow teachers and students to look at local, regional, national, foreign, or global distributions, overlaying various kinds of information, and seeing variations with time, are all powerful assets for learning. Google Earth is one recently available tool that illustrates the simplest of the concepts.

- **Collaboration systems:** Current two-way interactive videoconferencing is just the beginning of accelerating development in this area, where online chat systems are merging with videoconferencing systems, and they are adding the ability to share control of applications such as a Word document or Excel spreadsheet, show the video of multiple participants at multiple locations, and have shared whiteboards, voting, and other familiar group process functions. These will prove invaluable to administrators, to teachers engaged in professional learning, and to students who work with students from other schools, perhaps even outside the U.S., and with adult experts and practitioners in may fields and professions. This will be one of the important learning experiences for the future world of work, learning how to be effective in various forms of technology-mediated collaboration and teamwork.

Technical support services

High quality technical support within our schools is a crucial capability, one that may make all the difference between a vibrant use of educational technology or one in which it is used with trepidation and in only the most basic manner. Part of the approach in this plan is providing improved information about solutions to problems to educators throughout the state. This partly serves to relieve the routine load on skilled technical support staff, and it also supports those situations where technical support depends in substantial measure on staff without formal training in technology support and trouble-shooting. The plan, in another facet, addresses the provision of guidelines to schools on organizing appropriate, effective technical support.

The importance of generally available support resources can be seen in the following from a recent report (Hanson, 2005) titled “Effective Access” by Katherine Hansen and Bethany Carlson. This was a survey of several hundred teachers of science, mathematics, and technology to determine what was helping and hindering the use of educational technology.

> Almost half of the teachers said that they themselves were their only source of technical support. The rest of the teachers said that they could turn to a technology coordinator and/or other teachers. (p. 25)

Appendix V: Supporting Information for Funding

8 **Funding** $

Michigan will develop innovative methods of funding to transform and sustain teaching and learning through educational technology and build local, regional, and statewide capacity.

There is no question that Michigan faces serious structural problems with everything funded by state government, including public education. One relevant commentary on state governments is in the book *The Price of Government: Getting Results We Need in an Age of Permanent Fiscal Crisis* by Dave Osborne and Peter Hutchinson (Osborne, 2004). They speak of state governments in general, but their remarks apply to Michigan as well as any:

> The rising costs of health care, Social Security, public pensions, prisons, and interest on the public debt have put the price of government under immense upward pressure. Yet that pressure has met enormous resistance to broad-based tax increases. … [The] federal price of government [has been pushed] down to its lowest level in 50 years, by cutting taxes and borrowing the difference. Spending borrowed money may create the illusion that we're getting more for our money, but it is virtually impossible at the state and local levels, because such massive borrowing is nominally illegal. …
>
> This fiscal collision is undermining vital state and local services, while generating massive federal deficits. These circumstances suggest that some tax increases are inevitable. But given the political realities, we believe that our government and school districts must dramatically improve the services they offer, if citizens are to willingly pay a higher price. … Our public institutions must learn to work harder, but more important, they must learn to work smarter. (p 19)

The National Educational Technology Plan (U.S. Department of Education, 2004) echoes these thoughts:

> Needed technology often can be successfully funded through innovative restructuring and reallocation of existing budgets to realize efficiencies and cost savings. The new focus begins with the educational objective and evaluates funding requests – for technology or other programs – in terms of how they support student learning. Today, every program in *No Child Left Behind* is an opportunity for technology funding–but the focus is on how the funding will help attain specific educational goals. (p 40)

This statement in the National Plan carries a subtle but profoundly important subtext that must be understood by anyone contemplating the funding of educational technology. Five years ago a number of federal programs for funding educational technology were widely used in Michigan to advance education in many ways. In more recent years, those federal programs were totally restructured. The money that was explicitly for educational technology was folded into all the other programs of No Child Left Behind, and at the same time it was stated that there was flexibility to allocate those moneys as newly targeted, to educational technology, where that allocation was the right one to "help attain specific educational goals". The practical impact in Michigan was primarily to reduce funding for educational technology, with most educators not realizing that had happened. This is a key cause of the decline in statewide educational technology noted in the earlier background section. (See pages 59,on page 61)

The recent Technology Counts 2005 (*Education Week*, 2005) displays another facet of funding for educational technology. The following table shows state expenditures for educational technology.

State	Ed Tech Expenditures	2004 US Census	Per Capita Expenditures
MI	$5,450,000	$11,112,260	$0.49
National			
TX	$117,800,000	$22,490,022	$5.24
FL	$55,640,000	$17,397,161	$3.20
CA	$15,311,000	$35,893,799	$0.43
Great Lakes			
WI	$18,493,000	$5,509,026	$3.36
OH	$36,000,000	$11,459,011	$3.14
IN	$6,425,000	$6,237,569	$1.03
IL	$4,135,000	$12,713,634	$0.33
MN	$1,650,000	$5,100,958	$0.32

This shows a relatively low per capita expenditure level in Michigan. It might be assumed this is because Michigan is putting all the funding into the general State Aid funds sent directly to the schools. But recall that the same *Education Week* issue shows that Michigan ranks among the worst (43rd out of 50 states) in how many students are supported by each available classroom computer. (See page 61)

Statewide funding is often a sensible way to gain a cost advantage, leveraging the statewide investment to make a service or product available at lower cost throughout the state. It can also be a way to speed a process, where the availability of the funds, and in some cases the associated services or products, means that all schools, administrators, and teachers have the ability to move ahead regardless of local circumstances. Of course there are many times in which local action will be faster, but a balancing of these approaches, statewide, regional and local, is very important to foster.

A constant topic during the deliberations that have led to this plan has been whether to provide recommendations on budgets for specific items, or to note which ones are more matters of cooperative action or policy-making (many are). There have also been questions about whether to recommend specific educational programs, such as advocating more educational technology allocations under NCLB, focusing specifically on the AYP schools, for example. Another constant topic of discussion was whether to have a specific recommendation on sustaining Freedom to Learn. The conclusion we've reached is that our task was to articulate the value of educational technology and address how we may better use it to address student learning and reaching this plan's goal. What level of investment there should be in the overall programs for improving our schools and student learning, and what portion of that funding should be educational technology, is really a much broader topic, well beyond the scope of the committee that has produced this plan. We offer educational technology as a powerful array of capabilities for those overall programs and hope this plan has increased understanding of that potential and shown a path for effective incorporation of educational technology in all educational improvement planning.

When we advocate innovative approaches to funding, we mean both with the use of existing resources and the identification of new resources. In keeping with the comments of the previous paragraph, we do not have specific suggestions for particular recommendations, but we can outline several strategic considerations. The first of those is to make sure that all possible sources of funding are considered. The possibilities include funds that come from:

- State Aid funds allocated to districts
- Local millage and bond proposals
- Federal Title I, NCLB allocations
- eRate
- One-time state allocations (example: the Teacher Technology Initiative)
- Private foundation grants for specific projects (example: Gates, Microsoft)
- Corporate partnerships (example: Apple partnership with a Detroit High School)
- Federal research grants (example: university projects involving K-12)

The second strategic consideration is the time-scale and nature of the educational technology activity. This is the framework used for the strategies recommended in this plan. There are three categories that we have decided to use for activities involving educational technology:

1. Innovative uses, where there is strong expectation of success but the approach has not been tried before or there are new elements that add uncertainty. This is often seen as of a limited time-span, long enough to determine the success of the approach. Typically this is done with one-time funding, with that funding often coming from one of the last three categories above. These activities are usually done in only one or a few districts, with a research and evaluation component to determine success.
2. Adoption of best practices, making the transition based upon innovative uses that have been proven effective, into practices that are widely adopted. This is often associated with phrases such as "successful replication" or "making it scale" or "seeing how it works under different conditions." This often involves the ability to build upon experience gained during the innovative use stage, and even use materials developed at that time, such as for student and professional learning; this happens much more often if there is deliberate planning for this. The adoption process may require a heavy expenditure rate for a period, as the transition is undertaken and completed.

3. Long-term sustaining support, where an approach or practice has been adopted, but must be maintained, upgraded, and modified to keep pace with what is learned about making the approach more effective. There is a further characteristic that is within this one, that of multi-purpose educational technology. The Internet, the computers, the central servers, the individual and classroom displays, and many items of software such as Web browsers, email clients, word processors, spreadsheets, and PowerPoint, are all tools that may be used for multiple learning and administrative purposes. When they are in place, making the investment for undertaking either of the first two categories, innovation or adoption, becomes much less expensive and considerably easier.

In the deliberations of this committee that have led to this plan, the most challenging discussion of an innovative program was that for Freedom to Learn, the laptop program. On the one hand, there is considerable enthusiasm and evidence about the value of this approach to learning. As a means of supporting a transformation in education, it has shown remarkable promise. On the other hand, the funding implications for the adoption phase and the long-term sustaining support, especially in the current context of fiscal crisis and many other challenges to be faced at the same time, led many say it would be impossible to support a recommendation to proceed to wide adoption and making this part of the fabric of education in Michigan. If passion on both sides is an indicator of an important topic, this one qualifies. Anyone reading this full plan will probably find themselves struggling with the same confounding issues.

As Action Steps for each of the three recommended strategies, we've identified statewide efforts that will advance the use of educational technology. We want to emphasize that when we address the statewide activities, we are addressing a crucial point of leverage for all districts, for all educators in Michigan. We are also addressing a level at which important steps can be taken to assure equality of access across Michigan, making sure all educators have selected resources available to them either without further cost or at the lowest possible marginal cost. Yet the investment is by many measures quite modest. Many of the statewide recommendations involve policies and coordination. Most of the funds are expended through LEAs or ISDs. Using the Technology Counts 2005 (*Education Week*, 2005) figure of $5.5 million in state funding for educational technology, we see that is only 0.043% of the total State Aid funding of $13 billion, or about $3.08 for every one of Michigan's 1,785,160 students at that time. This educational technology plan is a guide for using those modest state resources to assist and guide the overall investment being made in Michigan to improve learning.

Appendix W: The History of Michigan's Educational Technology Plans

Michigan has an extensive history of statewide planning for educational technology (NCREL, 1996). The first state technology plan approved by the State Board of Education was the *Michigan State Board of Education Technology Plan (1987)*. In 1990 a document titled *Education: Where the Next Century Begins* proposed the creation of a five-year technology plan. In 1991 the Michigan Department of Education created an Office of Education Technology. In 1992 the State Board of Education adopted a five-year State Technology Plan that contained 22 recommendations. The following year, 1993, the State Superintendent appointed a Technology and Telecommunications Planning and Advisory Group (TTPAG) to facilitate the implementation of that technology plan and advise on associated policy issues.

Five years after the first State Technology Plan was adopted, in 1997, the State Superintendent created an Educational Technology Advisory Group (ETAG) for the purpose of advising on technology policy and planning. This led to the production of *Michigan's State Technology Plan (1998)*, which was the foundation document for several rounds of updates in the years to follow. It contained 21 recommendations and 14 belief statements (MDE, 1998), and the following statement:

> It is the Board's intent that unlike its predecessor, *Tech Plan '98* should not have an expiration date. It will be reviewed on a recurring basis and amended as needed to retain the relevance and vitality necessary to serve as "a living document."

In 1997 another statewide technology planning effort took place, under the leadership of Senator Carl Levin. A series of discussions and meeting were held, culminating in a 1998 meeting of about 500 people in Lansing, titled the "Working Session on Technology in Our Schools." Based on the input from that process, Senator Levin identified funding opportunities for the Teach for Tomorrow professional development project and the COATT (Consortium for Outstanding Achievement in Teaching with Technology) partnership among universities, colleges, and professional organizations.

The Council of Michigan Foundations, with primary support from the W.K. Kellogg Foundation, created the Michigan Information Technology Commission in 1998, and one of the major segments of Michigan's economy upon which it focused was education. Among the recommendations of that Commission was the creation of an organization to foster the implementation of the Commission's recommendations. This was the impetus for the creation of Cyber-state.org (now known as CyberMichigan).

Following the intent of the State Board of Education, another less extensive effort was put into the production of *Michigan's State Education Technology Plan (1998) – Update 2000*. Rather than rewrite the document, sections were added at the end of each recommendation that provided a status report and then additional recommended actions (MDE, 2000).

During 2000 the State Board of Education established five Task Forces to address high priority issues in education. One of those Task Forces produced *Embracing the Information Age* (MDE, 2001), from which five policy recommendations were adopted by the Board (MDE, 2002).

In late 2001 and early 2002 a group of educational technology leaders from different organizations in Michigan came together to serve in an advisory capacity to the Michigan Department of Education. This was facilitated by Cyber-state.org. The group called itself TEAM (Technology for Education Alliance in Michigan), and produced *Michigan's educational technology future: leadership actions* (TEAM, 2002).

With the enactment of No Child Left Behind (NCLB), it became essential for the Michigan Department of Education to examine the implications for educational technology. A group was brought together for this purpose and produced a report that was part of a series of six on various aspects of NCLB. While not a technology plan as such, it contained most of the same elements (MDE, 2003).

In 2004 another review of the 1998 plan was initiated and resulted in *Michigan's State Technology Plan (1998) - Update 2004.* As in 2000, the approach taken was to leave earlier materials intact and provide additional information on the current situation and further recommendations for actions. At the completion of this update and subsequent adoption by the State Board of Education (MDE, 2005), it was decided that there should be a fresh start on an educational technology plan for Michigan. That is what led to the work on this plan.

There are many common threads through all these plans. There is also considerable change in the areas receiving emphasis. Some of this is visible in this brief description of the earliest plans (MDE, 1998):

> *Education: Where the Next Century Begins* featured 14 Goals, including one that called for the creation of a five-year state technology plan. It also encouraged coordination in four major areas: 1) investments in educational technology; 2) support for the integration of technology-based programs in the curriculum; 3) technical assistance to educational agencies to maximize the successful use of technology; and 4) professional development to upgrade the technological skills of educators. Two years later, *Michigan's State Technology Plan (1992-1997)* was adopted by the State Board of Education. It included 22 Recommendations categorized into five major themes: 1) restructuring schools using technology; 2) developing statewide telecommunications systems for teaching, learning and communication; 3) professional development for the learning community; 4) technology investments for the future; and 5) copyright and fair use implications.

Appendix X: References

In addition to the references here, all of which are used in the text of the document, there are additional references in Appendix D (see page 42) each of which is annotated to assist you in identifying other useful reports and research publications.

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