Herding Elephants:
Coping with the Technological Revolution
in our Schools

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ABSTRACT: The focus of this paper is two-fold: to what extent do schools need to address computer technology and what strategies could be employed to maximize the benefits and minimize the difficulties in integrating computer technology into the current educational framework. It advocates the incorporation of computer technology into the educational practices of classroom teachers recognizing that computers are merely tools which can be utilized effectively by well-informed practitioners. It employs basic change theory in a discussion centering on managing and coping with change. Particularly, it encourages educators to make an orientational change to ensure that technology is used in "new" ways rather than simply to replace "old" tools.

RESUMÉ: L'objet de ce papier comporte deux volets: les mesures dans lesquelles les écoles doivent enseigner l'informatique les stratégies à employer pour en optimiser les bénéfices et réduire au minimum les difficultés pour l'intégrer à la structure éducative actuelle. Il conseille son intégration pendant les cours des professeurs en classe, reconnaissant que les ordinateurs sont simplement des outils qui peuvent être utilisés avec efficacité par des utilisateurs compétents. Il accepte la théorie du simple changement dans une discussion axée vers la gestion et la direction avec possiblité de réforme. Il encourage particulièrement les éducateurs à prendre un nouveau cap pour assurer ainsi, que l'informatique soit utilisé comme un outil «support,» nouveau plutôt que d'être utilisé comme substitut des «anciens» outils.

When one finds one's self in the presence of stampeding elephants, there are at least two potential choices available. If the skill and the requisite knowledge are available, one can attempt to "herd" them, calm them, and regain some sense of order. Alternatively, the person can simply get out of the way. One thing is certain, however. Whatever the individual's orientation, he or she cannot ignore the situation without running the risk of being trampled.

The situation regarding technology in contemporary education is analogous to the hapless elephant herder. A decision must be made to

either "manage" the situation to find a way to utilize technology and integrate it into the educational framework or to stand aside and let the technological revolution pass by. It is clear, however, that educational technology cannot be ignored. It will not go away and, like most innovations, it will not manage itself – at least, not very well.

The focus of this paper is to provide a conceptual framework for dealing with educational technology. It assumes that a choice must be made to integrate educational technology into the fabric of current educational programs. It does not profess to be exhaustive but rather to raise some issues to be considered when managing the change in schools. To begin, some terms and phrases associated with educational technology are defined. Then, an outline describes what this change may look like and some reasons for the change are presented. Finally, issues surrounding the process of that change are surfaced which, one would hope, will provide a "heads up" for those attempting to effect change.

Definitions

A review of the literature concerning educational technology produces some significant problems with respect to divining useful definitions. It seems that the meaning of the phrase "educational technology" or, as it is sometimes called, "technology in education," is somewhat dependent upon the author's orientation and the time frame during which he or she produced the piece. For example, Eleanor Howe (1998), an information technologist and computer literacy instructor (teacher-librarian), views educational technology in terms of electronic search skills. This clearly betrays her orientation in a definition which is reflective of her teaching discipline and which is also too narrow.

Other authors, however, are far more fuzzy about their conceptions of educational technology. Depending upon the publication date of their articles, authors may use the term "educational technology" to refer to anything from TV/VCR's and laser videodiscs to electron microscopes, scientific calculators, and virtual schools. However, for the purposes of this paper, educational technology will refer specifically to computers and the roles they have in today's educational milieu from a virtual classroom via the world wide web to computer-assisted drafting and graphic arts.

The Change: From What to What?

Current Reality

In its fundamentals, education has changed little throughout human evolution. A mathematics teacher, for example, teaches concepts that are hundreds or thousands of years old often supplementing his or her lectures by drawing or writing with a piece of chalk on a blackboard. One could argue that, from the student's point of view, this educational experience differs little from the experience of Pythagoras's students. However, whether or not this is true is a double-edged sword.

On one hand, it certainly could be argued that Pythagoras's students were likely able to understand and apply his mathematical concepts at least, in part, due to his tutelage. Therefore, the teaching methods he used were probably appropriate and successful. Perhaps it follows, then, that because his students successfully learned the concepts, that no change would be necessary for contemporary applications. In other words, since the concept has not changed, the approach need not change either. To an extent this may be true, for there is no substitute for good teaching. After all, "despite confident predictions, the teacher and the school have not disappeared simply because no technology can replace them" (Salomon, 1998, p. 8).

However, it could also be argued that while the concepts remain the same, both the context for their application and the context for those who are learning the concepts have changed. "Historically, our understandings of the human psyche, particularly cognition, and the technology we employ as metaphors or as tools for teaching, tend to go hand in hand" (Salomon, 1998, p. 4). In fact, "cognitive tools have been around ever since humans used piles of stones, marks on trees, or knots in vines to calculate sums or record events" (Reeves, 1998, p. 50). Presumably, Pythagoras used cognitive tools and metaphors available to him to explain the concepts and which made sense in his students' context. Computers, in today's context, represent a powerful tool for teachers to use to help develop cognition in contemporary students.

However, computers, in the reality of today's classroom, have not permeated the cognition-development tool palettes of most teachers. In a somewhat fatalist statement, Gardner (2000) states "a human being miraculously transported from 1900 to our time would recognize much of what goes on in today's classroom – the prevalent lecturing, the emphasis on drill, the decontextualized materials and activities" (p. 30). This implies that most of today's educators are

doing a poor job of educating students which is not the position of this paper. There is, in this author's opinion, a great deal of good teaching taking place in today's classrooms. However, "an alternative approach [which] involves using computers as 'cognitive tools' that students learn 'with' in a cognitive partnership" (Reeves, 1998, p. 50), has not, so far, come to fruition in most schools.

Kay (1997), accepts that computers have crept into educational delivery. However, he stresses that educators have not gone far enough. "[The current uses of computers] represent a desire on the part of a future-shocked public to see a new technology only as a better version of an old one" (p. 19). In other words, some educators may have adopted the change without really implementing it. Fullan (2001) posits "a teacher could use new curriculum materials or technologies without altering the teaching approach" (p. 39). They use the new technology in old ways – to replace old tools (e.g., chalk, books, overhead projectors, etc.) without creating the required new structures and contexts for appropriate utilization of the technology.

In summary, schools are, at best, in the infancy stages of incorporating computer technology into their daily business. Schools have begun the change but, "changes in our world are so rapid and so decisive that it will not be possible for schools to remain as they were or simply to introduce a few superficial adjustments" (Gardner, 2000, p. 30). Otherwise, "all the technology we put in schools is no more than the emperor's new clothes unless we attend to the content we want children to learn with the technology and the kinds of thinking we want them to be capable of" (Kay, 1997, p. 19). In other words, one will be trampled by the elephants if one does not respond to or manage their stampede.

Potential Future Reality

> Challenging interactive software, dramatic narrative conveyed through electronic media, beautiful art and animation, and the rhythmic force of music all have a strong appeal in our culture. To improve educational outcomes by exploiting this appeal is a powerful idea. (Becker, 1998, p. 20)

The purpose of most educational reform proposals is, and should be, to improve instruction and enhance student achievement. Indeed, a common phrase which has almost become a mantra in current educational circles is "What's good for kids?" This is sometimes a rather difficult question to answer. The above quotation, for example,

certainly sounds like it would be good for kids. However, as stated earlier, this is not the typical student's experience with educational technology. "Despite this great variety of ... software, the surveys suggest that relatively few students have the experience of using computers in these ways, or at most do so on only an occasional basis" (Becker, 1998, p. 27). So, the first cog in the wheel of the future potential reality is one in which students experience technology as a tool which enhances cognition by exploiting the lure of the very nature of technology and, therefore, becomes more engaging.

Gardner (2000), in his criticism of current educational practice, suggests that "much of education in the past [and present] was calibrated to make sure that individuals could carry out a regular job, reliably, throughout their productive adult years" (p. 31). This is no longer the reality. Most of the tasks which can be handled algorithmically will be and are handled electronically. In addition, statistics suggest that few people will occupy the same occupational niche for their whole lives. Further, "most adult teachers and parents will not have experiences on which they can draw to prepare youngsters for a world in which they can expect to change ... regularly" (Gardner, 2000, p. 31). Therefore, as many authors suggest, the focus of education today, more than ever, should be to help students become "life-long learners" who have learned the means for coping with the changes they will regularly face.

While the focus of education has always been, at least in part, to help students become life-long learners, it must be mentioned here that the term itself seems to have developed a subtle additional meaning. Reeves (1998) points out that, "integrated performance support systems are essential to the levels of workplace performance required of all workers in organizations that hope to compete in a global economy ... [and] that these support systems must be multi-sensory, integrating a variety of media appropriate to the task to be learned or performed" (p. 49). This requires workers to be life-long learners who are able to cope with the changes in technology and multi-media as well as the sheer volume of those media. However, they will not possess the skills necessary to perform at this level of multi-sensory competency unless schools program learning opportunities through the authentic use of computer technology across the curriculum which allow students to develop these skills. Thus, our elephant herder must learn not only to manage the vast number of elephants he encounters but also to develop new methods of reacting to the elephants themselves.

A potential future reality must also recognize that our society has entered an information age which is, perhaps, unparalleled in human

history. In fact, "information ... has quite suddenly become the world's most important resource" (Cleveland, 1997, p. 13). Therefore, a future educational reality must help students use technology to cope with and utilize this vast array of information.

The co-NECT school, for example, is one of the platforms of school reform advocated by the New American Schools movement. The basic underpinnings of the co-NECT school are built on a foundation which includes "...a comprehensive, technology-supported framework for learning ... [which is] project-based [and] interdisciplinary" (Kearns & Anderson, 1996, p. 14). Further, Becker, Wong, & Ravitz (1999) observed that "co-NECT schools can be characterized as schools involved in a thorough-going program of whole-school reform, one that involves substantial use of computer technology in pursuit of student learning that is project-based, interdisciplinary, and emphasizes authentic, real-world applications of academic content and community service" (p. 4). The co-NECT school platform is not exactly unique, however, it is illustrative of the kind of change in focus regarding educational technology advocated in this paper. Thus, the herder learns to use new tools and techniques for managing his elephants by using them to manage elephants!

While it is difficult to predict what skills and competencies students will need in the future, one can begin to paint a tentative picture based upon society's expectations as evidenced above. Jacquie MacInnes, in 1996, described an early experiment in the implementation of technology in the classroom. She suggested that the primary focus should be on the *effective* use of technology. For example, students should "use a wide range of processes, techniques, tools and materials to gather information, solve problems, create and evaluate products and communicate results" (1996, p. 15) in the context of safe and ethical use of technology with an eye to the evaluation of the influence of technology in our lives. This parallels the descriptions of the new expectations of lifelong learners outlined above and speaks to the activities one may complete in order to become prepared as expected by contemporary society.

This represents a significant change in thinking from seeing technology as a glorified library database as suggested by Howe (1998) or even as an internet surfer and e-mailer as suggested by many other authors. After all, "computers are really for helping us understand systems that are too complicated to think about in classical ways, such as political systems or the AIDS epidemic" (Kay, 1997, p. 19) and should be used in ways that reflect this reality.

Technology must be integrated into our educational systems so seamlessly that it would seem ludicrous to ponder whether or not a computer should be utilized in a particular context to accepting the computer as it is and allowing it to be used to its full potential as the tool it is. Mehlinger (1997) identifies seven principles adopted by Forest Hills Public Schools in Michigan which are indicative of a potential future school technological reality. He says that technology should:

(1) Develop student skills in problem solving, critical thinking, and analysis and management of information.
(2) Enable students to become comfortable with technology and understand that technologies are merely tools to help them perform their work.
(3) Focus students' attention on using technology as tools to extend knowledge and to individualize learning.
(4) Develop an active participatory learning process.
(5) Integrate all of the preceding principles into all grades and all disciplines.
(6) Provide a climate receptive to change.
(7) Assist teachers in changing their roles from presenters of information to learning facilitators and coaches. (p. A23)

Schools must, therefore, begin to create a new reality for themselves which embraces the technology as a fact of life rather than as an "extra burden." While "technology cannot supplant good instruction" (Thomas, 1998, p. 8), good instruction can utilize technology in more effective ways and can, as a result, prepare students for whatever future reality they may encounter.

It is difficult to predict just what a future reality could look like. The computational abilities of computers grows exponentially virtually every day which leads to ever more sophisticated software. However, the explosion of virtual schools and provincial on-line consortia shows some promise as does the proliferation of co-NECT and other school platforms. The creativity and imagination of students and teachers really provide the only bounds for technology in schools but, the key is to use technology in ways that are truly different. After all, to this point "students still spend most of their school day as if these [technologies] and information resources had never been invented" (Becker, 1998, p. 24) and virtually any use of computer technology would represent progress. However, it is the school's challenge and responsibility to create a culture which better integrates technology into its organizational framework.

Managing the Change

Change implies that individuals must give up or, at least, soften their grip on their current reality and accept or integrate a new reality in its place. Marris (cited in Fullan, 2001) observes that "*all* real change involves loss, anxiety and struggle" (p. 30). One might say that the feelings of loss, anxiety, and struggle will be particularly evident amongst teachers during the change to technological innovation because it radically alters the traditional teacher/student paradigm to one in which the students "learn to be constructors of knowledge and to think rationally, creatively, and critically ... [as they] solve authentic problems [and] retrieve and manage information" (Lowe & Vespestad, 1999. p. 35). This shifts the responsibility for learning to the student and changes the role of the teacher from knowledge dispenser to that of a learning facilitator. While good teachers have found ways to create this learning orientation in students, technology in this context could facilitate this paradigm shift. A thorough examination of the change process is beyond the scope of this paper. However, some key issues will be raised in examining the stages through which a school might progress as it seeks to make the sort of changes advocated by this paper.

Fullan (2001) identifies "three broad phases to the change process" which he calls "initiation, implementation and institutionalization" (p. 50). The following discussion of the change process will be organized according to these headings.

Initiation

Initiation, according to Fullan (2001), is when "someone or some group for whatever reasons initiates or promotes a certain program or direction of change" (p. 50). It is hoped that the information presented in this paper along with the vast body of evidence suggesting the change in technology focus will provide schools with the motive to initiate change. However, they may ask "How? Where do we start?" Perhaps, then, it would be valuable to examine the successful initiation procedures of a couple of schools in order to identify a possible strategy in this regard.

Lowe and Vespestad (1999) outline the initiation process of the West Junior High School in Lawrence, Kansas in the following way. The school began with a group of students expressing an interest in computer programming. They convinced a teacher to provide supervision and began a club to learn from each other. Over the course of a few years, the program grew until the school community recognized a need for and created a new mission statement reflective

of the growing importance of technology in the lives of their students and in society in general. The school states this mission as follows:

> Student work should incorporate a variety of complex information sources that will motivate a desire to expand the knowledge base. For teachers, professional development goals include achieving an instructional transition from a teacher-centered to a facilitative, learner-centered, constructivist environment that supports [local] exit outcomes. (p. 30)

From there, the school went about implementing or operationalizing the mission statement and has created a learning community which recognizes the importance of technology in word and deed.

A more general but similar strategy is advocated by Mehlinger (1997). He suggests that schools form broad-based committees made up of teachers, administrators, and community members (parents) which should lead the planning process and define the mission. Instrumental to the success of this plan, in his view, is that "a small group ... should not decide key issues without consultation with others" (p. A23). However, many other authors would suggest that the key issues in most successful innovations could be and often are decided by a small group (perhaps one or two people initially) or the innovation may never get off the ground because it gets bogged down in the consultation process. Nevertheless, this committee (whatever the makeup), according to Mehlinger, should develop a vision, assess the available resources, decide on goals and objectives, decide on an action plan, and evaluate the project regularly and objectively.

The above plans are echoed in much of the literature in the discipline. However, Bull, Nonis, and Becker (1997) identify an additional aspect of the change which seems likely to be a key ingredient if the change is to be successful. They emphasize the need for pointed professional development for teachers at the initiation stage in order to create an informed faculty and, perhaps, a more receptive one as well. In addition, it is suggested that "one of the chief barriers to developing technology [interest] in teachers was lack of sufficient access to computers" (Sheingold & Hadly, cited in Bull et al., 1997, p. 30). Since "educational change depends on what teachers do and think" (Fullan, 2001, p. 115), a "reculturing (how teachers come to question and change their beliefs and habits)" (p. 34) will be necessary. Getting the faculty "on-side" both from a philosophical and a practical point of view would be an important step at the initiation phase. This could be addressed, at least in part, by providing teachers with access to and instruction in the use of computers.

Finally, Fullan (2001) identifies eight factors affecting initiation. Virtually all of the factors can be brought to bear on the decision to initiate a technology-based educational framework. In the interests of brevity, only the factors with the most impact on the process will be identified here. With respect to the existence and quality of innovation, it is clear that a variety of models exist (e.g., co-NECT and West Junior High). It would not be difficult for a school to adopt an existing model or to develop one of its own based on an existing model. Technology, itself, might be seen as an external agent for change; the change in society which precipitates the inclusion of technology in schools definitely is. Which leads to the overwhelming community pressure on schools to change in this way.

Implementation

Implementation of a new idea is a complex process. It involves moving beyond the abstraction of the idea itself to operationalizing that idea in concrete terms. In other words, it requires action. No longer can the stakeholder community stand back and tacitly support an idea in principle – they must become involved and make the idea work. Fullan (2001) supports this notion with the observation that "educational change is technically simple and socially complex" (p. 69). Further, he posits "implementation is critical for the simple reason that it is the *means* of accomplishing desired objectives" (p. 70). If the initiation stage defined the objectives and set the course for change, implementation involves following that course in an attempt to reach those objectives. However, it should be noted that once the implementation of an innovation of any kind begins, it often evolves in ways that were not predicted or foreseen at the outset.

If one is to identify issues critical to the successful implementation of a new technology focus, a perusal of accounts of successful implementation in various school districts may again provide some suggestions. Bull and his colleagues (1997) identify two key factors of implementation success around which the following discussion will be organized – adequate technical support and relevant ongoing instructional support.

Adequate technical support. If school divisions truly wish technology to become integral in the educational process, they must ensure that the technology is "up and working" at all times and that there is a support person to manage the inevitable technical glitches presented by computers. "[When] teachers cannot rely on a computer or printer being in working condition, the use of technology quickly

takes a low priority and rarely becomes an integral part of the educational process" (Bull et al., 1997, p. 31). This probably requires that schools have a full-time computer technician. Yet, "the number of schools that allocate a full-time, non-teaching position to coordinating teachers' use of technology is small" (Becker, 1998, p. 24). Therefore, it seems that a critical factor in determining the success of implementation is having reliable functioning hardware with someone available to address concerns when they arise. The herder will soon give up on his new herding tools and techniques if they do not function correctly when he needs them.

Relevant on-going instructional support. Too often, teachers are expected to do more with less. They are often provided with ill-advised and episodic in-service which appears to be "'one-shot' or [of] short duration ... [which has] little or no impact [on instruction]" (OTA, cited in Bull et al., 1997, p. 31).

In addition, a school must create a culture in which change is seen as a positive and necessary means to a valuable educational end. Lowe and Vespestad (1999) describe the key professional development goal in West Junior High School as achieving instructional change. From that perspective, they say "we have created opportunities for teachers to engage in results-based staff development by providing released time for learning, practice with feedback, ongoing coaching, collaboration, mentoring, and planning" (p. 32).

Many of the other accounts of successful implementation also point out the need for relevant and on-going teacher development. In fact, "this kind of support and encouragement is the most important factor in determining successful [implementation] of educational technology" (Becker, cited in Bull et al., 1997, p. 31).

Institutionalization

The institutionalization or continuation of this or any educational reform will be influenced by the perceived importance of the change relative to other district initiatives as well as the level of active support for the continuation provided by the school or school system. In addition, the provision of mechanisms for on-going data collection and assessment must also be addressed. These issues will be discussed in the following sections.

Relative importance. School systems and individuals within them often suffer from what Fullan calls "innovation overload." He says

"the main problem is not the absence of innovation in schools, but rather the presence of too many disconnected, episodic, fragmented, [and] superficially adorned projects" (2001, p. 21). Other authors, notably Sabatier and Mazmanian, in their examination of the reasons that educational planning sometimes fails, state that "any particular policy [reform] decision is susceptible to an erosion of political support as other issues become relatively more important over time" (1979, p. 499). Further, Fullan points out that "the problem of continuation is endemic to all new programs ... negative school cultures, unstable districts, and uncoordinated state policies all take their toll" (2001, p. 89).

These observations paint a somewhat dismal picture of our attempts to herd the technological elephant in our schools. They imply that the odds of successful integration of educational technology into the schools are quite long indeed. However, in the face of the overwhelming evidence suggesting the need for this change to be successful, this is one innovation that simply should not be ignored or allowed to be eroded over time. Sabatier and Mazmanian (1979) suggest five strategies which tend to maximize the likelihood of successful integration and institutionalization of innovations over time. They include: having a sound theoretical base, an unambiguous policy directive, well-trained leaders, active support from the school board, and an on-going indication of high priority of the innovation (p. 483).

The sound theoretical base supporting the integration of educational technology can certainly be constructed. This paper, for example, is a start in that direction. Of course, it is important for teachers to know why the change has been proposed in the first place and what impact it will have on them and their students. Well-trained leaders, in this case, are probably related to the strong theoretical base. It seems that if teachers are going to be asked to implement the use of technology that many of them are not terribly familiar with, they will need some well-trained leaders to provide support and encouragement. In addition, it would seem prudent to add the additional dimension of teacher training in this context. "Teachers are the key to effective and efficient technology utilization" (Jefferson & Edwards, 2000, p. 140). The technology which is being proposed here was not in existence when many current teachers were trained. A constructivist approach to in-service opportunities in which teachers are provided opportunities to begin learning about educational technology from the point at which their personal computer knowledge begins may be the most successful strategy.

The remaining three strategies could be grouped together for ease of discussion. It may not be necessary to enact a policy directive in this case because of the nature of the innovation. However, support from the school board is often seen at the school level as money. If a school board wants technology to be fully integrated into the instructional delivery of the classroom, it will have to specifically attach a significant amount of money over a long period of time to the acquisition and maintenance of computers and their related software as well as to teacher training. It may be essential, then, to include a budget line indicating the school board's support of this endeavor.

On-going data collection and evaluation. This aspect of managing change needs to be monitored closely both from the point of view of whether the requisite funds and support structures are in place and whether the desired instructional changes have been made. Admittedly, it will be difficult to monitor the implementation of instructional technology in the classroom. However, instructional supervision can shed some light here. Perhaps, it will be possible, over time, to alter the supervisory culture in schools to include teachers' use of technology. It will require the development of a new vocabulary for supervision and, probably, new supervisory structures as well. Nevertheless, it is hoped that the change will ultimately become a part of the fabric of school culture and no longer be viewed as an innovation at all. Again, the goal is to integrate technology so seamlessly into the context of the educational experience of students that computers almost vanish in their use and the decision to use them becomes as commonplace as picking up a pen or a book.

Conclusion

So, how should one manage the stampeding elephant of educational technology in the contemporary school environment? While educators have choices in this regard, the only responsible choice is to recognize the importance of technology in society from a practical and an operational perspective and functionally integrate it into the fabric of students' educational experience.

From a practical point of view, technology has permeated the very fabric of contemporary society. It would be virtually impossible to identify an aspect of human endeavor that has not been affected by computer technology. While schools have a variety of intended objectives for students, one could argue that at its most basic, schools intend for students to have the requisite knowledge and skills for whatever future they may choose for themselves – in other words, that

they become life-long learners. If this is true, schools are doing a disservice to students if computer technology is not fully integrated into basic instructional curricula. Technology is a powerful cognitive tool which can be used to enhance understanding and to manage the vast stores of information which exist in today's world. The elephants have definitely begun to stampede! It is critical that educators provide every tool available to students to help them avoid being trampled.

Operationally, technology has the potential to be a powerful arrow in the quiver of educators. Cognitive research suggests that all students do not learn in the same ways and that those who drop out often identify boredom and frustration (they did not "get it") as reasons for not continuing in school. Technology, with its powerful lure, may provide a method for reaching more of those students. It is critical, however, that technology be seen as the tool it is. It is not a panacea for all that ails education today. Much good teaching takes place and many students learn under current educational structures. However, perhaps our elephant herders must try to use *every* tool available to them in their attempts to manage their herds. Technology provides a significant advancement in the manner that good teachers can employ to present educational opportunities to students. In fact, it may be possible to point students in the direction of the information and "herd" them as they interact with it. Perhaps this, again, defines the teacher's role as learning facilitator or coach rather than as transmitter of knowledge. This, one would hope, will led to student behaviours which resemble those of the lifelong learner described earlier. Education, in this context, could be a sort of super-charged resource-based learning or on-the-job herd management!

So, responsible elephant herders everywhere must seek to find ways to manage the stampede by choosing appropriate and meaningful means of integrating technology into the instructional curricula at all levels of public education. Virtual schools and platforms such as co-NECT provide the templates and society provides the impetus for instructional reform. Now, it is up to educators to enact that reform.

REFERENCES

Becker, H. (1998). Running to catch a moving train: Schools and information technology. *Theory into Practice, 37*(1), 20-30.

Becker, H., Wong, Y., & Ravitz, J. (1999). *Computer Use and Pedagogy in co-NECT Schools, A Comparative Study.* Teaching, Learning, and Computing: 1998 National Survey Special Report, University of California, Irvine.

Bull, G., Nonis, A., & Becker, F. (1997). Realizing technology's potential. *Principal, 76*(3), 29-31.

Cleveland, H. (1997). Information is the critical resource of the future. *The Futurist, 31*(1), 13-15.

Fullan, M. (2001). *The new meaning of educational change* (3rd Ed.). New York: Teachers College Press.

Gardner, H. (2000). Technology *remakes* the schools. *The Futurist*. March-April, pp. 30-32.

Howe, E. (1998). Integrating information technology into and across the curriculum: A short course for secondary students. *Knowledge Quest, 26* (2), 32-40.

Jefferson, A. & Edwards, S. (2000). Technology implies LTD and FTE., [Monograph]. *Pan-Canadian education research agenda*. Ottawa, ON: Canadian Society for Studies in Education.

Kay, A. (1997). Technology and powerful ideas. *The American School Board Journal, 184*(7), 16-19.

Kearns, D. & Anderson, J. (1996). Sharing the vision: Creating new American schools. In S. Stringfield, S.M. Ross, & L. Smith (Eds.), *Bold plans for school restructuring: The new American schools designs* (pp. 75-108). Mahwah, NJ: Erlbaum.

Lowe, M. & Vespestad, K. (1999). Using technology as a tool to enhance teaching and learning. *NASSP Bulletin, 83*(607), 30-37.

MacInnes, J. (1996). Technology in the classroom. *FWTAO/FAEO Newsletter, 15*(2), 14-19.

Mehlinger, H. (1997). The next step. *American School Board Journal, 184*(6), A22-A24.

Reeves, T. (1998). 'Future schlock,' 'The computer delusion,' and 'The end of education': Responding to critics of educational technology. *Educational Technology, 38*(5), 49-53.

Sabatier, P. & Mazmanian, D. (1979). The conditions of effective implementation: A guide to accomplishing policy objectives. *Policy Analysis, 5*(2), 481-504.

Salomon, G. (1998). Technology's promises and dangers in a psychological and educational context. *Theory into Practice, 37*(1), 4-10.

Thomas, R. (1998). Supporting the learning process. *Thrust for Educational Leadership, 27*(5), 6-8.

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