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Promotion of student learning by small, rural school districts as they design and integrate technology plans

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Abstract

How will small, rural school districts promote student learning by the design and integration of technology plans? In addition, other elements that affect the successful implementation of technology include time, money, and attitude. Realistic goals should be established based on these elements. Research included in this paper focuses on concepts and applications that could be implemented in a school with limited financial resources.

If technology is to have an impact on student learning, it must be used in ways that reflect a new understanding of learning. Technology not only may assist traditional instruction, but it may also aid in the transformation of education. This process must become more active and emphasize curiosity, social interaction, and problem-solving experiences.

Educational technology has existed since the turn of this century. Many students, teachers, and parents have observed this since the early 1980' s when the personal computer began appearing in our homes. The School Improvement Technology Act will enable public schools to implement technology equitably into the learning environment.

PROMOTION OF STUDENT LEARNING BY SMALL, RURAL SCHOOL DISTRICTS AS THEY DESIGN AND INTEGRATE TECHNOLOGY PLANS

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CHAPTER I

Introduction

The Meservey-Thornton Community School District (MTCSD) is located in north central Iowa with an enrollment of approximately 220 students. Many students have access to computers and related technologies in their own homes. In some cases, this equipment is superior to the equipment at school.

Computer hardware includes Apple equipment. Over the past few years, the district has been purchasing Macintosh models to replace the aging Apple IIe's. 7Currently, MTCSD has one sixteen-machine Ethernet local area network (LAN) functioning in the middle school. The Iowa Communications Network (ICN) room at MTCSD is nearing completion and will be utilized beginning with the 1998-99 school year. A wide area network (WAN) plan has been identified and, dependent on obtaining the financial resources, will be implemented as early as the next school year also. Several Internet related courses and applications will become reality upon the completion of this WAN.

Most classrooms at MTCSD are equipped with at least one Macintosh computer and printer. Various workshops have been presented on word processing applications including Microsoft Works and, most recently, ClarisWorks. Last fall the staff at MTCSD had an opportunity to visit the AEA Technology Lab and examine software. Based on individual discussions with colleagues, the technology questionnaire used for an instructional development project, and follow-up technology plan surveys, staff members desire more training with technology.

One of the most important components built into the Technology Act is the development and implementation of a technology plan (School Improvement Technology Act, 1996). The MTCSD technology plan is on schedule through its second year. To receive the yearly allocation, MTCSD will adhere, as closely as possible, to this plan and report progress to the Iowa Department of Education. One

key element that must be included is how the plan affects student achievement. Current hardware already in use will be utilized as MTCSD upgrades and replaces obsolete equipment. MTCSD has developed a "wish" list of hardware and software that will enable it to satisfy this element. This list will require additional funding that this allocation cannot account for. MTCSD continuously seeks additional funding from grants and other sources like the Universal Services Fund.

Locally, MTCSD needs to address other issues before committing district funds to supplement this plan. Infrastructure, declining enrollment, and budget deficits will affect how the district's financial resources are expended throughout the implementation of this plan. A successful bond issue was passed last fall to subsidize the infrastructure issue. Even with this increase in funds, the margin for error is not great.

The technology plan addresses selection of software by individual teachers. Teachers have integrated this software into their curriculums through a variety of methods including various drill and practice in related subject areas, some individualized instruction, and enhancement. Inservice and staff development opportunities have been available also. A recent Introduction to ClarisWorks course offered at MTCSD is representative of the desire by its staff to seek technological training. Ten certified staff members (currently 22 certified staff members are employed in the district) attended this training.

All decisions regarding technology should be made realistically dependent on the financial resources, current hardware and software, and expertise of staff. Students at MTCSD deserve access and training in technology so they may compete for careers as we near the twenty-first century. One important question that should guide this process is how does a small, rural school district utilize the technology funding effectively.

Research Question

How will small, rural school districts promote student learning by the design and integration of technology plans?

Terms

interactive video: a video or television system in which the user interacts with the program in such a manner that the program sequence will change for each user

staff development: classes, workshops, or other training that improves a teacher's effectiveness and increases knowledge

standardized tests: examinations administered to measure and compare student achievement in the basic skills

curricular: relating to the courses of study in an educational institution

socio-emotional: how people interact emotionally in a social situation

portfolios: a method of monitoring student progress by collecting and storing examples of his or her academic papers

multimedia: any combination of video, sound, text, animation, and graphic images in a computer-based environment

student engagement: a learning measurement observing students' time on task

ditto: obsolete method of mass duplication of educational materials

SCANS Report: report completed in 1991 by the United States Labor Secretary that identified five minimum competencies workers needed to possess in order for the U.S. to maintain its economic and competitive strength.

hypermedia: various forms of software, including HyperCard, which double as programming environments, allowing the development of non-linear, multi-layered documents

linear: having an effect or giving a response directly proportional to stimulus, force, or input

infrastructure: facilities, buildings that house educational activities

interface: means of interaction between two systems

stack: Hypermedia term identifying data found on a series of cards or slides

desktop publishing: a system for designing,editing, and producing camera-ready documents such as newsletters, brochures, magazines, using a microcomputer, a printer, and special software like Aldus PageMaker

cooperative learning: instructional strategy in which students work collaboratively with assigned responsibilities as they master assigned materials

telecommunication: interactive communication integrating video, audio, and multimedia technologies

scientific management: comprehensive study conducted by Frederick Taylor at the turn of this century whose goal was to increase production at a lower cost

teaching machine: primitive form of today's computer first designed by Sidney L. Pressey that tested intelligence and information

CHAPTER II

Literature Review

The classroom of the future will include a variety of instructional technologies. Small, rural school districts, due to open enrollment, need to actively participate in this transformation on a relative level to remain competitive. Multimedia, telecommunications, and interactive video will enable teachers and students to communicate and access information resources outside their local school districts. Evans, (1996) asserts, "For any community to sustain its viability and be successful and healthy, its schools must prepare their children and citizens to lead in a highly competitive, technologically oriented work economy" (p. 14).

Student to computer ratios have improved considerably since the arrival of the personal computer. In 1983, the ratio was one computer per 125 students compared to one computer per nine students in 1995 (Glennan and Melmed, 1996). In many districts, students are already using the Internet to access information and communicate with other learners and educators throughout the world. Sivin-Kachala and Bialo (1996) stated "Most forward-thinking educational leaders realize that significant and sustainable school reform will only occur if and when the school is restructured to incorporate modern technologies--especially the microcomputer" (p. 2).

As personal computers became affordable to individuals and schools alike, they have appeared and been utilized in the classroom. Peterson (cited in Cuban, 1986) declared:

> Educational computing, like the Force, is with us. Microcomputers are proliferating our schools and unless a lot of people are wrong they're here to stay. But the $64 question is whether these computers will make any difference in the education of our children . . . (p. 72)

Educational leaders and lawmakers have identified the importance of providing students in Iowa with the ability to compete in this rapidly changing age of technology. During the 1996 legislative session, the Iowa general assembly committed financial support schools may use for technology:

> The general assembly finds that it was in the public interest to develop and equitably fund instructional technology within the public schools of this state to ensure that students, teachers, and administrators are equipped and prepared to excel in the twenty-first century. Toward that goal, it is the intent of this chapter to establish and fund a school improvement technology program. School Improvement Technology Act (1996)

This legislation will provide 30 million dollars to public schools and area education agencies each year through June 30, 2001. Allocations to each district will be based on enrollment with no school receiving less than $15,000. Each district may use these funds to purchase hardware, software, build infrastructure, and create staff development and training opportunities.

In order to receive each year's allocation, schools will need to show how this plan will improve student achievement. Specifically, the legislation states:

> The board of directors of a school district shall adopt a technology plan that supports school improvement technology efforts and includes an evaluation component. The plan shall be developed by licensed professional staff of the district, focus on the attainment of student achievement goals under sections 280.12 and 280.18, consider the district's interconnectivity with the Iowa Communications network, and demonstrate how the board will utilize technology to improve student achievement. School Improvement Technology Act (1996)

Consequently, many schools have developed a technology plan. Policy makers are driven by the desire to prepare students with "cutting-edge" skills that will equip them to enter the workplace or succeed in college. They emphasize the needs of a new global economy, the skills it requires from workers, and the need for Americans to be competitive in the global marketplace (Lockwood, 1998). Emphasis should also be placed on ensuring equitable access to technology by students from homes representing all income levels.

Utilizing technology in education is not a new concept. The turn of this century found the United States enjoying an ever-increasing population and prosperity, the result of a creative and industrious society. Business and industry saw public schools as an important and convenient method to provide them with an adequate supply of skilled workers. As this part of society became more efficient, society in turn pressured education to fall in line. Experts like Bobbit, Dewey and Kliebard provided education with applicable methods to make mass public education more efficient (Kliebard, 1987).

Due to numerous influences, educational technology including teaching machines, the predecessor to today's computer, began appearing in American classrooms and curriculums early this century. Taylor's "Scientific Management" (Callahan, 1934) had a tremendous effect on how industry operated. American industry was stifled by poor management practices and an underachieving and lazy work force. His plan basically strove for enhanced efficiency by increasing initiative and offering incentives. Hess and McNergney (1998) quoted Taylor by writing "Science had transformed American business, he reasoned, so surely it could do the same for public education--and do so inexpensively" (p. 31).

Schools were affected by this sudden need for efficiency also (Kliebard, 1987). Administrators became educational engineers as schools imitated their industrial counterparts and stressed that learners leave school with vocational training. These

changes in schools led to the discovery of more efficient ways of delivering instruction.

The first form of educational technology was the teaching machine (Skinner, 1968). Students could interact with these machines to reinforce basic knowledge. The machine's evaluation component would, in turn, provide reinforcement and incentives (Skinner, 1968). The computer, the backbone of today's educational technology, has been programmed to include these same principles. B. F. Skinner (1968) in response to the use of television as an effective visual aid supplement to education reinforced the use of television ". . . they serve one function for the teacher: they present material to the student and, when successful, make it so clear and interesting that the student learns" (p. 37).

Teaching machines, the predecessor to our modern computer, were introduced in America's classrooms as early as the 1920's. Sidney L. Pressey was an early pioneer in this area and designed several machines for use in the classroom. These primitive forms of technology could not only test and score within minutes, but as Pressey found, they could also teach (Skinner, 1968).

In response to the call for more efficiency, Pressey's teaching machines addressed students' variance in abilities. Teachers were presented with a tool that allowed all students--fast or slow--to learn at their own pace. He was considered to be the first to respond to educational critics' contention that students were "mere passive receivers of instruction.

Teaching machines had several important features. Students must be able to compose their response rather than select it from a set of alternatives. Skinner (1968) supported this assertion by stating "We want the student to recall rather than recognize--to make a response as well as see that it is right" (p. 33). Students must pass through a carefully designed set of steps, long or short, in a carefully prescribed order. As programming became more sophisticated, the teaching

machine concept could be compared to a private tutor. Just as industry could mass produce, one teacher could present lessons to a room full of students in a more efficient manner. Teaching machines enabled educators to utilize another instructional strategy where there was a constant interchange between program and student. As students advanced through grade-level appropriate material, the goal was for thorough comprehension. Each unit provided assistance in choosing the right answer and immediate reinforcement for every correct response.

Technology has changed the educational setting. The use of computer technology has rapidly increased since the 1980's (Neuman, 1996). Computers and technology are costly. The high cost of these technologies and the constant need for the updating of equipment generates many questions regarding its effectiveness.

Does research reinforce that the use of technology will positively impact student learning? Some educational technologists are apprehensive about funneling money into technology as it measures the computer's impact on student achievement. Dede (1998) states that "Multimedia-capable, Internet-connected computers are seen by many as magical devices, 'silver bullets' to solve the problems of schools" (p. 10). He suggests that technology is a cost-effective investment only in the context of systematic reform. Other educational issues--standards-based curriculum, assessment, and school organization--need to be included with the investment of large amounts of money that are being channeled into school districts for technology (Dede, 1998).

School infrastructure, equipment, and furnishings throughout Iowa and the United States are in need of repair or replacement. Teachers require training in the effective application and utilization of technology into their curriculums. Infusing large amounts of money into technology now does not address long-term issues in

operational training and maintenance. Dede (1998) supports this contention ". . . taxpayers now see computers as similar to blackboards: Buy them once, and they are inexpensively in place for the lifetime of the school" (p. 12).

Those individuals in local school districts responsible for determining their mission and purchasing hardware and software are in the best position to select appropriate technology. Hess and McNergney (1998) suggest "If your district especially values 'child centerness' or 'interdisciplinary studies' or 'preparation for the workplace', then decisions about technology should reflect these aspects of its mission" (p. 30). A collaborative effort between those establishing technology policy and the decision makers for the overall district is important in implementing a long-term plan. Without this component, a technology plan is subject to change whenever these individuals are no longer employed by that district.

Technology plans in school districts are subject to physical and human constraints. Hess and McNergney (1998) identify these constraints as physical and human. "Physical constraints might include the age and layout of schools or the wiring of phone lines. Among the human constraints could be the educational level, years of experience, and technological expertise of the work force" (p. 31). A primary influence guiding the implementation of technology plans is getting the best value. Each decision should answer one basic question, "What is this specific investment supposed to achieve?" (Hess and McNergney, 1998, p. 31).

Another question that should be asked is "Who controls technology--and how will it be used to further teaching, learning, and education reform?" (Means and Schuhmann, 1998, p. 11). For effective learning to occur, Means and Schuhmann contend that students should be in control of the technology as they make the decisions. Too much time is spent by students who waste time providing

responses on demand or playing games that do not address educational goals. Computers should not be relegated to labs where daily classroom instruction does not occur. Staff should be included in the decision making process also.

Research has examined the use of technology and its effect on learning. In 1985, Apple Classrooms of Tomorrow (ACOT) began exploring, developing and demonstrating the use of technology in teaching and learning. Baker, Gearhart, and Herman (1992) stated that "ACOT views technology as a necessary and catalytic part of the effort required to fundamentally restructure America's education system" (p. 1). This study focused on the effects technology had on student learning.

Over two years, an ACOT research team administered standardized tests including the Iowa Tests of Basic Skills and the Iowa Tests of Educational Development, and collected student writing samples (Baker, et al., 1996). Teachers completed a questionnaire emphasizing curricular practices, perceptions of student achievement, and attitudes toward work. Parents provided information on their perception of the ACOT study, aspirations for their children and the use of computers in the home.

Student learning involved problem-solving activities and a very high level of access to technology. Results showed that ACOT students maintained their performance levels on standardized tests measuring basic skills while maintaining a positive school attitude. Secondary students improved the quality of their essays.

Teachers were satisfied with the academic progress of students, although they were concerned about covering the standard curriculum (Baker, et al., 1996). They did admit some stress but discovered that the use of computers in their teaching did positively impact their job interest and performance. Some indicated they had developed higher expectations for their students due to a new found understanding of students' abilities and roles in their own learning.

Parents were pleased with the results of the ACOT study (Baker, et al., 1996). They did; however, express concern regarding covering the standard curriculum. Most generally felt the project had benefited the children in their knowledge of computers, attitudes towards learning, and achievement.

This research shows that the critical factor is not the novelty of the computer but rather how the technology is being used in classroom instruction. Sandholtz, Dwyer, and Ringstaff (1997) added "Students can become bored just as quickly with technology as with traditional instruction. Drill-and-practice exercises on the computer differ very little from drill-and-practice exercises on paper" (p. 2).

Technology has an enduring, positive impact on student engagement in classrooms where teachers do the following (Sandholtz, et al., 1997):

1. Use technology as one tool among many instructional strategies
2. Integrate technology use into the larger curricular framework
3. Emphasize the use of tool applications such as word processing programs and desktop publishing software
4. Adjust the use of technology to individual differences in both interest and ability.

ACOT teachers were challenged by their beliefs about traditional teacher roles (i.e. curriculum based, passive learning) as they integrated technology into their curriculum. Their styles of instruction became increasingly more child-centered as their students' learning became more active (Sandholtz, et al., 1997).

Student engagement is another factor in how technology positively affects student learning. It was feared that students using computers would become social isolates. These studies (Dwyer, 1994) found that "cooperative and task-related interaction among students in the ACOT classrooms was spontaneous and more extensive than in traditional classrooms" (p. 4).

Integrating technology can be frustrating to both students and teachers, but can also increase the level of enthusiasm. ACOT researchers began observing for indications of student initiative, self-motivation, independent experimentation, spontaneous collaboration, and peer coaching (Sandholtz, et al., 1997). One ACOT teacher declared "They don't get tired of working on the computer. They actually ask for things to do. In all of my years of teaching, I never had anyone ask for another ditto" (Sandholtz, et al., 1997, p. 1).

Students were spending more time on assignments and began exceeding the minimum requirements as well as experimenting with other applications. This caused students to practice cooperative learning skills which resulted in spontaneous peer coaching. Teachers realized that this new-found level of enthusiasm reinforced their instruction in addition to positively impacting their own learning.

Challenges were also encountered (Sandholtz, et al., 1997). Because students were spending so much time working on the computer, teachers sometimes found it difficult to divert their attention to other classroom activities. Some students, due to noise and movement, had difficulty adjusting to these student-centered activities. Assignments that were too easy or hard, as well as, repeatedly used software programs became frustrating for them.

Another ACOT study (Tierney, 1994) documented the impact of unlimited access to new technology on students' thinking, approach to learning and their interactions with others. This study identified six students in two different classes as they progressed through high school. Its goal was to measure how students use technology to expand their choices and ways of knowing, sharing, and collaborating. Kozma (1991) states that:

> the capabilities of a particular medium, in conjunction with methods that take advantage of these capabilities, interact with and influence the ways learners represent and process information and may result in more and different learning. (p. 79)

Researchers involved in this study decided to measure students' illiteracy in terms of its symbolic, cognitive, and social dimensions. Eight student competencies (Tierney, 1994) were analyzed including: dynamic exploration and representation of information; experimentation and problem solving; social awareness and confidence; effective communication; computer use; independence; expertness and collaboration; and a positive orientation to the future. They discovered many common similarities from this study to the competencies found in the Labor Secretary's Commission on Achieving Necessary Skills (SCANS) report prepared in 1991.

Six students were selected randomly from 100 who applied to this study. These students were from working class homes and attended school at West High School in Columbus, Ohio. Classes were blocked in science and math and English and history and team-taught. All participants had access to a Macintosh computer at home as well as in school. Students (Tierney, 1994) had access to a wide range of software: spreadsheets, word processing, programming, desktop publishing, video editing, multimedia, and databases. Printers, laser disc players, scanners, and overhead projection were available at school.

Data for this study was collected through observations and interviews. General interviews were used in hopes of providing details of the students' attitudes, expectations, perceptions of learning experiences, thought processes, and learning outcomes (Tierney, 1994). Observations were documented by videotaping and maintaining a cumulative record of behaviors and activities. Terminology such as "graphics", "friends", and "interface" was recorded as students progressed through

the study. In year one, the words "type", "read", and "write" were used frequently. By year four, the words "layout", "multimedia", "stack", "animation", and "graphic" emerged (Tierney, 1994).

As these six students entered this study, they had the perception that technology enabled them to word process and edit text rather than produce a handwritten product. "In her freshman year, one student referred to 'accuracy and neatness' as the major attributes of the computer" (Tierney, 1994, p. 4). They were familiar with computers and working collaboratively with others but were unaware of the potential technology could have on their education. Another student (Tierney, 1994) was somewhat frustrated with technology as she commented:

> A lot of times I think of this great wonderful thing, but then I don't think I can do it. So I change my mind, and I have it started and I say no, I can't do that. I have to do something different. I think think probably all those things influence what I'm doing." By the eleventh and twelfth grades, these students had realized this potential. (p. 4)

Their knowledge of technology had transformed from basic word processing to the utilization of hypermedia in how a document represents and communicates ideas. Tierney (1994) stated:

> in terms of their appropriation of the technology, the introduction of desktop publishing, scanning capabilities, and hypermedia contributed to some major shifts in how students represented ideas and approached the integration of ideas from various sources. (p. 6)

Hypermedia tools, including graphics, were used to produce more professional "dynamic" rather than "static" texts. The students began considering how the issues they were wrestling with might be explored across an array of still pictures, video segments, text segments, and sound clips (Tierney, 1994).

A third student (Tierney, 1994) realized "A lot of times I make my own graphics. When you watch TV you always see really neat graphics and the way they present it--I get an idea from that and I'll see how to do it and it's pretty neat" (p. 7). A fourth student (Tierney, 1994) discovered:

> Now I incorporate graphics with my text a lot more. I relate it or I try to link it together so that it looks like one unit. Like the text and the graphics are just one object. I try to make it look more aesthetic and I try to have it more pertinent to what the text is. (p. 9)

They became more aware of their own expertise in working with technology and gained a more in depth appreciation of skills they needed in their future educational or workplace careers. This student used the traditional writing processes (brainstorming, drafting, revising) during the first three years. By year four he was using hypertext to draft his ideas, add graphics, and script the two together (Tierney, 1994). Some even used their experiences to help family members with projects or for their own profit.

This study examined the social dimensions of computer literacy also. Although these students were concentrating on individual goals, they were also given an opportunity to work collaboratively. Working in groups offered them a chance to interact, assist others, and share ideas. They often used a HyperCard stack and took turns controlling the mouse as they put their ideas together after discussing the activity and distributing the workload. The fourth student (Tierney, 1994) had the opportunity to give advice and teach others:

> Well, one thing, especially when the class is new, (sharing information), helps build confidence and friendship among the people, because no one knows what they're doing. But there will be a few people who catch on

> quicker and people will be asking them 'how do you this' or they'll be offering help--the ones who have learned it faster. So it's one way to meet people. (p. 10)

Higher quality projects resulted from this collaboration as everyone contributed their ideas. These results disproved the perception that using technology isolates students from one another.

This ACOT study strengthens the assertion that technology does positively affect a student's learning. The study of ACOT is not the examination of whether or not a certain program is effective, but an opportunity to study computer acquisition in an environment where individuals can explore and participate in its uses (Tierney, 1994). Students were challenged to involve themselves in productive and creative experiences rather than more traditional ones that rely heavily on memorizing and repetition. Technology also offered them an opportunity to develop specific skills and vocabulary as they became more confident and aware of their future endeavors.

Between 1990 and 1995, Interactive Educational Systems Design, Inc. (IESDI) examined 176 studies on the effects technology had on student achievement, self-concept, and attitudes toward learning. Sivin-Kachala and Bialo (1996) declared that "an evaluation report conducted by IESDI showed that the use of technology as a learning tool can make a measurable difference in student achievement, attitudes, and interaction with teachers and other students" (p. 1).
IESDI discovered a positive impact on students' self-concept and self-esteem. Utilizing computer technology presents students a challenge and sense of control over instruction. Students relish software presented in game format when they are allowed to take on roles in a fantasy environment. Computer-based technology also improved interactions of students with their peers.

Teachers found that technology improves their instruction as well. It enables the teacher to integrate other curricular areas and empowers students in their own learning. Technology provides an opportunity to utilize cooperative learning activities and group students more effectively.

Other studies have researched the effectiveness of student learning utilizing a computer-based learning system. Integrated Learning systems (ILS) are integrated hardware/software systems that deliver instruction generally related to basic skills including math, reading and language arts. Wiburg (1995) asserted that "ILS systems can be associated with behavioral instruction models of the 1950s and 1960s" (p. 7). These models proposed that effective instruction could be broken down into small, sequential steps and presented to students in any setting.

ILS software is loaded on a central server and lessons are sent to many student computers in a lab or a single computer in a classroom. Van Dusen and Worthen (1995) ascertained that "most systems provide individual instruction that targets specific learning objectives; however, it can be applied to whole-group classrooms also" (p. 28). A management component collects and reports results of student progress. Student progress is tracked each time it is used, and an assessment file is updated daily. Some ILS systems can evaluate student learning by alternative forms of assessment including multimedia student portfolios (Van Dusen and Worthen, 1995).

ILS systems have reported large gains on standardized test scores when they have been implemented correctly. This implementation begins with the identification of clearly defined objectives for its application into the curriculum. Some studies have found that an ILS system has a significant impact in the lower and upper levels of student achievement. One challenge would be to find a way to affect those in the middle level.

ILS systems are expensive and require an adequate amount of equipment in the classroom or computer lab. Studies suggest at least one computer for every three students as the minimum (Van Dusen and Worthen, 1995). Students need an adequate amount of time on the system each day. Van Dusen and Worthen (1995) observed that each student must spend a minimum of 30 minutes per subject area per day on the computers to achieve significant learning gains.

Teacher training is very important in the successful implementation of an ILS system. Van Dusen and Worthen (1995) determined:

> An ILS curriculum is not intended to supplement the class curriculum; rather, there should be one curriculum that is presented through a combination of ILS activities, small-group instruction, one-on-one tutorials, and other activities. (p. 32)

Finally, administrators must commit time and money if an ILS system is expected to be successful.

Technology also impacts the learning of special education students. At Wayland-Cohocton Middle School (WCMS) in Wayland, New York, special education teachers utilize computer software and Hyperstudio to allow their students to remain in the regular classroom. Deborah Baker, a teacher at WCMS, maintains "the technology is most helpful as a stimulus. It motivates them to solve problems and make decisions in ways that would not have been possible in a regular classroom" (cited in Holzberg, 1998, p. 52). Social interaction between the regular and special education students increased as they watch and help each other with their assigned tasks. "For students with disabilities, Baker reinforces this contention that the best thing about technology is that it equalizes the playing field" (cited in Holzberg, 1998, p. 52). They gain self-confidence through not only this interaction, but by utilizing the same tools like spell/grammar check and thesauruses just like regular education students.

Choosing the correct technology to assist the appropriate disability is very important for success by special needs students. One former special education teacher used a talking word processor to facilitate the writing process (Holzberg, 1998). This allows them to enter a word and receive immediate reinforcement as the word processor reads their entry aloud. Students who experience dyslexia also benefit from this technology.

Even the simplest adjustments like enlarging the print size of reading materials enables special needs students to succeed at reading. Sharon Keller a technology coordinator and special education teacher at Colonial School District in New Castle, Delaware offers this observation about technology: "One of the best things about using technology to instruct students with special needs is seeing the looks on their faces when they realize they can do something they had previously been unable to do" (cited in Holzberg, 1998, p. 55). She also states that technology may raise the teacher's expectations which allows children to learn at a higher level.

Project-oriented learning is another instructional strategy to utilize technology in the classroom if a computer does not exist. It is a form of the constructivist theory as students and teachers construct knowledge together (Means and Schuhmann, 1998). Technology may be implemented individually or in a cooperative setting.

At Northbrook Middle School (NMS) in Houston, Texas, students have access to computers in the classroom as well as labs. Student motivation is one area where there has been significant improvement. As students explore, they are encouraged to be creative. Some serve as technology assistants as they share their expertise with peers and teachers.

Sixth grade students at NMS take a computer literacy course. Each student has an individual account on the district file server where they store individual portfolios. Technology was integrated across all content areas so students can update these portfolios daily. Lockwood (1998) continues:

> As we prepare kids to go out into the world, we realize they have to know something about technology. Using it as a tool accomplishes at least two goals: not only teaching and learning in a constructivist manner but also giving students an opportunity to learn something that will be very valuable to them when they leave school and enter the outside world. (p. 19)

Community High School (CHS) in Ann Arbor, Michigan has also been successful motivating students by integrating technology and project-based instruction into their curriculum (Lockwood, 1998). Students at CHS who are involved in publishing their weekly, eight-page newspaper apply these skills in a "real-life" setting. Each week, a new editor takes home a laptop computer. Other staff members format their stories in the computer lab and e-mail them to the editor who organizes them. PageMaker is used to organize the entire paper which is then printed at a publisher outside of the school and then delivered to the school each Wednesday.

Lockwood (1998) identifies this as an authentic student production "to learn, apply, and refine their use of technology . . . it also forms the structure through which they experience real-life deadline pressure, collaborative work among peers, and development of ideas" (p. 24). The newspaper is received well by students and staff at CHS as Lockwood (1998) states "When it is published each week, everything stops in its tracks . . . kids are sitting all over the place immersed in it; teachers are reading it as well" (p. 24).

In more aesthetic areas, such as art, computer use has opened a whole new field for student production. The interpretation of signs and signifiers using technology is again another medium to struggle with. Chia and Duthie (1994) indicated "Computers are making unprecedented aesthetic experiences possible

and revolutionizing the way art is conceived, created, perceived and taught. The profound impact of digital technology on the art of the last 20 years and what it portends for the future is only beginning to be appreciated" (p. 197).

One integral element in designing and implementing a technology plan is patience. It is easy to rush into decision-making and risk mistakes with the tremendous amount of pressure government, private business, and local citizens have been putting on local school districts. Poor decisions could cause them to lose time, money and educational opportunities for their students.

What will an effective plan look like after it's implemented? Hess and McNergney (1998) suggest evaluating a plan on several different levels. Students' and teachers' capabilities, motivations, and interests will be enhanced. They will have greater involvement with technology and be more productive. Their ability to use the technology and their attitudes toward innovation and work will become more positive. People, students and staff, will be doing things they could not have done without the effects of the technology plan.

CHAPTER 3

Summary

How will small, rural school districts promote student learning by the design and integration of technology plans? In addition, other elements that affect the successful implementation of technology include time, money, and attitude. Realistic goals should be established based on these elements. Research included in this paper focuses on concepts and applications that could be implemented in a school with limited financial resources.

If technology is to have an impact on student learning, it must be used in ways that reflect a new understanding of learning. Technology not only may assist traditional instruction, but it may also aid in the transformation of education. This process must become more active and emphasize curiosity, social interaction, and problem-solving experiences.

Educational technology has existed since the turn of this century. Many students, teachers, and parents have observed this since the early 1980's when the personal computer began appearing in our homes. The School Improvement Technology Act will enable public schools to implement technology equitably into the learning environment. This legislation will provide specific funds that might not otherwise be available for school districts like MTCSD.

Today the catch phrases from the early part of this century have been replaced with new ones: technical literacy, national standards, and curriculum integration. These new phrases have the same goals: to improve the public school systems. Change is again driven by society, government and the business world. Technology such as telecommunication classrooms and computer labs, are being used to effectively and efficiently improve school image, thus increasing enrollment and revenues.

Most classroom teachers have committed their time and energy over the years because they enjoy working with young people. Effective teachers include imagination and improvisation as they build rapport with their students. Perhaps teachers are unwilling to integrate technology into their classrooms because they feel these ingredients will disappear or they feel intimidated. Teachers will need to re-examine their traditional roles and styles. Technology will affect how we teach as it becomes integrated into our curriculums during the next few years. Our students should expect this commitment.

Technology will not diminish the necessity for teachers. Technology is a tool to be used by the teacher; it's NOT the teacher. It allows teachers to do more with a classroom of students. Teachers will need to be well-prepared as they will still be responsible for setting the tone and expectations in their own classrooms. If legislators and administrators are willing to provide the training and technical assistance, teachers will be more comfortable integrating technology into their classrooms. Teachers will need to meet these challenges as they prepare students for success in the work place.

Very little research exists that pertains to the effects of technology on student achievement; however, it does address improvement in student attitude, engagement and motivation. The ACOT study found that participating students achieved higher scores on standardized tests and improved performance on essays after being exposed to high levels of access to technology. Students, teachers, and parents were pleased with the impact of utilizing computer-based technologies. One positive affect found by this study was higher student expectations.

Other research has discovered that students enjoy learning with the use of computers and as a result builds self-concept and self-esteem. Students do take a more active role in their own learning when utilizing technology. Special needs students are affected positively by technology. Their attitude and motivation can

improve because it allows them to remain in the regular classroom. Social interaction occurs as all students can help each other.

Integrated learning systems allow students to progress through basic curriculum individually or in a large group setting. Reports that communicate daily progress would be helpful and allow more time for other forms of instruction. ILS systems have increased student achievement where the systems have been implemented correctly. Elementary students at MTCSD These systems are expensive, so their implementation in MTCSD would require much research.

Reading Renaissance I, an accelerated reading program for elementary students, most resembles an ILS system at MTCSD. Students read grade-level, age-appropriate books. They then take a computer-adaptive test which measures their grade-equivalent reading level and percentile rank. Reports are then generated for individual student progress, parent communication, and teachers to monitor reading their reading program.

Project-based instruction is another option for providing technological training and access to students in districts with limited resources. Programs at Northbrook Middle School and Community High School offer students an opportunity to apply technology in an authentic way. These examples once again reinforce how student motivation and attitude can be affected positively. MTCSD currently offers middle school students a one quarter exploratory publishing course which utilizes Aldus PageMaker. Electronic portfolios could begin as soon as the building is networked.

Preparing students to think critically and solve problems will affect current educational practices drastically. Technology offers students the opportunity to communicate with persons all over the world. As technology plans evolve, more students and teachers will be introduced to the tremendous capabilities it provides.

REFERENCES

Baker, E. L., Gearhart, M., & Herman, J. L. (1992). Assessment: Apple classrooms of tomorrow (ACOT) evaluation study, first- and second-year findings. (Apple Classrooms of Tomorrow Research Rep. No. 7). Cupertino, CA: Apple Computer, Inc.

Callahan, R. (1934). Reform-conscious America discovers the efficiency expert. In Education and the cult of efficiency New York: Harcourt, Brace, and Company.

Chia J. and Duthie, B. (1994). Computer-based art learning: Primary children's responses. Computers in Education, 23, 197-209.

Cuban, L. (1986). Teachers and machines: The classroom use of technology since 1920. New York: Teachers College Press.

Dede, C. (1998). Casting a wider net: Investing in distributed learning. Multimedia Schools, 5, 10-14.

Dwyer, D. (1994). Apple classrooms of tomorrow: What we've learned. Educational Leadership, 51, 4-10.

Evans, C. (1996, June). Educational technology principles of audits and planning workshop. Workshop conducted for member schools of Northern Trails Area Education Agency, Mason City, IA.

Glennan, T. K., & Melmed, A. (1996). Fostering the use of educational technology: Elements of a national strategy. Santa Monica, CA: Rand Corporation.

Hess, F. M. & McNergney, R. F. (1998, March). Technology trade-offs. Electronic School, 30-33.

Holzberg, C. S. (1998). Helping all learners succeed: Special ed success stories. Technology & Learning. 52-56.

Kliebard, H. M. (1987). The struggle for the American curriculum 1893-1958. New York: Routledge.

Kozma, R. B. (1991). Learning with media. Review of Educational Research, 61, 179-212.

Lockwood, A. T. (1998, Winter). Technology and educational transformation. New leaders for tomorrow's schools. North Central Regional Educational Laboratories, 2-3.

Means, B., & Schuhmann, L. (Winter, 1998). Technology and constructivist learning. New leaders for tomorrow's schools, North Central Regional Educational Laboratories, 11-23.

Neuman, D. (1996). Current research. School Library Media Quarterly, 25, 51-57.

Sandholtz, et al, J. H., Dwyer, D. C., & Ringstaff, C. (1997). Student engagement revisited: Views from technology-rich classrooms. (Apple Classrooms of Tomorrow Research Rep. No. 21). Cupertino, CA: Apple Computer, Inc.

School Improvement Technology Act, IA Sen File 2063 (1996).

Sivin-Kachala, J. & Bialo, E. R. (1996). Report on the effectiveness of technology in schools. Washington, DC: Software Publishers Association.

Skinner, B. F. (1968). The technology of teaching. New York: Meredith Corp.

Tierney, R. J. (1994). Computer acquisition: A longitudinal study of the influence of high computer access on students' thinking, learning, and interactions. (Apple Classrooms of Tomorrow Research Rep. No. 16). Cupertino, CA: Apple Computer, Inc.

Van Dusen, L. M.& Worthen, B. R. (1995). Can integrated instructional technology transform the classroom?. Educational Leadership. 28-33.

West, G. (1994). Planning for tomorrow's technology. The School Administrator 32, 26-30.

Wiburg, K., (1995). Integrated learning systems: What does the research say?. The Computing Teacher. 7-10.