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Awareness and response: Schools' first steps toward reform through technology

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This review of literature includes sources published from 1990-95. The critical role of reform in education is examined. It identifies connections between technology and reform, and recognizes that technology can be a catalyst for reform. The literature states that computer based instruction enhances the goals of reform. It suggests studying the nature of reform before and during the process of technology implementation. A systems is model is analyzed, to understand the impact of change in most school systems. This review identifies the component of leadership in educational technology as an effective response to reform. Planning, initiatives, and teacher roles are considered key elements in providing leadership towards change. Included in this review are noted studies, research, and best practices that provide a balanced perspective surrounding the issues of technology and reform.

AWARENESS AND RESPONSE:
SCHOOLS' FIRST STEPS TOWARD REFORM THROUGH TECHNOLOGY

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Introduction

Change within the educational domain is frequently referred to as "reform", or "restructuring." Changes are often shortlived, because educational movements lack support or occur in isolation. Thus these reform efforts lack a framework for success.

The genuine relationship between teacher and student has survived all educational trends in sustaining quality learning. The advent of educational technology reinforces new insights into the roles of teacher and student. Teachers can become facilitators of knowledge construction, while students take more responsibility in their learning. Technology provides a richer base of information to analyze and investigate. The teacher-student relationship is enhanced through these changing roles (Means, 1994).

The discussion of reform itself is politically and socially motivated. Many experts agree that schools need to change, yet there are no clear formulas for successful reform initiatives. The dynamics of social change along with Society's demands of schools place great pressures on educators. In addition, it is perceived that America's schools are not working very well. There are studies and theories to suggest needed reform, yet there are conflicting ideas about what works. Technology's impact upon reform is still being evaluated. The idea of a Digital Age sounds strikingly familiar with other ages, such as the Industrial Age. Some schools have responded much the same as in the past. That is, adding new elements to the school structure, without consideration. Thus, it is worthwhile to look at technology's impact, and specifically, it's connections and interactions with reform.

There are many components of reform. Some believe reform constitutes new delivery systems in learning, but the interpretations can vary. It may mean the restructuring of schedules, curriculum, student groupings, leadership, evaluative procedures, or technology integration. For the purpose of this analysis, this paper will refer to reform, restructuring, or revitalization as similar terms. Further, this paper will refer to technology as computer-based instruction including interactive multi-media. Educational technology will refer to the realm of instructional systems, design, and development, all revolving around computer utilization. Educational technology will be considered a specific component of reform that deserves further study.

This paper will look at responses that meet the challenges instructional technology places upon educational systems. Too often changes in educational practices involving technology fail to include considerations of the complex components in reform, such as scheduling, learning structures, assessment, student roles, and teacher roles.

In a study of federal programs supporting educational change, it was found that some schools adopt external innovations for opportunistic reasons, rather than a need to solve problems. The reforms may bring about extra resources, and represent only symbolic change (Fullan & Miles, 1992). Thus, it is logical to explore technology utilization in schools to discover whether it is an external addition, or a common thread that ties many aspects of reform together.

Purpose

The confusion surrounding educational reform makes schools' efforts more difficult. At the same time, some educational institutions are committing funding to technology and hardware without regard to the impact on present school structures. This paper will investigate processes, models, or case studies related to reform. It will note successful reform initiatives adopted by practicing schools. Assumptions, beliefs, and research surrounding reform and technology utilization will be discussed. Through sources, response initiatives will be cited.

This review will help compile strategies that prepare schools for change. It will focus on technology's place in restructuring efforts. It will include in content a foundation for understanding the reform movement in general.

Review of Literature

The impact of technology and reform efforts are the basis of discussion in this review. Technology's place in education will be studied. Problems, realities, and projections of technology's role in the future of education are included. The noted sources rate technology as historically significant. Most sources refer to reform and technology as if they were interconnected and dependant upon each other.

The first source, Restructuring Education Through Technology by Frick (1991), offers an understanding of the nature of reform by looking at the characteristics of systems. Some states are mandating reform, while individual school systems around the country are taking steps towards reform. The scope or limits of these reform efforts often depend on the interpretation of just what reform means. The concept of reform comes from agreed upon changes of a system. A system example could be a government, business, or an educational system. An educational system is greater than the school district, teachers, and students. It is made up of many relationships. These relationships, or parts fit together as a whole. The connections of these parts are complex. When change is put into place within a system, the impact is felt in a variety of relationships. They are student, teacher, context, or content. Each relationship mode is an essential element necessary for education to occur (Frick, 1991). The question arises as this discussion progresses, what would the impact in an educational system be if technology is a primary part of the instructional delivery?

If technologies were used, such as computer-based instruction, tutorials, simulations, guided-practice exercises, interactive video, or hypermedia/multimedia, then changes would be necessary in essentially all the relationship modes. Students would need several teachers to create, interact, present, receive feedback, and earn assessment through achievement (Frick, 1991). One teacher might coordinate the student's individual plan of instruction, while other teachers would be needed for the varied disciplines studied. The relationship between student and content would dramatically change since electronic data and information are available with greater flexibility. The teacher would have a different role regarding context due to the capability to instruct or advise from home or distances. Students might not need the traditional classroom. They could use blocks of time, and "outside the classroom" experiences to complete a project.

The relationships identified in Frick's (1991) system model are:

1. Teacher-student relationships
2. Student-content relationships
3. Teacher-content relationships
4. Student-context relationships
5. Teacher-context relationships
6. Content-context relationships
7. Educational system and environment relationships

Each relationship change seems to impact the others. An understanding of these implications can assist school systems in planning technology utilization.

Frick's (1991) relationship studies could lead educators to discuss the future of reform in their schools. This systems model is fully explored as he writes about restructuring education through technology. His model can be applied to existing situations. It provides a whole picture of change rather than isolated, fragmented incidences. The future scenarios he describes are credible.

Technology and reform become interdependant. It is not possible to have a change in student-content, without it affecting other relationship modes. If, for example, the teacher-content and teacher-context relationships have not been carefully analyzed, technology will fail to support curricular changes even though it provides a rich resource for teachers to create and produce instructional materials. In practice, teachers soon discover the interdependencies of student, content, teacher, or context. It cannot be assumed that technology can be added to an existing system without adjusting all other relationships.

The struggle in technology implementation continues because educational systems often ignore the needs of change each relationship mode requires. The complexities created by this stress on existing systems may doom changes and innovations to a short life without the flexing of a school's restructuring backbone (Fullan and Miles, 1992).

The element of time seems to be a recurring problem facing existing educational systems. Schedules, bells, and the school calendar dictate the teaching-learning process. Students spend much of their time reading printed materials, and writing about what they have read.

These noted inadequacies in a system already implementing technology prove that each aspect of the systems model must be considered, if educational reform is to be successful. If there is not enough time for project-oriented learning, students suffer from inadequate outcomes. If there is not enough time for training devoted to assisting teachers in gaining expertise of content and context relationships, students may suffer from a lack of depth and quality in the content offered to them (Means, 1994). Teachers continue to struggle with these system inadequacies as they acquire new hardware and software, experiment with multi-disciplinary and shared classes, or try alternative scheduling such as block scheduling.

Frick's (1991) comparisons of present and future school system scenarios, using the future as an example of restructuring, gives schools an opportunity to visualize realistic changes.

In contrast, Perelman's ideas about teaching and learning are similar, but his solution to reform suggests eliminating schools and systems entirely (Perelman, 1994). His message, "school's out", cannot have validity however, without discussing the relationship modes in a system essential to a learning context. He suggests new technologies mandate an end to education that operates with expensive buildings and staff. Hyperlearning can occur outside this inefficient institution. He believes that life learning, utilizing the technothreads of smart environments, accessing the telecosms, (a communication infrastructure with knowledge accessibility), using hypermedia, and other hyperlearning technologies, will provide a new system for learning.

Students will gain authentic experiences in the real world, through work, apprenticeships, and organized learning projects. His perspective gives no hope to existing institutions. Bold renovations of the old systems are neccessary. It is suggested that a greater emphasis be placed on research and development in all areas of education. The areas of educational technology, assessment systems, school choice, restructuring (as it relate to the roles of teachers, administrators, students, including higher education), social and political influences are all examined.

Perelman's (1994) dismantling of existing school systems might provide a new twist to financing and structure, but what will be the cost to the critical relationship modes identified by Frick? Frick's (1991) analysis is a model for response, while Perelman provides little direction in how schools can adopt such sweeping changes. This comparison of two noted educators reveals the struggle of reform as an entity of its own. Its components are numerous, and its relationships critical to the whole. Essential in both educators' positions is the belief that technology impacts, stimulates, or in some cases, ties together relationships of reform.

As this discussion progresses, it will be important to recall the defined problem as one of response to reform. Are schools preparing responses to change? A powerful source on this subject comes from the educational technology field, Educational Technology: Leadership Perspectives by Kearsley and Lynch (1994).

It addresses the topic of leadership in educational technology. The book immediately establishes it's main premise, that leadership in the area of technology is different. It is also noted that similarities in other aspects of leadership are important as well.
Kearsley and Lynch (1994) pick up with a stage in the leadership process where "people begin to see that technology in the form of hardware or software, can only be truly effective if it is integrated in the total fabric of the educational environment, rather than remaining as an enclave or system itself" (Kearsley, Lynch, 1994, P.viii). The reason for their passion about leadership differences in educational technology once again refer to awareness and understanding. Educators need a solid understanding of technology types, what can and can't be accomplished with them, an understanding of the special technologies, the planning process, and the factors that affect implementation. The strength a school might have in educational technology is directly linked to the quality and quantity of leadership potential.

A list of skills taken from Collis (cited in Kearsley and Lynch, 1994), identify leadership skills in technology that include all levels of leadership, from state, district, principals, teachers, and technology specialists (Table 1). This list does not contain any new surprises yet categorizes specific skills that are necessary for educators in their leadership roles. Technology leaders can then apply these skills to their planning process.

Table 1

Examples of Technology Leadership Skills

(Adapted from Collis, 1988)

1. State Level
- establish a common format for data processing across districts
- negotiate discounts for district hardware and software purchases
- support regional technology centers
- maintain a state-wide educational computer network
- conduct evaluations of technology in schools
- specify policies for copyright enforcement

2. District Level
- identify specific objectives for technology use in schools
- coordinate hardware/software purchasing and maintenance
- ensure integration and communication among all levels of schools with respect to technology use
- plan and conduct teacher and staff inservice training
- coordinate district-wide administrative computer use
- provide special services and equipment relevant to district needs

3. Principals
- ensure equal access and opportunity to technology resources
- establish policies for ethical use of technology
- ensure facilities for technology are appropriate
- establish priorities for technology use in school
- provide released time for technology training
- reward outstanding technology applications
- seek out funding sources for technology

4. Teachers
- use teaching techniques that fully exploit technology
- encourage parental involvement with technology
- match technology applications to needs of students
- look for cross-curriculum/cross-cultural applications
- facilitate cooperative student applications
- use technology to improve personal efficiency

5. Technology Specialists
- provide personal support to teachers/staff
- develop new applications of technology
- identify educational problems for which particular technologies may provide solutions.
- articulate technology problems and promise across all administrative levels
- disseminate information about technology
- encourage ethical behavior (e.g., copyright)
- introduce new software or hardware
- recommend/evaluate software or hardware
- troubleshoot software/hardware problems

Groups are not addressed on this leadership list, but Kearsley and Lynch point out their importance regarding collaboration. As the levels of leadership are discussed, the consequences of quality leadership are identified (Table 2). It lists the benefits of good technology leadership, and the common problems associated with poor technology leadership. Leadership training is included in this discussion as a critical element. Teachers and administrators "are not properly prepared to promote and manage technology in schools. This conclusion is based upon the many cases where technology is inappropriately or ineffectually used and by the almost complete absence of any specific training focused on technology leadership. There is a critical need to establish formal training programs for teachers and school administrators in technology leadership" (Kearsley & Lynch, 1994, Pg.13). It is not the technology alone that is needed, but the leadership to carry out its implementation.

A study by Wiske (cited by Kearsley & Lynch, 1994) identified what teachers using technology say they need. Their responses ranged from access and availability to technology, guidance in its use, adequate training, needed layers of support staff, influence on technology policy, and more research on effective computer use. All of these needs should be addressed in a technology leadership training program (Table 3). Table 3 shows the scope of an effective technology leadership training program, including goals, objectives, and topics for training.

Table 2

Consequences of Leadership

What are the benefits and problems associated with good and poor technology leadership? The potential benefits of good technology leadership can include:

- Improved academic achievement by students
- Improved student attendance and reduced attrition
- Better vocational preparation of students
- More efficient administrative operations
- Reduced teacher/staff burnout and turnover

Cited studies on student achievement include: (Bosco, 1986, Kulik, Bangert & Williams, 1983, Niemiec & Walberg, 1987, Ronblyer, 1988).

Cited studies on administrative operations inlude: (Bluhm, 1987, Kearsley, 1990).

A cited study on teacher/staff burnout include (Kearsley, Hunter & Furlong, 1992)

Some of the common problems associated with technology use in education (Becker, 1987, Dwyer, Ringstaff & Sandholtz, 1990, Sheingold & Hadley, 1990) can be attributed to poor technology leadership, including:

- Lack of knowledge about how to use technology (resulting in eneffectual usage)
- Lack of adequate time or funds to properly implement technology
- Use of technology for its own sake rather than genuine need
- Unequal access creating "have" and "have-not" groups
- Poorly designed facilities resulting in limited access
- Poor results resulting in negative attitudes about technology
- Overt resistance on the part of potential users

Table 3

Technology Leadership Training Program

Goal:
To develop individuals capable of improving our educational system through the wise use of instructional technology.

Objectives:
- Conceptualize and design technology-based solutions to educational problems.
- Know and employ strategies that result in the successful implementation of technology-based educational solutions.
- Explain and predict the changes that adopting a new technology will entail
- Understand the strengths and limitations of current and emerging technologies
- Conduct evaluations of technology including formative and cost/benefit studies.
- Understand the conceptual and theoretical issues underlying the application of instructional technology.

Topic:
- Computer Applications in Teaching and Learning
- Computer Applications in Educational Administration
- Educational Hardware Systems
- Organizational Dynamics
- Leadership Theory
- Instructional Theory & Design
- Program Evaluation
- Educational Policy Studies
- Instructional Software Design
- Distance Education
- Interactive Multimedia
- Educational Systems Design

The strength of this suggested program is its scope beyond a one day, "how to" session, to a sequence of issues that include leadership, instruction, and theory.

The philosophy of leadership in technology deals with the concept of vision. Vision is considered an important part of the planning or development of leadership perspectives. Rhodes (cited in Kearsley & Lynch, 1994) writes in a report of the National Foundation for the Improvement of Education, that "before any kind of fundamental changes can be made in a school or district, a 'vision' for students must be created, understood and shared by teachers, administrators, parents and the entire learning community" (Kearsley & Lynch, 1994, Pg.29). This is an emphatic vote for the response element needed prior to carrying out any actions in reform. Attitudes and beliefs must be addressed. Two school districts are given as examples of how vision played an important part in the success of reform through technology. Belridge School in McKittrick, California, was a wealthy system, ready to fund technology to improve education in 1988. The district decided to create a community of global learners. Meanwhile, in Kitsap, Washington, a district that was stretched for revenues, decided to invest in improvements using technology. In Belridge, teachers and students were given computers for school and home. In Kitsap, funding was spent on a multimedia workstation, a TV station, and labs. Curriculums were redesigned along with other elements needed to improve education and prepare students.

The end result was that Belridge's efforts fizzled after only two years, while Kitsap became a national model of successful change in education. Kitsap called their plan Strategy 2020, which was formed by teachers, administrators, parents, and other community members. The entire community participated in creating a vision for their school, while at Belridge only the teachers and administration were involved in forming their plans. Rhodes concludes that lasting change in education of any kind can succeed only if everyone touched by the change shares in the same vision, and understands that change will work to improve education. She also gives endorsements to the building of visions creating scenarios. The Christa McAuliffe Institute is part of the NFIE program, that is involved in vision development. The institute encourages and honors the pioneering efforts of risk-takers in education. Summer workshops are held for Fellows teams to plan projects through scenario building. Participants then take the experiences and results back to their districts, hopefully to help build a solid foundation for reform (Kearsley and Lynch, 1994).

This foundation of building visions moves educators further along in the leadership process. A helpful visual diagram further illustrates the process of diffusion, or implementation of a specific technology (figure 1). It refers to a process of the development and movement of transitions. Individual initiatives indicate the level of involvment of certain technology innovations.

(figure 1)

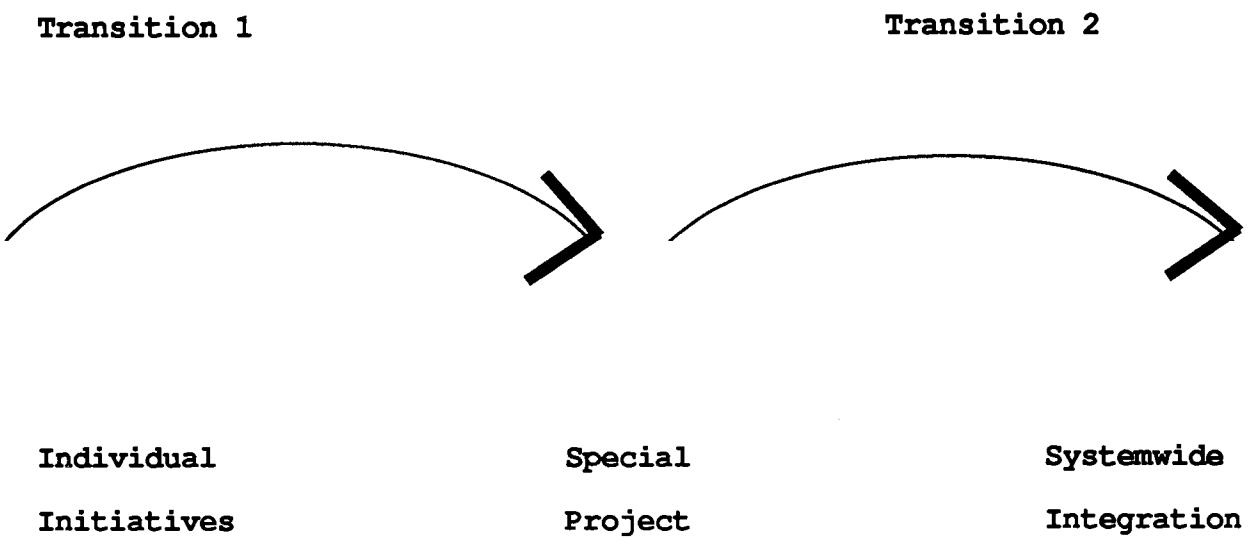

Figure 1 illustrates the progress as the technology is used, should it move from an individual initiative, to a special project, and finally, a systemwide integration. In each step, the transition stage is noted as being critical for further progress. Pelgrum and Plomp (Cited in Kearsley & Lynch. 1994) conducted a study of computer use within nineteen educational systems world wide. In many cases, "Some sort of stalled process with respect to computers in education, both in terms of systemwide institutionalization, and in terms of integration into the teachers daily practice occurred" (Kearsley & Lynch, 1994, pg.115).

The role of educational leadership in this adoption process can increase the chances that a technology will be diffused. In the individual initiative stage, technology might be implemented as an innovation and may be at a grassroots level in terms of leadership decision-making. Through an acceptance or momentum of these initiatives, it may become a special project where much time, money, and support is given to the effort. Then, the third step is adoption at the systemwide level. Once it becomes practiced, it is considered institutionalized, or ongoing in routine and practice (Kearsley and Lynch, 1994). This simple visualization reveals the pitfalls of implementation. Kearsley and Lynch provide other studies that reveal diffusion often does not make it to completion through the process.

Another study by White (Cited in Kearsley & Lynch, 1994) describes the success rate for the implementation of innovative programs beyond the special project phase as very low, at about 20%, while another study by Fullan (Cited in Kearsley & Lynch, 1994) defines this as a problem of continuation that is related to special funding. When the funding stops, very few projects continue. Collis and Carleer (Cited in Kearsley & Lynch, 1994) provide examples of special technology enriched case studies. They provide details of school-based projects that have been tried out, then adopted as an instructional practice or not, depending on the results.

The special project approach requires leadership in innnovation and experimentation, and it takes time and initiative to establish. The process can take years to realize results. With this in mind, getting to the systemwide diffusion stage seems almost impossible. But it applies more to the organization and content. It would mean the computer, being adopted just as books in the library are used in the everyday practice of the school setting.

The leadership needs at the systemwide diffusion stage are more challenging, because educators must informally evaluate the integration between many groups, departments, or grade levels, and also think about the implications as teachers implement the technology. Time continues to be an element in this process stage. The process of leadership and reform defined by Kearsley and Lynch furnish some of the realities facing schools as they act on reform.

By breaking down the entire process of technology diffusion into stages, it becomes clear that the leadership element is crucial for successful reform. Educators face many roadblocks as they work with technology. It is not just the use of a computer as a tool, but the implementation of educational technology within a system that becomes the challenge. The presence of strong educational leaders at all stages of technology implementation can be foremost in yielding exemplary educational practices.

The future of leadership in educational technology is defined further in Kearsley and Lynch's final chapter. Perelmen (cited in Kearsley and Lynch, 1994) states that future success is tied into the training of educational technologists. It is also critical to devote a greater amount of funding and efforts in research and development. The technology gap that results is fueled by high education costs with little funding going to research and development. Efforts at restructuring should be linked to studies and research. Innovation is noted as important in closing the technology gap. Schools should create greater incentives for educators to develop effective strategies and practice instructional technology, Perelmen (cited in Kearsley and Lynch, 1994).

Kearsley's and Lynch's work addresses the tremendous need for leadership in the use of technology to ensure that it contributes to valuable and lasting change in education. It is a work that should be placed on everyone's reading list that is involved in education today, whatever their role might be. The educational technologist can use this as an effective model for continued planning related to technology and reform. The concept of leadership is well defined and named as a key element in the success of any kind of reform, including technology. It provides many rich ideas, sources, and experts, in research and case studies. This source should be a part of all educators' professional libraries.

The difficulty in approaching the subject of reform lies in its broad scope, because it impacts so many elements of education. By examining the first steps required in the journey of reform, it is however more approachable. Educators who focus on positive issues remain leaders that can surpass the naysayers' negative agendas. As in any task, effective planning is helpful in accomplishing it. This is also true in efforts to change as educators. If teachers take action or respond with a plan, they can impact the process. More importantly, they will motivate other educators to be a part of technology and reform. This is happening in many different ways in education. One direction to explore is the idea of "best practices." This can be in the form of case studies, reports from educational or research groups, online data, or books. One of the books that can be of help in this area is Educational Technology: Best Practices From America's Schools, by Bozeman and Baumbach, 1995. It offers a contemporary view of technology practices. It is a source for quick reference with a clean overview of computer technology, including technical aspects of instructional computer applications and profiles of schools that are presently involved in instructional technology projects.

An example of the reference format is shown by the profile list in table 4 (Bozeman and Bambach, 1995). It is the Alhambra Model Technology Schools Project which lists broad topics describing the project.

Table 4

The Alhambra Model Technology Schools Project

Goals of Program:

- Provide student-centered learning in a technology environment, focusing on collaborative instruction
- Promote technology literacy, by using computers as tools

Things to Consider:

- Time
- Planning
- Training.....

Keywords

- Restructuring
- Student-directed learning
- Cooperative learning
- At-risk students
- Multimedia

Location

- Alhambra High School.....

Description of School and Community

- Grades 9-12...
- 650 students.....

Description of Program

- The focus....student-centered...
- History of project, funding etc.....
- Technology used.....

Table 4, Continued

The Alhambra Model Technology Schools Project

Special Outcomes, Results, Accomplishments:

•Project involved students from culturally diverse environment

•Research used to identify processes and stages of integration

•A design-team approach use to develop technology site plans

•Success of the project, what was modelled, such as portfolio assessment, interactive learning environment, catalyst for change in restructuring, demonstrate community and business linkages and partnerships.

Difficulties (Anticipated and Unanticipated)

•Get teachers to move forward toward student-centered cooperative and collaborative mode of instruction.....

Things to Consider:

•Time

•Planning

•Training.....

Costs:

•Well-funded project model, not meant to be replicated in its entirety. Parts will be adopted, when evaluated.

•Actual dollar funding noted here, for how long, and who contributed.

•Breakdown of where funds were spent

•Contact Information

Individuals

Information

There are other profiles offered which furnish a variety of project information. The Apple Classrooms of Tomorrow are noted, The Center for Applied Technology, Mainstreaming Technology, Technology Educators Grant: Mentorship On-Line, The Visual Arts Center, are also included. (Bozeman and Bambach,1995).

In looking through the profiles, the only criticism is the ambigous nature of the success of a project. It is not clear what success, if any, is found in moving these projects into the mainstream of teaching. The brevity of the project description format can be an advantage when seeking examples of a broad nature, but it is helpful to know more about the implications and the realities of each project. It is, however, a quick reference, with contemporary content that will be useful for technology leaders who may be in the planning and development stages of technology utilization. Noted research is not directly addressed in these projects. Its merit as a guide to restructuring is more general, where the reader could analyze reported implications, and seek further help by contacting the project leader. This source helps those who may be seeking some hands on research for their own analysis.

It seemed important to include examples of best practices, to give depth to the issues affecting restructuring. Educators might look to this source as they prepare for change. These examples can be useful in comparing or modelling best practices.

The concept of technology and school restructuring is discussed;

> Schools which have embraced technological change in instructional delivery have witnessed many dramatic improvements which are consistent with proponents of school restructuring... It is still too soon to know the extent to which technology will be a catalyst or instrument for school restructuring. Technology does offer the possiblilty for major shifts in teaching practices and organizational paradigms. Perhaps most importantly, technology can be the tool by which teachers can become instructional leaders. (Bozeman & Baumbach, 1995, p.33)

The work of Means (1994) addresses technology and reform, but more importantly, the link between the two. The honesty of her perspective begins with the statement "instructional technology has rapidly developed, yet the state of practice in many places has not kept pace" (Means, 1994, p.1). She concedes that most schools are redesigning themselves without a consideration of technology.

We are reminded of that consideration when discussing the traditional uses of new technologies. Traditional uses of technology do not constitute change, and certainly not reform. The impact of this message is to recognize the issues of educational technology, and clearly define needs that can be met to accomplish reform. A partnership of reform and technoloogy is essential (Means, 1994).

Reform must start with curricular and instructional goals that use technology as a tool to accomplish them. Means (1994) addresses most effectively the instructional impact of technology and reform. She states, "There is widespread agreement among educators and psychologists that advanced skills in comprehension, reasoning, composition and experimentation are acquired not through the transmission of facts, but through the learners' interaction with content" (Means, 1994, pg.4). This is not argued by educators, yet it is quite general in direction. Further reading provides an overview of the teacher and student roles using technology. This includes the positive impact on the learning environment, and the relationships of this learning to real world experiences. The context provided by discussing reform and technology as it relates to realities and promises affords the reader the opportunity to understand the complexities involved in reform.

Further discussions of the realities brings up teacher preparedness. "Professional development has been identified as the missing link in successful educational reform" (Means, 1994, p.48). It is suggested that schools should invest at least as much in professional development as in the technology through school funding and grant sources. It may be possible but it seems a daunting task. The challenge would be to convince school officials that this investment will pay off.

Means provides insight into evaluative processes using technology. She points out that standardized testing can be very misleading as to the effectiveness of the instruction and the actual learning that takes place. There is a problem of developing adequate research since technology is not implemented in isolated school settings. Outcomes will be hard to measure by existing standards. Means (1994) suggests qualitative evaluations by documenting case studies and looking closely at the processes and effects of the project. The basis for the qualitative evaluations and criteria considered should be clearly understood, before school officials base research on their plans for action. A statement can become distorted when it is taken out of context. This same analogy using research can occur. Studies that seem to replicate similar educational settings and visions are more likely to assist in evaluating technology's effectiveness. Each year more schools acquire the technology, implement it, and find whether or not it works for them. Research can help evaluate results and analyze areas needing improvement.

Means (1994) places a challenge in all educators hands, much like the leadership roles defined by Kearsley and Lynch (1994);

> Technology by itself is not the answer to this nation's educational problems. The power of technology will come from it's combination with serious educational reform.

> The responsibility is upon schools, to rethink their missions, starting with students and instruction, before they can understand ways in which technology can help them. (Means, 1994, pg.191)

Mean's source is a valuable tool to evaluate and develop an analysis of technology's role in reform. It cites studies and research which offer a big picture of current thought concerning reform.

It is insightful in it's objectivity and would be a good source to initiate discussion and questions centered around the planning, or response stages of early reform. For those educators who are involved in some sort of reform, it can provide a constructivist's view of learning with helpful suggestions and research sources to explore further.

A final analysis that looks more closely at the student's role in technology and reform is a report conducted by Sivin-Kachala & Biato, (1994) called The Effectiveness of Technology in Schools, 1990-1994. It is directed towards student achievement, self-concept and attitudes about learning, and the effects of technology on teacher, student, and learner interactions. It was based on 133 research reviews and reports on original projects. The research includes studies that synthesize and analyze data from more than one study. Some studies are based on classroom observation, and surveys.

This informative report provides an example of the research methodology that is applied in technology studies. It addressed the meta-anlysis of the effects of technology-based instruction in comparison with other instructional treatments, using traditional methods. Meta-analysis is a method of assessing, in this case, technology based instruction across many different studies. A common measurement scale, called the effect size (ES) is used. One study by Kulik and Kulik (Cited in Sivin-Kachala & Biato,1994) considers 0.3 ES as moderate to significant in effect regarding the kindergarten through higher education level of computer based instruction (CBI). Ryan (cited in Sivin-Kachala and Bialo, 1994) conducted a meta analysis of elementary schools administering CBI. It was found that the students of teachers with more than 10 hours of training significantly outperformed students of teachers with 5 or fewer training hours. This study was calculated at an average of .309 ES. It revealed the significance of teacher training in CBI.

Of most interest was a study on student self concept and attitudes about learning. The research confirmed that technology had beneficial effects on student self-concept. An urban elementary school participated, with one group receiving classroom instruction plus CBI, while the other group received only traditional class instruction. There were significantly higher measurements of self concept with the instruction-plus-CBI approach. Students found success using technology in their learning (Sivin-Kachala & Bialo,1994).

This report on effectiveness of technology helps finalize thoughts and analysis concerning reform and technology. By studying results, one can develop a a position, or retrospective of information concerning technology's impact on learning. It would be irresponsible to ignore research data. It is important to understand it's source, and the environment the research was conducted in. It is also significant that these studies were conducted by a software group with an obvious interest in finding positive results.

Regardless of the motivating factors involved with research and studies, it is critical to emphasize the importance of the learner, the student, in this discussion. In the end, this is the ultimate purpose of inquiry in seeking exemplary teaching practices. This search addresses the vision that technology allows for new methods of instructing and learning. In harmony with that vision is the foresight of educational leaders to seek new structures in education that meet the needs of a digital learner.

Conclusion

This review of literature brought together some components that, when considered and compared, helped form a knowledge base related to reform and technology. Frick's (1991) analysis of a systems model in education provided a context to work from when anticipating change and planning change in the learning structure. His emphasis on restructuring through technology offers insight by encouraging scenarios of a school of the future. Without a doubt, most who speculate about this, include technology. The proposals and ideas expressed by Perelman (1992) vividly describe schools of the future, fully dismantled, and completely driven by technothreads of hyperlearning. The term "hyperlearning", is really a deluxe label for what is going on now in technology. It just isn't going on in many schools, however. Why does it take so long for schools to adopt innovations and change? Is it because educators stop pushing for innovation and settle for stable, passive learning environments? The fields of medicine, science, and most businesses have seen dramatic changes in how they practice their expertise, brought about by the driving force of technology.

The argument that urban schools are in trouble continues. No one seems to have answers for the best way out of that trouble. The answer does not come from a single solution but in the shared ideas of collaboration, planning, communicating, and establishing a vision of where local schools and communities should be today and in the future.

Educators must come up with ways to keep students excited about learning. At present, technology is one way. There is a backlash involved though. Traditional systems tend to remain as they were, thus the development of technology could simply be a phase that fades in time. This backlash comes from those who might fund schools, particularly in technology. If taxpayers find that very little has changed, including students' test scores, they may question the need for continued support and funding.

Technology's new paradigm, introduced in a very traditional structure, creates more pressures on schools to perform and measure up to sterile standards. Let's get away from grades, and work towards standards of performance in evaluating learning. Let's get away from students sitting passively in a chair and encourage students to work in groups, solve problems together, write, and communicate to the outside world. Let's use technology as much as possible to teach and model. Let's encourage students to seek excellence and be self-directed in their learning.

These are not unattainable goals. What educators find is that they have no roadmap of how to get there. Some educators take off without a destination, and inevitably get lost. Others advise against going anywhere because that would require them to move away from their familiar landmarks. Others still are willing to hitchhike, taking great risks with their safety and future. This could be a metaphor for the dilemma educators face in making decisions concerning restructuring, or reform.

What about learning a bit about map reading? Why not buy a compass, plan an itinerary, and talk to others who have travelled out in the world? Could this trip, or journey be so frightening if one prepared themselves for the trip? Understanding the dynamics of reform and studying a systems model could prepare educators for the journey, using technology as they practice their teaching skills.

It is recommended, through reading about leadership and educational technology, that teachers need active, energetic, and vocal tour guides. Leadership will be the instrument of change. Leaders, or tour guides will show them how to use the compass, the maps, and help them practice finding their way. Individuals who are willing to work harder to organize memorable experiences on this technology journey are critical.

World travellers who have taken exciting sojourns, can share their experiences. Reading case studies, research, and best practices will provide guidance along the route. Even more important than the journey, are the artifacts brought back in experience, philosophy, and wonder. Can educators instill this kind of learning ethic in their classrooms? Students will also be a part of the journey, as they meet others, and share in the excitement of learning. Teachers may ask their students to travel new routes to destinations through technology. It may result in higher expectations for all involved.

This metaphor seems to flow endlessly with scenarios of learning and restructuring. Yet to put into practice a philosophy, or vision will require leadership to influence policies and procedures.

Educators should take every advantage of opportunites to impact decisions centered around technology. Serving on committees, attending professional conferences, or showcasing technology achievements will present a strong position as an advocate for technology's use, and direction towards reform.

Educators are not prepared to advocate reform, unless they are strong advocates of reform. That means being knowledgeable about recent research and professional reviews, and, like the problem described in this paper, prepared for change.

It is certain that technology and reform will continue to shape the entire format and meaning of what educators once knew as school. They can be a force in creating a school of the future, despite the naysayers. They have a map of how to get there. It is called educational technology.

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