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Learning technology policies in action : Where do the States stand?

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In states with technology plans, there is a common belief that technology has the power to increase the effectiveness and efficiency of the learning environment of the classroom. Many states' technology policies and plans reflect a demand for information about student learning outcomes and the cost and benefits of education programs. The eight states in the North Central Regional Technology in Education Consortium (NCRTEC) are: Illinois, Indiana, Michigan, Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin.

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Learning Technology Policies in Action

Where Do The States Stand?

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Abstract

In states with technology plans, there is a common belief that technology has the power to increase the effectiveness and efficiency of the learning environment of the classroom. Many states' technology policies and plans reflect a demand for information about student learning outcomes and the cost and benefits of education programs. The eight states in the North Central Regional Technology in Education Consortium (NCRTEC) are: Illinois, Indiana, Michigan, Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin. The need for district spending in education technology, such as computer training, professional development, service/support networking, supplies, and hardware, has become a major issue across the states. Technology tools used in classrooms provide both formative and program information to teachers, students, curriculum directors, and policy makers for their individual and collective needs.

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CHAPTER ONE

Introduction

The purpose of this research paper is to review the importance of professional development for teachers as schools work to effectively use computers in classrooms. Issues include making professional development an integral part of school technology plans, providing teachers with hands-on learning experiences, and supplying educators with the necessary technical support.

In their report Policies To Support The Use of Technology In Education, Ramirez & Bell (1997) indicate that states are asked to take the lead in:

(1) Developing a plan for integrating technology throughout the curriculum and assuming that (a) technology is an intellectual tool useful for creating, exploring, interpreting, generalizing, constructing, and reasoning, (b) the appropriate use of technology can improve both what is taught and learned and how it is taught and learned, (c) access to a wide variety of technologies must be possible for all students and teachers.

(2) Specifying the technological resources that should be available to all students, classrooms, schools, and districts.

(3) Identifying the professional development that will be necessary in order to integrate the technology.

(4) Assuming responsibility for management, accountability, and operation of the system, allowing for (a) a flexible system of reporting that can meet local, state, and national accountability

requirements, (b) a management information system that is integrated and flexible enough to provide necessary information relevant to policy considerations over time.

(5) Developing appropriate instructional goals, objectives, and strategies. Ramirez & Bell (1997, p. 42) go on to say that many of the state technology policies and plans reflect a demand for information about student-learning outcomes and the cost and benefits of education programs. With such information at hand, the assumption is that accountability and decision-making will be made easier and more cost-efficient.

Technology is seen as having the unique potential to help create real sustained reform in education. It is considered a means for restructuring the learning process and more effectively meeting student needs in a global/information society. State planners in the North Central Region Technology Education Consortium (NCRTEC), integrating technology into the education system through telecommunications and electronic networks will transform education at the building, district, area, and state levels to support the learning process (Remirez & Bell, 1997).

Purpose

States and local education agencies are engaged in many technology development activities in education, but the picture does not provide a clear focus or direction for where to take us into the future. That will require further planning. There is much to be learned about the effective process of integrating technology into curriculum, instruction, learning, and teaching.

The purpose of this paper is to review the available literature and to discuss its implication regarding the need for state technology planning. All states should have a technology plan. Every state should evaluate their plans and have a schedule for revising them. This paper also focuses on technology-based tools to enhance effective teaching and learning, training and professional development and increasing technology capacity to help schools and districts build the technical and support infrastructure needed to sustain long-term technology integration.

The focus will be on the North Central Regional Technology Education Consortium (NCRTEC), as well as the eight states involved to view the development of technology, and how each state's plan and policies help create a better educational environment.

CHAPTER TWO

Review of the Literature

Over 22,000 schools and 6,000 districts are in the North Central Regional Technology Education Consortium (NCRTEC, 1999, p.3) region. NCRTEC is a developing strategic partnership with the intermediary service agencies in each of the states. The goal is to work closely with these agencies to assist them in providing high-quality professional development opportunities to the schools they serve. The work is geared toward a research-based professional development model that involves five dimensions:

Building a Knowledge Base

Observing and Analyzing Models

Reflecting on Practice

Changing Practice

Gaining and Sharing Expertise (NCRTEC, 1999, p. 3)

NCRTEC (1999) also states that the goal is to bring the NCRTEC library of components and strategies to clients to help them develop and provide courses, workshops, and on-going professional development opportunities. Some of the components in this library include:

Research-based information on the web

Video tapes

Software tools and resources for classroom use

Teacher-collaboration support

Tools for self-evaluation and reflection (p. 3)

The focus of the NCRTEC (1999) curriculum is on the use of technology to support learning. Curricular areas under development include:

(1) Using technology to enhance learning communications;

(2) Building depth of knowledge through models and simulations;

(3) Using technology to support collaborative knowledge integration;

(4) Assessing and using information resources for learning;

(5) Using technology to demonstrate learning to authentic audiences;

(6) Using technology to support on-going assessment (p. 3).

State of Illinois

The Illinois State Board of Education's (1999) Goal 5 reads, "All Illinois public schools will have effectively use of technology as a resource to support student learning and improve operational efficiency" (p. 30). According to the State of Illinois Board of Education "a number of activities have been initiated at the state level to support this goal, including the launching of the Educational Technology Hubs, the deployment of a state wide computer network, the establishment of internet points of presence" (p. 30). Grants to 292 schools are available for on-line curriculum projects, grants to 98 schools and 4 museums for "Museums in the Classroom," strategic technology resources for 36

economically challenged schools, and the development of the Illinois K-12 plan for information and technology.

The purpose of the state-wide network is to assist the learning technology center of the Illinois state board of education in providing "a coordinated state-wide support infrastructure which assists school districts in planning for implementation, assessing, results, and educating school staff in the use of technology and telecommunications in curricular, instructional, and administrative functions" (Illinois State Board of Education, 1999, p. 4). Area One Hub is entirely funded by the Illinois State Board of Education. Regional superintendents and intermediate service center directors comprise each hub's governing board. The governing board ensures that the hub's program plans are aligned with the Illinois State Board of Education contract and with regional needs. Area One serves 306 school districts, 1,460 learning facilities, over 45,000 educators and 862,325 students in suburban Cook, Lake, McHenry, Kane, DuPage, Will, Kendal, and Grundy Counties.

A research study by Education Week (1999) states that Illinois is pushing toward a long-term goal of making technology more accessible to students. Following a four-year period in which state technology spending jumped from $5 million in fiscal 1995 to $43.7 million in fiscal year 1998, lawmakers have slowed the pace a little. They earmarked $48.8 million for education technology this fiscal year - a five percent increase over fiscal year 1999, which ended June 30.

According to a study by Sandham (1999) the state of Illinois is in its third year of a four-year funding formula that allocates between $24.5 million and $26 million in state technology grants annually. Having given the funds to the state's neediest districts in fiscal year 1998, and the next neediest group in fiscal year 1999, the state is now opening its pocketbook to middle-class and suburban districts. The state's wealthiest group of districts will gain access to state technology funds in fiscal year 2001. The one exception to this formula is the Chicago Public Schools which will receive $18 million over the course of three years. For teachers, the state has continued to support opportunities for professional development for all public schools.

State of Indiana

The state of Indiana requires that school districts submit five-year technology plans for spending capital projects funds and technology funds. The new Indiana technology fund provides $10,000 grants to be used for planning by those schools qualifying for major funding. Indiana allocates $4 million annually to the Educational Technology Fund to support three programs: The Buddy System Project, the 4R's Program for early grades, and Access Indiana. The Buddy System Program gives elementary students access to computers at home; Project 4R's is a program that incorporates technology into reading, writing and mathematics instruction in kindergarten and first grade, and various professional development efforts. Access Indiana information network is an interactive communication and transaction system

designed to make communication of information quicker and more convenient for schools and businesses throughout Indiana (Education Week, 1999).

The Indiana Technology fund is currently being supported by $20 million from gaming revenues. It funds Internet Connections and the expansion of the Buddy System Project. The School Technology Advancement Account supports one percent interest loans of $5 million annually. The Computer Learning and Training Account, currently funded at $1.6 million annually, has supported a professional development program for teachers since 1983 (Indiana Board of Education, 1999).

According to the Indiana State Board of Education (1999) all Indiana schools were granted accreditation as part of the Performance-Based Accreditation (PBA) system (1999). These 418 schools represent about 20 percent of all schools that take part in the accreditation process each five years. They include 351 public schools from 40 school corporations, as well as 67 non-public schools.

Intelenet Commission manages a fiber-optic network that connects 256 institutions of higher education, government agencies, and schools throughout the state. As a result of the Indiana Utility Regulatory Commission's approval of an Ameritech regulatory reform plan, Ameritech is investing $120 million over a six-year period to extend an advanced communications network to every interested school, hospital, and major government center in its Indiana service area. This network, which includes broad

voice, data, and interactive video applications, could link as many as 1,700 schools (Natale, 1999).

Natale (1999) states that Indiana made some important strides in education technology, including solidifying its state technology plan and earmarking record sums for local school technology spending.

Huffman (1999), a special assistant for technology to the state schools superintendent, says the General Assembly has stepped up support for school technology. In the biennium that began in July 1999 and ends June 2001, legislators are funneling $55 million from state gaming revenue - which includes proceeds from lotteries, riverboat gambling, and horse racing - into the Technology Plan Grant Programs. Huffman (1999) would prefer that more technology funding came from the general fund because gaming revenue can be subject to fluctuations.

State of Iowa

"Education is Iowa's Future" is a state-wide plan for education that directs the State Department of Education to take "a leadership role by developing and communicating a compelling vision for using technology to transform the teaching and learning process, by facilitating the acquisition of technology and providing appropriate staff development" (Iowa Board of Education, 1999, p. 1).

Iowa has developed the Iowa Communications Network, an interactive fiber-optic network, designed to link all of Iowa's K-12 schools, education agencies, community colleges, colleges, and

universities. Phases I and II of the Network, creating a state-wide backbone, are complete. Phase III (see Appendix D), connecting all school districts, area education agencies, and some public libraries will be completed soon. In 1995, the legislature appropriated $36 million for fiscal year 96 and fiscal year 97 for operating and completing Part III. They instituted a bill in 1996 that appropriated $150 million over five years to develop and fund instructional technology in public schools.

Natale (1999) states the Iowa legislature has once again put cash behind its commitment to school technology by allocating $30 million in the current fiscal year for schools to spend on hardware, software, and infrastructure. The financial support has been steady in this state. The School Improvement Technology Act, passed in 1996, set aside $30 million per year for five years to further school technology. Iowa lawmakers recently agreed to extend funding until 2003.

"Many of my colleagues and I believe technology, especially through distance learning, is necessary to maintain strong schools" (Kramer, 1999, p. 82). "The diversity of the curriculum we can offer in small districts using distance learning is very important to us" (p. 82). Every district gets a share of the money based on its student population. Among other things, the funds have helped to support an effort to connect every district to the Iowa Communications Network.

Now in its third year, the five-year project is on target to provide every district with at least one link, usually at a high

school, by the end of the current school year (Pfitzenmaier, 1999).

State of Michigan

The state government is planning for the creation of a Michigan Information Network -- a "Virtual Network" that would ensure the availability of high-speed, high quality voice, video, and data communications for K-12 schools, community colleges, universities, libraries, medical facilities, governmental units, private businesses, and the general public. Also the State Board of Education is on record as supporting the use of technology in education through the 22 recommendations in it's five-year State Technology Plan (State Technology Curriculum, 2000).

Michigan Department of Education (2000) talks about assessment information and the reading program. Michigan is committed to the goal that all children will become independent readers by the end of third grade. The Curriculum Development Program has focused its efforts to support the development of a Reading Progress Portfolio and the Michigan Summer Reading Program. A list of training sites for the Michigan Literacy Progress Profile is available. Also available is a list of the 1999 summer reading program grantees. Their curriculum framework consists of focusing on content, teaching and learning, assessment, and professional development. Standards under development will address teacher preparation programs.

Teachers, administrators, and parents have voiced their needs for leadership to use the standards for improvement of student

achievement. Curriculum development staff use a strategy of promoting use of the standards directly with state-wide content organizations, intermediate school districts and targeted local school districts and individual school buildings (Michigan Board of Education, 1999).

The challenge for school technology advocates remains the same: how to move technology ahead in local districts without state dollars dedicated to the cause (Milken Exchange, 1999). The biggest short-fall in Michigan is that it has been unable to have any state appropriation for any technology, whether it is hardware, software, or professional development. Most of the money Michigan's school systems spend on technology comes from local bond issues or from federal grant programs. One time grants totaling approximately $10.5 million were awarded to two state-wide and six regional projects in 1995 by the Michigan Public Service Commission -- the result of a sharable earning case involving Ameritech.

State of Minnesota

Minnesota's Department of Children, Families and Learning (1999) states that learning requires managing and giving meaning to information yet schools have few information technologies. While some schools in Minnesota have invested heavily to provide information technologies to teachers and students, the majority of schools have limited information in the classroom to assist in the learning process. In addition, some families are able to purchase these technologies for their children to use at home; the majority

of schools, however, lack the resources to find information technologies to support the learning process (Bradley, 1999).

Increasingly, schools and individuals with information technologies are the "haves"; they can access information via local, state, and global networks. These schools have the tools to provide learning tailored to individual learning styles. They can provide teachers with efficient and effective means to manage student information and develop curriculum based on the latest research. These schools are equipped with the information technologies needed to help learners achieve in an information-intensive society and workplace. Schools without information technologies are the "have-nots". They must try to meet the challenges of the information age without the tools that most organizations see as critical to effective and efficient operation. These schools try to help students learn how to manage information without the technologies they use at home and work.

Minnesota's districts received record increases in overall education funding, but it will be up to them to spend some of it on technology (Bradley, 1999). After years of earmarking money for specific projects, the legislature decided to give districts more flexibility to pursue their own initiatives. Just $14.9 million was set aside specifically for technology in the biennium that began in July, down from nearly $91 million in the previous two years. The state will spend a total of $7.8 billion on K-12 education.

The funding strategy represents a philosophical shift among Legislators and Reform Party Governor Jesse Ventura toward local flexibility, officials say, rather than a lessening of the state's commitment of school technology. "The Governor is a very strong proponent of local control" (Hasledalen, 1999, p. 90). "He favors giving money to school districts and letting them determine where they should spend the money" (Hasledalen, 1999, p. 90). Although lawmakers cut state funding for the Minnesota Technology Learning Academy, there is an effort to train teachers to use technology and integrate it into their classes.

State of North Dakota

Partnership with the North Dakota State University System and the Department of Public Instruction have created two state-wide programs: The Center for Innovation In Instruction, which provides technology-related training and Technical Assistance, and SEND-IT, which is the state's K-12 computer network and internet gateway (State Support for Technology In Education, 2000, p. 2).

The Education Standards and Practices Board (ESPB) is the agency which approves professional development as acceptable for license renewal in the State of North Dakota. The ESPB, as part of its role, developed a model for the schools to use as they seek to improve professional development, and continues to work to assess state needs, and project programs responsive to those needs. In this role, the ESPB has developed professional development guidelines and has completed an evaluation of the status of professional development in the state (North Dakota

Board of Education, 1999). Over 150 individuals across the state have been trained on the use of the model.

Manzo (1999) says that recognizing that technology may hold the key to teaching a rapidly shrinking and geographically distant student population. North Dakota has dramatically expanded its offering over the internet this school year with some 180 courses available to students throughout the state.

In a state where many tiny districts are unable to offer a comprehensive curriculum, the program increases student's options to take electives and other classes. By the end of the year, officials hope that all of the 200 courses available throughout the state will be offered on-line. "Students can take the courses at home, but many districts use them within the high school and have teachers supervise the class" (Linnertz, 1999, p. 20).

According to Linnertz (1999), the legislature voted to spend $6 million of its $540 million biennial education budget on technology-related infrastructure and teacher training, the same amount as the previous biennium, which ended July 30.

State of South Dakota

While several educational organizations have pursued technology planning activities, no state-wide technology plan has been developed. South Dakota does not have a specific state appropriation that supports year-to-year educational technology expenditures. Current efforts in educational technology are funded by a diversity of federal, state, local, and grant resources. The South Dakota Department of Education and Cultural

Affairs presents a key indicator of educational progress in the state for the 1998-1999 school year. To answer the question "How are our schools doing?" The publication includes attendance and drop-out rates, achievement test scores, ACT scores and Board of Regent's feedback on students entering state universities. The information is provided both in state-wide summaries and in individual school district profiles (South Dakota Board of Education, 1999).

Several years ago, Republican Governor William Janklow submitted up an ambitious proposal to wire all of South Dakota's schools to the Internet. Having completed the job in 1998, the state is now focusing on training educators to use technology to teach (Parry, 1999, p. 2).

The state also sponsored sessions for people who manage local-area networks and for school administrators. Federal dollars, South Dakota's Technology Literacy Challenge Fund Grant and Goals 2000 money, paid for most of this training, but about $1 million came from the legislature (South Dakota Board of Education, 2000). In all, the legislature is spending $5.6 million on school technology in fiscal 2000, which began July 1 (Education Week, 1999).

State of Wisconsin

The state published its technology plan in 1996 and intends to revise it in the coming year (Education Week, 1999). Wisconsin did not calculate the cost of implementing the plan and has not conducted an evaluation of it. However, the state partnered with

Quality Education Data (QED), a profit market research firm that conducts an annual survey on education technology at both school and district levels. Wisconsin plans to participate with QED each year in the future. State spending in fiscal year 1998 for the TEACH Wisconsin Technology Program included $27 million in block grants, $2 million in competitive grants for training and technical assistance, $5 million in competitive grants for schools and libraries, and $4.4 million for telecommunications access, for a total of $38.4 million. The funds came from a variety of sources including the state's general fund.

Blair (1999) writes that "...all initiatives will help schools meet the state's new academic standards" which include provisions for technology instruction. The state mandated that districts either adopt the standards or create guidelines of their own. The state standards say technology must be integrated throughout the curriculum in elementary schools. By grades 6-8, technology should be a part of the core curriculum and teachers should emphasize the role technology plays in everyday life. By high school, students should be technologically literate and schools should offer in-depth courses for those interested in engineering, math and science, electronics, and other fields of study in which technology is a large component.

CHAPTER THREE

Discussion

The North Central Regional Education Laboratory (NCREL) is a not-for profit organization dedicated to helping schools--and the students they serve--reach their full potential. They specialize in the educational applications of technology. One of ten Regional Educational Laboratories, they provide research-based resources and assistance to educators, policy-makers, and communities in Illinois, Indiana, Iowa, Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin. NCREL's ultimate goal is to help these eight states build tools and apply proven practices to create schools where all students can develop their skills and abilities (NCREL, 2000).

The NCREL has seven major goals: (1) to create new knowledge and tools -- including strategies and programs for improving school practice -- through collaborative field development and applied research efforts with schools and agencies; (2) provide research-based information and direct assistance to help school leadership teams and policy-makers solve real problems; (3) forge strategic alliances by linking schools, agencies, and organizations with each other to help educators and policy-makers become networked in ways that support on-going learning and pool resources and talents; (4) operate the North Central Mathematics and Science Consortium, which provides direct assistance to schools and districts toward the goal of meaningful, engaged learning through the systemic reform of mathematics and science

education; (5) operate the North Central Regional Technology in Education Consortium, which helps schools and districts integrate technology in education in ways that lead to improved learning for all students; (6) publish NCREL's Learning Point Magazine, which is mailed to every principal, school librarian, district superintendent, and educational service agency in the region and also is available on-line (NCREL, 2000).

To better understand the impact of technology on learning, NCREL documents the three distinct phases of educational technology uses and provide cumulative findings around each use: Print Automation, Expansion of Learning Opportunities, and Data-Driven Virtual Learning. The following questions are asked in each phase: (1) what evidence is there that the use of computer-based technology had a positive impact on learning? and (2) what significance do the findings have for educators today as they try to make technology-related decisions that have an impact on student learning?

For Phase One Print Automation (see Appendix D), Kulikand (1991) conducted one of the most comprehensive studies of the effectiveness of using computers to increase student achievement. In 81 percent of the studies examined, the students in the Computer-Based Instruction (CBI) classes had higher examination scores than students who were taught by conventional methods without computer technology. The typical student in an average CBI class performed at the 62nd percentile on achievement exams:

The average student in a conventionally taught class performed at the 50th percentile on the same exam.

Phase one concludes that research and educator's experiences attest to the value of some technology-supported, closed-ended learning activities in regular classroom and when students need remediation. Sivin, Kachela & Bialo (1996) state that evidence supports the claim that "low achieving students and students with little prior content knowledge are likely to require more structure and instructional guidance than other students" (p. 2).

Phase Two argue that technology studies that focus on the ability to creatively access, organize, display, and communicate information should not measure outcomes using standardized tests. These are tasks that computer technology has been specifically designed to improve and, therefore, the tasks are the more logical places to go when looking for the effects of computers on achievement (Means, Blando, Olson & Middleton, 1993). It also has been argued that the traditional basic skills Tests were not designed to show the value-added education that educational technology represents.

Means & Olson (1995) (see Appendix D) noted that Phase Two technology can be used for four things:

1. Tutorial use, where the technology does the teaching and the system controls what material will be presented in a self-paced environment so students at different levels can move at appropriate, self-determined times.

2. Exploratory uses, where the student is free to roam around the information displayed or presented by the technology. Exploratory uses may promote a discovery or guided-discovery approach to learning facts, concepts, or procedures.
3. Tool uses -- such as word processors; spread sheets; data-base management programs; graphing software; desk-top publishing systems; internet browsers; and video recording, digitizing, and editing equipment -- where the curriculum resides not in the software but in the instructional activity for which the tool is used.
4. Communication use, where the technology allows students and teachers to send and receive messages and information to one another through network or other technologies, giving students and teachers access to a broad range of resources.

Meta-analysis of computer-based instruction and multi-media applications (see Appendix C) indicate that the effectiveness of educational technology on improving student achievement depends on a match between the goals of instruction, characteristics of the learner, the design of the software, the technology, and the implementation decisions made by teachers (Sivin, Kachala & Bialo, 1993).

There was at least one study of the effectiveness of technology during Phase Two. The Software Publishers Association (SPA) commissioned an independent meta-analysis of 176 studies

focusing on the effectiveness of technology in schools. The report concludes that the use of technology as a learning tool can make a significant difference in student achievement as measured by standardized tests (Sivin, Kachula, & Bialo, 1996). Positive effects on achievement were found for all major subject areas, in preschool through higher education, and for both regular education and special needs education.

Schools that have been successful in implementing educational reform measures have discovered methods for stimulating creative and critical thinking skills and the mind's seemingly endless capacity for learning. Reports of best practice and program evaluations show that students become energized and engaged when given the leeway to explore, inquire, and make connections between their prior knowledge and new-found answers to their questions about the way the world works (Johnson & Johnson, 1996). Teachers and professional experts often find themselves inspired by the questions children ask and the conclusions they draw from their collaborations. A very powerful rationale for using technology is that it gives license to try new open-ended and collaborative ways of learning and teaching. However, educational experiences show that efforts to introduce open-ended uses of technology require significant teacher professional development opportunities and a sufficient critical mass of technology before it benefits students.

Phase Three data-driven decision making (see Appendix D) is much different from the instructional management systems found in

Phase One software or integrated learning system. Instead of tracking the mastery of isolated skills or knowledge facts, data-driven decision making now encompasses making systemic changes in curriculum, instruction, and assessment to the extent that it requires changes in student roles, teacher roles, and teaching and learning tasks and expectations. Data-driven practices help facilitate effective learner-centered practices.

Phase Three, more than Phases One and Two, recognizes that teachers are extremely important in any use of technology and they need new kinds of professional development assistance. John Bailey, Director for the Office of Educational Technology, Pennsylvania Department of Education, stated "You may have the best computer, the most sophisticated curriculum software, and the fastest internet connection...but if that teacher doesn't know how to use any of that, it's not going to improve education" (Rivero, 1999, p. 54).

The Minnesota Department of Education and the NCREL analyzed data derived from the Third International Mathematics and Science Study (TIMSS) concluded that Minnesota students were extremely competent on some key "Gateway" concepts and lacked significant understanding of other "Gateway" concepts. Gateway concepts are those concepts so important to a content area that failure to understand them has a severe impact on learning of the subject matter. At the same time Minnesota Legislature demanded that evidence be provided that technology and technology professional

development were addressing important learning needs (NCREL, 2000).

Fully implementing an effective development program as part of a well-designed technology plan requires support from school administrators and leaders. Administrators must have a clear vision of technology to support student learning and an understanding of the roles that all school staff must play in achieving that vision. Under the State Plan Program, Sec. 3603, (see Appendix A) states in general, in order for a state to receive a grant or an allocation of funds for any fiscal year, such state shall have in effect for such fiscal year a state plan. Such plan shall designate the state educational agency as the state agency responsible for the administration of programs. State Programs, Sec. 1203, (see Appendix A), states each state that receives a grant under section 1202(d)(1) may use not more than 5 percent of the grant funds for the cost of administration; and providing through one or more subgrants or contracts, technical assistance for program improvement and replication, to eligible entities that receive subgrants under subsection (b) which states in general...each state shall use the grant funds received under Section 1202(d)(1) and not reserved under subsection (a) to award subgrants to eligible entities to carry out even start programs.

A significant portion of the technology budget should be allocated for professional development. School districts, typically devote no more than 15 percent of their technology

budget for teacher training but a better amount would be 30 percent (Office of Technology Assessment, 1995).

Sec. 3133, State Application, (see Appendix A) states, to receive funds, each state educational agency shall submit a statewide educational technology plan which may include plans submitted under the Goals 2000: Educate America Act or other statewide technology plans which meet the requirements of this section. Such application shall be submitted to the secretary at such time, in such manner, and accompanied by such information as the secretary may reasonably require.

"The education technology that is implemented today must allow for increased capabilities in the future, rather than the threat of total replacement of the system," note Bell & Ramirez (1997, p. 42). The technology used for professional development should be the same as the technology used in the classroom. Funds should be available to provide teachers with technology that they can use at home or in private to become comfortable with the capabilities it offers. Funding also should be considered for a networked computer on every teacher's desk to allow telecommunications support for teachers and provide easy access to programs and files.

The Recommended Educational Technology Guidelines states each institution should have, as part of its institutional strategic plan, an educational technology plan that addresses the acquisition use, financing, and maintenance of educational technology for teaching purposes. The institution should have a

process in place for keeping the plan current as technologies develop, relative costs change, and institutional policies evolve. As a minimum, the plan should address the campus data network, the campus video distribution system, faculty and staff development, and the campus infrastructure to facilitate the use of technology to support teaching and learning. Development of the plan should involve the institutions faculty, staff, students, and administration and other persons as appropriate.

Heinich, Molenda, Russell, & Smaldino (1999) suggest that within the context of doing wonderful things in service of humanity, a core aim of educational technology is a cost effective achievement of measurable learning objectives. Educational technology is especially important because we aspire to help our students achieve high-level worthwhile objectives, but in the context of limited time and resources.

Heinich et al (1999) add that educational technology is a systematic process involving application of knowledge in the search for replicable solutions to problems inherent in teaching and learning.

Conclusions

Research and trends show that technology applications have been heavily influenced by reform movements within education, cognitive science, learning theories, and societal/cultural demands. A review of research shows that technology can and does help students develop all kinds of diverse skills from the basics to higher-order thinking. However, for technology to be truly

successful, schools need to maximize the effectiveness of their investments in technology by using it in a spectrum of ways. Effective technology uses minimally require employing research and best practices to match technology software to the curriculum and the development needs of learners: to customize content area learning, to enrich learning experiences with communications and links to others beyond the school walls, to offer new learning opportunities, and to help learners see the value of learning by applying knowledge and skills to real-world tasks.

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Appendix A

"Sec. 3133. State Application

"Sec. 1203. State Programs

"Sec. 3603. State Plans

Appendix A

"SEC. 3133. STATE APPLICATION.

To receive funds under this subpart, each State educational agency shall submit a statewide educational technology plan which may include plans submitted under the Goals 2000: Educate America Act or other statewide technology plans which meet the requirements of this section. Such application shall be submitted to the Secretary at such time, in such manner, and accompanied by such information as the Secretary may reasonably require. Each such application shall contain a systemic statewide plan that--

"(1) outlines long-term strategies for financing technology education in the State and describes how business, industry, and other public and private agencies, including libraries, library literacy programs, and institutions of higher education, can participate in the implementation, ongoing planning, and support of the plan; and

"(2) meets such other criteria as the Secretary may establish in order to enable such agency to provide assistance to local educational agencies that have the highest numbers or percentages of children in poverty and demonstrate the greatest need for technology, in order to enable such local educational agencies, for the benefit of school sites served by such local educational agencies, to carry out activities such as--

"(A) purchasing quality technology resources;

"(B) installing various linkages necessary to acquire connectivity;

"(C) integrating technology into the curriculum in order to improve student learning and achievement;

"(D) providing teachers and library media personnel with training or access to training;

"(E) providing administrative and technical support and services that improve student learning through enriched technology-enhanced resources, including library media resources;

"(F) promoting in individual schools the sharing, distribution, and application of educational technologies with demonstrated effectiveness;

"(G) assisting schools in promoting parent involvement;

"(H) assisting the community in providing literacy-related services;

"(I) establishing partnerships with private or public educational providers or other entities to serve the needs of children in poverty; and

"(J) providing assurances that financial assistance provided under this part shall supplement, not supplant, State and local funds.

"SEC. 1203. STATE PROGRAMS

"(a) State Level Activities.--Each State that receives a grant under section 1202(d)(1) may use not more than 5 percent of the grant funds for the costs of--

"(1) administration; and

"(2) providing, through one or more subgrants or contracts, technical assistance for program improvement and replication, to eligible entities that receive subgrants under subsection (b).

"(b) Subgrants for Local Programs--

"(1) In general.--Each State shall use the grant funds received under section 1202(d)(1) and not reserved under subsection (a) to award subgrants to eligible entities to carry out Even Start programs.

"(2) Minimum.--No State shall award a subgrant under paragraph (1) in an amount less than $75,000, except that a State may award one subgrant in each fiscal year of sufficient size, scope, and quality to be effective in an amount less than $75,000 if, after awarding subgrants under paragraph (1) for such fiscal year in amounts of $75,000 or greater, less than $75,000 is available to the State to award such subgrants.

"SEC. 3603. STATE PLANS.

"(a) In General.--In order for a State to receive a grant or an allocation of funds under this part for any fiscal year, such State shall have in effect for such fiscal year a State plan. Such plan shall--

"(1) designate the State educational agency as the State agency responsible for the administration of the program assisted under this part;

"(2) set forth a program under which funds paid to the State in accordance with section 3602 will be expended solely for--

"(A) acquisition of school library media resources, including books and foreign language resources, for the use of students, school library media specialists, and teachers in elementary and secondary schools in the United States; and

"(B) administration of the State plan, including development and revision of standards, relating to school library media resources, except that the amount used for administration of the State plan in any fiscal year shall not exceed three percent of the amount available to such State under section 3602 for such fiscal year; and

"(3) set forth criteria to be used in allotting funds for school library media resources among the local educational agencies of the State, which allotment shall take into consideration the relative need of the students, school media specialists, and teachers to be served.

"(b) Plan Submission.--The State plan may be submitted as part of a consolidated application under section 14302.

Appendix B

Sec. 3132. School Technology Resources Grants.

Sec. 3134. Local Use of Funds.

Sec. 1603. State Administration.

Appendix B

"SEC. 3132. SCHOOL TECHNOLOGY RESOURCE GRANTS.

"(a) Grants to States.--

"(1) In general.--From amounts made available under section 3131, the Secretary, through the Office of Educational Technology, shall award grants to State educational agencies having applications approved under section 3133.

"(2) Use of grants.--

"(A) Each State educational agency receiving a grant under paragraph (1) shall use such grant funds to award grants, on a competitive basis, to local educational agencies to enable such local educational agencies to carry out the activities described in section 3134.

"(B) In awarding grants under subparagraph (A), each State educational agency shall ensure that each such grant is of sufficient duration, and of sufficient size, scope, and quality, to carry out the purposes of this part effectively.

"(b) Technical Assistance.--Each State educational agency receiving a grant under paragraph (1) shall--

"(1) Identify the local educational agencies served by the State educational agency that--

"(A) have the highest number or percentage of children in poverty; and

"(B) demonstrate to such State educational agency the greatest need for technical assistance in developing the application under section 3133; and

"(2) offer such technical assistance to such local educational agencies.

"SEC. 3134. LOCAL USES OF FUNDS.

"Each local educational agency, to the extent possible, shall use the funds made available under section 3132(a)(2) for--

"(1) developing, adapting, or expanding existing and new applications of technology to support the school reform effort;

"(2) funding projects of sufficient size and scope to improve student learning and, as appropriate, support professional development, and provide administrative support;

"(3) acquiring connectivity linkages, resources, and services, including the acquisition of hardware and software, for use by teachers, students and school library media personnel in the classroom or in school library media centers, in order to improve student learning by supporting the instructional program offered by such agency to ensure that students in schools will have meaningful access on a regular basis to such linkages, resources and services;

"(4) providing ongoing professional development in the integration of quality educational technologies into school curriculum and long-term planning for implementing educational technologies;

"(5) acquiring connectivity with wide area networks for purposes of accessing information and educational programming sources, particularly with institutions of higher education and public libraries; and

"(6) providing educational services for adults and families.

"SEC. 1603. STATE ADMINISTRATION.

"(a) Rulemaking.--

"(1) In general.--Each State that receives funds under this title shall--

"(A) ensure that any State rules, regulations, and policies relating to this title conform to the purposes of this title and provide any such proposed rules, regulations, and policies to the committee of practitioners under subsection (b) for their review and comment;

"(B) minimize such rules, regulations, and policies to which their local educational agencies and schools are subject; and

"(C) identify any such rule, regulation, or policy as a State-imposed requirement.

"(2) Support and facilitation.--State rules, regulations, and policies under this title shall support and facilitate local educational agency and school-level systemic reform designed to enable all children to meet the challenging State content standards and challenging State student performance standards.

"(b) Committee of Practitioners.--

"(1) In general.--Each State educational agency shall create a State committee of practitioners to advise the State in carrying out its responsibilities under this title.

"(2) Membership.--Each such committee shall include--

"(A) as a majority of its members, representatives from local educational agencies;

"(B) administrators;

"(C) teachers, including vocational educators;

"(D) parents;

"(E) members of local boards of education;

"(F) representatives of private school children; and

"(G) pupil services personnel.

"(3) Duties.--The duties of such committee shall include a review, prior to publication, of any proposed or final State rule or regulation pursuant to this title. In an emergency situation where such rule or regulation must be issued within a very limited time to assist local educational agencies with the operation of the program under this title, the State educational agency may issue a regulation without prior consultation, but shall immediately thereafter convene the State committee of practitioners to review the emergency regulation prior to issuance in final form.

"(c) Payment for State Administration.--Each State may reserve for the proper and efficient performance of its duties under this title the greater of--

"(1) 1.00 percent of the funds received under subsections (a), (c), and (d) of section 1002; or

"(2) $400,000, or $50,000 in the case of the outlying areas.

Appendix C

Meta-Analyses Involving Technology and Achievement

Appendix C

Table 1

Meta-Analyses Involving Technology and Achievement

Meta-Analysis	Grade Level	Type of Technology	No. of Studies
Bangert-Downs, Kulik, & Kulik (1985)	Secondary	CBI, CMI, CEI	51
Burns & Bozeman (1981)	Elementary & Secondary	Drill & tutorial	44
Hartley (1978)	Elementary & Secondary Math	Drill & tutorial	33
Kulik & Kulik (1986)	College	CBI, CMI, CEI	119
Kulik & Kulik (1991)	Kindergarten to higher education	CBI, CMI, CEI	254
Kulik & Kulik & Bangert-Downs (1985)	Elementary	CBI, CMI, CEI	44
Niemiec & Walberg (1985)	Elementary	Drill, tutorial, CMI, problem solving	48
Roblyer (1986)	Elementary to higher education	CAI, CMI, CEI	82
Ryan (1991)	Elementary to higher education	CAI, CMI, CEI	40
Sivin-Kachela & Bialo (1996)	Preschool through higher education	CAI, CMI, CEI	176

Note: CAI = computer-assisted instruction; CBI = computer based instruction; CEI = computer-enriched instruction; CMI = computer-managed instruction.

Appendix D

Phases of Computer-Based Technology and Learning

Appendix D

Phases of Computer-Based Technology and Learning

Variables	Phase I Print Automation	Phase II Expansion of Learning Opportunities	Phase III Data-Driven Virtual Learning
Engaged Learning-Instruction-Student Roles	Students use technology that automates print-based practices with some increase in active hands-on learning.	Students use technology to organize and produce reports, often using multi-media formats.	Students use technology to explore diverse information resources inside and outside school and produce information for real-world tasks.
Engaged Learning-Instruction-Teacher Roles	Teachers have limits on structuring the learning due to the closed-end design of the software. The quality of learning depends on the intended learning outcomes set by software developers.	Teachers use technology to access information, model problem solving, and develop simulations that provide greater understanding of how technology is used in the work world.	Teachers continue to use technology to guide and engage students in self-directed learning activities. They model problem solving that reflects real work but focuses on areas that are other-wise difficult to teach.
Engaged Learning-Instruction-Grouping	Amount and quality of collaboration is highly dependent on the design of the software.	Learning approach is individual, but the outcome is sharing a product with classmates.	Learning approach is a developmental process that is enhanced by working with others inside and outside the classroom.
Engaged Learning-Content-	Content is usually focused on skills and inert knowledge with little attention to standards or research.	Content reflects research and best practices but is usually not linked to national standards. Technology use focuses on finding and presenting information.	Content reflects national standards, research, and best practices. Technology use is aligned with standards to enhance application of content learning to real-life situations.

Engaged Learning-Content-Conceptual Integrity	Segmented skills or knowledge are emphasized without conceptual connections.	Conceptual integrity is considered important, but analysis of key understandings is usually limited.	Conceptual integrity is important; key understandings are defined; and a variety of resources and strategies are linked to integrated concepts.
Engaged Learning-Content-Authentic Tasks	Design of the software determines whether work reflects real-world problems and resources. Printed resources convey established knowledge.	Students are given opportunities to make real-world connections, but because access to outside-building resources is limited, true real-world connectivity is superficial and forced.	Students have greater opportunities to access up-to-date, real-world resources and experts, especially through the Internet and other telecommunication resources; focus on solving authentic tasks.
Technology-Connectivity	Limited to electronic print. Information is transferred via exchanges of portable diskettes.	Electronic print with some limited multimedia and networking capacity. Information transfer largely limited to connectivity tied to a hard drive in a building.	Multimedia and global telecommunications network infrastructure enables unlimited information transfer and online collaboration.
Technology-Learning Access	Few opportunities exist to take online courses. Distance education is lecture driven.	Some courses delivered to schools via video-conferencing when access to qualified teachers is limited. Courses are traditional lecture mode with minimal interaction and summative evaluation.	Students and teachers anywhere can access learning experiences online as they need them; and engaged learning strategies are used in the instruction. Data-driven decision making helps determine the flow of instruction and appropriate uses of technology resources.
Systemic Integrity-Vision for Use of Technology	Vision is focused on obtaining technology hardware and software. Little attention is given to changing learning strategies.	Vision is focused on increasing learning opportunities and strategies to better succeed in an information-rich world.	Vision is focused on increasing learning opportunities by using data to determine priorities and strategic use of recources.

Systemic Integrity-Professional Development	Sites provide technology-focused workshops emphasizing basic hands-on skills. Typically workshops are "sit-and-get." Teachers have little time to practice and have little access to ongoing support.	Professional development is beginning to focus on instruction and learning as the driver to designing technology-based units. Efforts are still limited by poor access to technology and a poor vision of learning.	Professional development is aligned with research and best practices where teachers participate in just-in-time study groups, online seminars, action research, and collaboration with colleagues.
Systemic Integrity-Professional Development	There are few efforts to use technology to involve parents and the community.	Technology is used to inform parents and the community, but communication is limited primarily to technology-developed newsletters and multimedia presentations.	Web sites and interactive electronic systems are used to provide multi-tiered collaborations among educators, students, parents, and community members. Data-driven practices inform all levels of collaboration.
Systemic Integrity-Evaluation and Accountability	Many data-gathering efforts exist, but they are not tied to objectives. The results are not structured for technology use that would allow easy and customized analysis.	Objective data is available, but technology programs provide only district and classroom data with little disaggregation of data for formative evaluation.	Technology data tools are used in classrooms that provide both formative and program information to teachers, parents, students, principals, curriculum directors, and policymakers as appropriate for their individual and collective needs.