What's In, What's Out - An Analysis of State Educational Technology Plans

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This paper presents an analysis of dominant discourses in state educational technology plans. The potential pedagogical, political, and financial implications of state technology plans were the impetus for the current study. Our primary purpose is to understand the views promoted in these plans. The promotion of some ideas automatically implies demotion of some others. We are thus also interested in finding out what ideas are missing. We hope that, by highlighting both the prominent and missing ideas about educational technology in state technology plans, we have presented some insights that will be beneficial to policy makers, teachers, and researchers. There are four important dimensions of educational technology: technology, students, teachers, and educational goals. How each of the aspects is viewed and presented in the technology plans influences decisions on hardware and software purchases, strategies for teacher professional development, formulation of teaching objectives, as well as development of learning opportunities for students. Our analysis concentrated on views of these dimensions, specifically on the views endorsed and ignored by the technology plans.

Executive Summary

Educational technology planning is a new and booming phenomenon in American education. A number of national reports have done a very good job conveying the message that technology holds great potential for education, but students are not using it to improve their learning because: a) they don't have access to adequate hardware and software and b) their teachers have not been adequately prepared. This message is fueling the multi-billion dollar frenzy to get technology into schools and provide technology training to teachers. Accompanying this campaign for technology in schools is the dramatic growth in technology plans. These plans serve as frameworks for integrating technology in education at the state, district, and school level. As an important rhetorical device used by state and local educational policy makers, who are behind the generous spending on technology, these plans also attempt to convince the public that technology ought to be integrated into education as an effective solution to a myriad of educational problems.

Educational technology plans are not only a rhetorical devices or political exercise, they have serious financial and technological consequences, which in turn have great implications for educational practices. Because technology plans are quite often a pre-

requisite for accessing major funding opportunities, such as the five year two billion dollar Technology Challenge Funds and the over five billion dollar Universal Service Fund (e-Rate), schools and state educational agencies must develop technology plans in order to obtain technology funding. Moreover, since very often locally generated funds through bond or taxes can only legally be used for hardware and connectivity purchases most schools and individual teachers have to look to the state for funds to support professional development and efforts to integrate technology in education. These funds are normally dispensed in the forms of competitive grants. State technology plans are usually used as the basis for selecting grant proposals (e.g., State of Michigan). Thus it is logical for teachers and schools to propose ideas that are endorsed by state technology plans. Consequently, state technology plans become sources of strategies, concepts, and approaches for developing programs for teacher professional development and classroom technology integration. They also dictate the kinds of software tools, on-line resources, and other technology related materials schools and teachers may purchase or develop. In other words, state technology plans act as a powerful policy instrument shaping expenditures on technology, the focus of professional development initiatives, and research on technology and its uses in schools.

The potential pedagogical, political, and financial implication of state technology plans was the impetus for the current study. There are four important dimensions of educational technology: technology, students, teachers, and educational goals. Our primary purpose is to understand what views of these dimensions are promoted in state technology plans. The promotion of some ideas automatically implies demotion of some others. We are thus also interested in finding out what ideas are missing. We hope that, by exposing the prominent and missing ideas about educational technology in state technology plans, we will gain some insights that will be beneficial to policy makers, teachers, and researchers.

Based on our analysis of state technology plans, we have come to the following conclusions. First, in terms of technology, we found that state technology plans seem to favor "new" technologies over "old" technologies. Furthermore, the portrayal of the inevitability of change as a result of technology adoption was a pervasive theme through the technology plans. Second, in terms of students, we found that the plans more often than not focused on technology's capacity to improve student test scores, paying little attention to important epistemological assumptions about student learning. Third, in terms of teachers, our reading of the technology plans suggests that the plans do acknowledge that teachers are important in technology adoption but do not go as far to as to identify ways in which teachers can be resourceful, knowledgeable, and purposeful designers of educational technology. Fourth, in terms of educational goals, the plans privilege the goal of economic progress or social efficiency over democratic equality.

Cutting across the views embraced in the four dimensions is the skillful use of sales techniques which capitalize on our fear of being left behind, hope for quick and simple solutions to complex problems, dreams of a utopian future, and desire for practical and measurable outcomes. The following excerpts from Texas' educational technology plan

epitomize such techniques:

Imagine a home...

> ... where every parent regardless of native language or socioeconomic background can communicate readily with teachers about children's progress, improve parenting skills, and get a degree or job training without leaving home or work.

Imagine a school...

> ... where every student regardless of zip code, economic level, age, race or ethnicity, or ability or disability can be immersed in the sights, sounds, and languages of other countries; visit museums; research knowledge webs from the holdings of dispersed libraries; and explore the inner workings of cells from inside the cell or the cold distance of outer space from inside a virtual spacesuit.

Who, in their right mind, would refuse to work for such a wonderful future! The seductive image painted in the above excerpts sets in motion a sales pitch, typical of the other state educational technology plans we reviewed. Each, in similar ways, was trying to sell technology by projecting a tempting vision. Each, in trying to sell technology, skated lightly over any need to present research about the intricacies of realizing the promised land or outcomes of such multi-million dollar investments. Each, in trying to win customers, relied more on exclamation about the benign nature of technology, singular, rather than explanation about the constraints and possibilities of various technologies, plural. Each, in trying sell a politically fair plan, relied more on sloganizing about equity than elaborating on ways of redistributing resources in favor of those traditionally marginalized in past waves of technology innovations in schools. Each focused more on future possibilities than present constraints and past failures. In sum, state technology plans privileged an innovative over a social practice discourse. This privileging of an innovative discourse was nowhere more apparent than in the conception of positive, ceaseless, inevitable educational change as a consequence of adopting the new technologies.

It is no surprise for the state technology plans to take the form of idealistic vision statements because they are used to rally political support. However, the pattern of privileging innovative over social practice discourse in state technology plans is problematic for a number of reasons.

- It downplays serious inequities in the U. S. education system that will impinge on access and opportunity to learn from technology as a function of racial, social class, geographic, and gender stratification;
- It underestimates the complexity of social change inherent in educational reform by overselling technology as the solution or *deus ex machina* for education;
- It is guilty of technocentrism which both dupes us into believing in technologically-driven

progress and eliminates a conversation about the possibilities and constraints of computer hardware generally, and specifically about the variety of software packages available each with its own constellation of possibilities and problems; and

- It simplifies the challenges of students developing complex understandings of their social and natural world and blinds us to the contextual nature of technological innovation.

In summary, state technology plans skillfully and conspicuously utilize innovation-focused discourses served by compelling visual images to project a technological utopia for education. To some extent, these images are, consistent with current thinking about student learning, teacher professional development in many ways, and school reform. They are, however, overstated and naive in that they portray technology as the sole cure for many societal and educational ills. In other words, by highlighting the potential of technology, more often than not in a decontextualized fashion, they scotomize other important dimensions of education.

Main Article

INTRODUCTION

There are many ways one could think about a forest. Conservationists usually think of a forest as habitat for birds and other wildlife. Farmers and ranchers often think of forested land as an obstacle to planting in rows or to livestock grazing. Loggers, experienced loggers, can look at a forest and estimate the number of board feet of lumber that can be extracted from it. Reading Aldo Leopold's essays on the environment, we get a habitat construal. Reading documents from the U.S. Forest Service about how they are "managing" forests, we get a complicated construal that is part habitat, part board feet. Thinking about technology and its uses by students and teachers, reading state educational technology plans, we find much the same thing: There are many ways that one can think about these things, technology plans select some of them and ignore others. Our purpose in this article is to present how state educational technology plans "think" about technology, learners, teachers, and education by contrasting views included in the technology plans with those left out.

Educational technology planning is a new and booming phenomenon in American education. A number of national reports(2) have done a very good job conveying the message that technology holds great potential for education, but students are not using it to improve their learning because: a) they don't have access to adequate hardware and software and b) their teachers have not been adequately prepared. This message is fueling the multi-billion dollar frenzy to get technology into schools and provide technology training to teachers. Accompanying this campaign for technology in schools is the dramatic growth in technology plans. These plans serve as frameworks for integrating technology in education at the state, district, and school level. As an important rhetorical device used by state and local educational policy makers, who are behind the generous spending on

technology, these plans also attempt to convince the public that technology ought to be integrated into education as an effective solution to a myriad of educational problems. The recently released National Educational Technology plan (US Department of Education, 2000) is a telling example.

Educational technology plans are not only a rhetorical device or political exercise, they have serious financial and technological consequences, which in turn have great implications for educational practices. Technology plans are quite often a pre-requisite for accessing major funding opportunities, such as the five year two billion dollar Technology Challenge Funds and the over five billion dollar Universal Service Fund (e-Rate), which means schools and state educational agencies must develop technology plans in order to obtain technology funding. In other words, schools that do not have an acceptable technology plan are not eligible to apply for the Technology Challenge Funds or the Universal Service Fund. Furthermore, the state technology plan is used to guide technology spending in the state. For instance, the State of Michigan has consistently followed the recommendations in its state technology plan in dispensing around 60 million dollars from the Technology Literacy Challenge Fund over the past four years. The Michigan State Technology plan was used as the basis for identifying funding priorities. Moreover, portions of the funds were set aside for projects that specifically address the recommendations of the technology plan. Over five million dollars have been allocated to these statewide projects, each of which was required to identify one or more recommendations in Michigan's Technology Plan as a focal point of their efforts. Additionally, even projects proposed by local schools must be consistent with recommendations of the State Technology plan, as the 1999 Request for Proposals from Michigan Department of Education clearly stipulates:

> In January 1998, the State Board of Education adopted Michigan's State Technology Plan (1998) http://www.mde.state.mi.us/tplan/final.shtml to assist the state's educational institutions in planning technology initiatives. The Plan includes 21 recommendations and more than a dozen belief statements, each of which corresponds to one or more of the four pillars of the National Plan. Applications for funding through this grant must be consistent with Michigan's State Technology Plan (1998). (Michigan Department of Education, 1999, p. 3).

State technology plans not only indicate the areas in which resources should be deployed, but also shape what technology is purchased, what pedagogical approaches are used, and what professional development should contain. Because very often locally generated funds can only legally be used for hardware and connectivity purchases most schools and individual teachers have to look to the state for funds to support professional development and efforts to integrate technology in education. These funds are normally dispensed in the form of competitive grants. State technology plans are usually used as the basis for selecting grant proposals. Thus it is logical for teachers and schools to propose ideas that are endorsed by state technology plans. Consequently, state technology plans become sources of strategies, concepts, and approaches for developing programs for teacher professional development and classroom technology integration. They also dictate the kinds of software tools, on-line resources, and other technology related materials schools and teachers may purchase or develop. In other words, state technology plans act as a powerful policy instrument shaping expenditures on technology, the focus of professional

development initiatives, and research on technology and its uses in schools.

The potential pedagogical, political, and financial implications of state technology plans were the impetus for the current study. There are four important dimensions of educational technology: technology, students, teachers, and educational goals. Our primary purpose is to understand what views along these dimensions are promoted in state technology plans. The promotion of some ideas automatically implies demotion of some others. We are thus also interested in finding out what ideas are missing. We hope that, by exposing the prominent and missing ideas about educational technology in state technology plans, we will gain some insights that will be beneficial to policy makers, teachers, and researchers. In the remainder of the paper, we first present a brief description of the nature of state technology plans. We then describe how we selected, coded, and analyzed fifteen state technology plans in terms of their views of technology, teachers, students, and educational goals. We then present our findings in four sections, each containing, first, a survey of possible views and, second, the views endorsed in the state technology plans. We conclude this paper with a discussion of the significance technology plans in the light of research findings about educational reform.

WHAT ARE STATE TECHNOLOGY PLANS?

State technology plans are state level policy documents that provide frameworks for implementing educational technology in the state. These plans were usually constructed by a committee composed of educational stakeholders. A typical committee consisted of representatives of the state department of education, private businesses, district administrators, school board members, university faculty, K-12 teachers, district technology specialists, and various professional organizations. Most plans were then sent to the state board of education for approval. Upon approval, they become legal documents that would guide state spending on educational technology.

METHODS

SELECTION OF STATE TECHNOLOGY PLANS

Having become generally familiar with the format and contents of the state technology plans nationally, we selected fifteen state technology plans for further analysis. These plans were selected for their representativeness according to size of state (Texas to New Jersey), geographical dispersion (from Alaska to Maryland), and time of creation (1993 to 1997). We accessed the plans at their respective websites. Table 1 lists all technology plans we used in this study and a summary of the state technology-related information.

Table 1: State Technology Summaries (Source: Education Week, 1997)(a)

STATE	Tech. literacy Challenge Fund	Other Federal funds	No. of students	Students to multi-media computer	No. of teachers	Tech. trained teachers
Alaska	FY 1997: $1 ml.	$1.2 ml.	126,015	16:1	7,644	21%

	$1 ml. FY 1998: $2.1 ml.					
Colorado	FY 1997: $1.9 ml. FY 1998: $3.9 ml.	$1.4 ml.		20:1		
Georgia	FY 1997: $4.8 ml. FY 1998: $10.9 ml.	$712,048	1,321,239	18:1	81,683	18 %
Illinois	FY 1997: $9.1 ml. FY 1998: $17.9 ml.	$3.7 ml.	1,961,299	20:1	115,859	10 %
Indiana	FY 1997: $3.1 ml. FY 1998: $6.2 ml.	$1.8 ml.	984,610	19:1	56,412	13%
Kansas	FY 1997: $1.5 ml. FY 1998: $3 ml.	$526,699 + $883,359	465,140	11:1	30,750	15%
Kentucky	FY 1997: $3.5 ml. FY 1998: $6.9 ml.	$2.4 ml.	663,071	23:1	39,235	28%
Maryland	FY 1997: $2.4 ml. FY 1998: $5.5 ml.	$1.8 ml.	818,947	23:1	47,005	15%t
Michigan	FY 1997: $8.6 ml. FY 1998: $18.2 ml.	$2.5 ml.	1,662,100	20:1	84,200	10 %
Mississippi	FY 1997: $3.5 ml. FY	$1.5 ml.	504,168	28:1	29,237	11%

	1998: $6.7 ml.					
Nebraska	FY 1997: $1 ml. FY 1998: $2.1 ml.	$4.3 ml.	292,121	13:1	20,109	15%
New Mexico	FY 1997: $1.7 ml. FY 1998: $3.5 ml.	$1.2 ml.	330,522	23:1	19,608	10%
New Jersey	FY 1997: $3.9 ml. FY 1998: $8.9 ml.	$1.4 ml.	1,221,013	18:1	88,822	11%
Texas	FY 1997: $16.3 ml. FY 1998: $35.3 ml.	$2.8 ml.	3,809,186	20:1	247,526	18 %
Vermont	FY 1997 $1 ml. FY 1998: $2.1 ml.	$145,633 + $533,383	106,607	25:1	7,787	18%

(a)State Education Agency Web Site: All state departments of education maintain home pages on the Internet. *Technology Literacy Challenge Fund*: The figures listed show how much the state received from this federal source in fiscal 1997 and is projected to receive in fiscal 1998. The fund provides formula grants to state education agencies. The grants help the agencies implement statewide technology plans through competitive funding to districts using new technologies to improve schools. *Number of Students*: The figure represents a projection for the 1996-97 academic year and is based on the best available data. The source is "Public Elementary and Secondary Statistics: School Year 1996-97, Early Estimates,'' National Center for Education Statistics, U.S. Department of Education, 1997. *Student-Multimedia Computer Ratio*: The source is a survey completed in June by Market Data Retrieval. A multimedia computer has a sound card and a CD-rom drive, components that enable it to use cutting-edge educational software. *Number of Teachers*: The source is "Public Elementary and Secondary Statistics: School Year 1996-97, Early Estimates,'' National Center for Education Statistics, U.S. Department of Education, 1997. *Technology-Trained Teachers*: The figure shows the percentage of a state's teachers who had at least nine hours of educational technology training in 1994. The tabulation comes from the National Data Resource Center. Data are collected as part of the U.S. Department of Education's "1993-94 Schools and Staffing Survey.''

ANALYSIS

We developed categories as a result of our analysis of the technology plans, a review of relevant literature, and our knowledge of views of technology, students, teachers and educational goals in previous waves of technological innovation in education. We then individually coded the four focal dimensions (technology, teachers, students, and

educational goals). Subsequently, we cross-checked our results in an iterative fashion to ensure adequate reliability. When there was any disagreement we discussed our different interpretations to reach a consensus. Table 2 presents the categories we developed.

Table 2: Rubric for Analyzing Images of Technology, Students, Teachers, and Educational Goals in State Technology Plans

TECHNOLOGY	STUDENT	TEACHER	EDUCATIONAL GOALS
Technology as "stand-alone" information machine	Passive respondent to stimuli	Luddite	Workforce preparation for economic progress
Computer technology as "network"	Active solo inquirer	Gatekeeper or filter	Equity
Technology as "deus ex machina"	Active social inquirer	Designer	N/A

RESULTS AND DISCUSSION

OVERVIEW OF STATE TECHNOLOGY PLANS

All fifteen plans we examined were developed by a committee representing envisioned partnerships of various community stakeholders who were expected to jointly support the implementation of the plan. Many committees had both educators and business representatives. Typifying such partnerships is the advice for those interested in further information about the Maryland Plan for Technology in Education, to contact *either* the Director of Instructional Technology at the Maryland State Department of Education or the Maryland Business Roundtable for Education.

The fifteen state technology plans we examined vary a great deal in length, and degree of detail and elaboration. The length of the plans, for instance, varies between Indiana's four pages to Illinois's 162 pages. Degree of detail often corresponds to length. The five page Colorado plan has one page about vision, six lines each about instruction, administration, and networking, and outlines eight goals taking up the other two and half pages. On the other hand, the body of the ninety one page Georgia plan includes a nine page introduction, seven pages on the current status of educational technology in the state, eight pages about the benefits and potential outcomes of the planned technology program, three pages summarizing a major needs analysis, three pages of recommendations, thirty seven pages encompassing implementation strategies and an action plan, and finally six pages detailing funding strategies.

VIEWS OF TECHNOLOGY

The various views of technology, broadly speaking, concern three fundamental aspects of technology. First, the nature of technology, i.e. what is it? Second, the functions of technology, i.e. what does it do? And lastly, the meaning of technology, i.e., what are its implications for the society? We use these three lines to thread our discussion of the portrayals of technology in education.

What is technology?

The term "technology" is often used without a clear definition as if it were a single, monolithic object that was clearly understood by everyone while in reality it means many different things and often brings up quite different images in peoples' minds. Even within the context of education, although the dominant image of technology has been computers, microcomputers to be more exact, the term is still frequently used to include video, television, and telephone.

What does technology do?

Most technologies have a more clearly delineated set of functions, at least primary functions. For example, the functions of televisions are mainly to broadcast information in a video format. Its potential uses in education are therefore confined to providing widespread access to information. This is, however, not true with computers. Computers are much more generic and malleable, thus leaving their functions much more open to redefinition. Roughly speaking, the functions of computers can include accessing information, publishing information, and manipulating information. Means (1994) delineated the four functions of computers defining how they can be used as a tutor, used to explore, applied as a tool, and used to communicate (p. 11). They can be used as tutors to "instruct" through drill and practice, simulation, or explicit instruction. They can also be used as tutees to engage students in activities where students attempt to "instruct" the computers with computer languages. Furthermore, they can be used as large multimedia databases whereby students search for and acquire information, store and analyze data, and compose documents. Moreover, they can just be used as a communication medium, via local and global networks, to link students with their peers, experts, and the community from beyond their classroom walls. Indeed, it seems to be an all-purpose machine, just as Walker (1986) argues:

> The appeal of the computer can be traced in part to its inherent pedagogical strengths. Elsewhere I have identified some of these: more active learning; more varied sensory and conceptual modes; individually tailored learning; nearer the speed of the thought; and an aid to abstraction. In addition, as a technology, the computer has one very considerable advantage over earlier forms of educational technology-versatility. It can be used in nearly unlimited ways to achieve virtually any educational aim and to conform to virtually any educational philosophy. (p. 23-24)

Historically, one of the most dominant images of technology has been a stand-alone information machine. Its capacity to store and retrieve information as well as link to remote sources of information has been considered a primary reason for its use in education (The National Information Infrastructure Advisory Council, 1995; US Congress Office of Technology Assessment, 1988). More recently two new functions have emerged to be considered significant. First, as constructivist learning theory became accepted in

education, technology has been considered a cognitive tool that supports students' construction of knowledge (Pea & Sheingold, 1987; US Congress Office of Technology Assessment, 1988). Second, as a result of wider acceptance of the social constructivist theory and the spread of the Internet, technology has begun to be viewed as a communication tool to create and sustain learning communities.

What does technology mean?

There is no shortage of authors offering interpretations of the meanings of technology in terms of its social and educational consequences. Three images dominate the literature: technology as *deus ex machina*, technology as Frankenstein, and technology as a neutral tool. In ancient Greek and Roman dramas, where there was an insoluble difficult situation, *deus ex machina*, or a god from a machine, would be introduced by means of a crane to provide a solution, often unexpectedly. Technological innovations have often been viewed by some to be the *deus ex machina* for education, which has been criticized for years to be inefficient and outdated (Papert, 1980). Since B. F. Skinner's learning machines (Skinner, 1968), most technologies have been touted as potential "transformative" solutions to "insoluble educational" problems even though they were not invented with that intention. They were indeed unexpected "gods" from the machine.

Rooted in the American tradition of technological utopianism (Kling, 1997; Segal, 1985), this image of technology views the use of technology in education as a positive force that will bring the much needed revolution to education in a variety of ways. For example, John Gibbons (1995), Director of OTA in forward of *Linking for Learning: A New Course for Education* maintains:

> Electronic links, used for learning, are creating new neighbors among schools, classrooms, teachers, students, and other members of the community . . . these technologies, united with trained and enthusiastic teachers, are beginning to enrich all our school environments." (p. iii)

Similarly, Papert (1980) argues:

> I see the classroom as an artificial and inefficient learning environment that society has been forced to invent….I believe that the computer presence will enable us to so modify the learning environment outside the classrooms that much if not all the knowledge schools presently try to teach with such pain and expense and such limited success will be learned, as the child learns to talk, painlessly, successfully, and without organized instruction. This obviously implies that schools as we know today will have no place in the future. (pp. 8-9)

Similar arguments have been made in regard to the Internet, despite unfulfilled promises of technology in the past:

> The next five years will radically change the ways schools relate to the world around them as global computer networks...link up to primary and secondary schools. (Fishman & Pea, 1994, p. 1)

In stark contrast to this image is the one that depicts technology as the monster Frankenstein, who broke free of his master's control in Mary Wollstonecraft Shelley's (1994) novel of the same name. In other words, "...mankind's inventions now control their inventors." (Taylor & Johnsen, 1986, p. 220). Ellul (1964) emphatically expresses this concern about the threat of technology taking over human kind:

> Man is caught like a fly in a bottle. His attempts at culture, freedom, and creative endeavor have become mere entries in technique's filing cabinet (p. 418).

Based on similarly expressed concerns and fears many like-minded skeptics of technological innovation agree with Taylor and Johnsen (1986) when they advocated "that technological momentum can be and should be resisted." (p. 229).

A more modest, less emotionally charged view is that technology is just a neutral tool. It does whatever you want it to do. "In and of itself, it does not have any pedagogical bias." (Means, 1994, p.14). "A computerized information communications system, in itself, is inherently neither good or bad, but it is powerful. What makes it good or bad is how we learn to use it, how intelligently we apply our skills as thinking people." (Walker, 1986, p. 19). Therefore, "It can be used in nearly unlimited ways to achieve virtually any educational aim and to conform to virtually any educational philosophy" (Walker, 1986, p. 23-24). By treating technology as neutral, innocent, and powerful tools, this view avoids the ideological debate over whether technology is a solution to existing problems or it brings more problems. It shifts the focus from whether technology should be used to what uses it should be made of. The problem thus lies in the user and the social contexts wherein technology is used. It is a seemingly more practical, realistic view. But careful examination reveals that this image is quite problematic. Tools can be flexible but they are designed for certain purposes with certain possibilities and constraints. In other words, a technology, by design:

> inevitably favors some applications and prohibits others. The claim that a hammer can be used to build anything overlooks the fact that hammers don't work particularly well with screws. (Bromley, 1997, p. 109)

Telephones are better used for oral communications while faxes for written. Computers are indeed more generic than hammers or telephones in terms of their applications, but they are not unlimited. For example, the limited screen size of the monitor makes it very difficult to simultaneously present multiple charts or many pages of text, while one can easily hang as many charts or pages of text on the wall. This limitation makes paper a much better candidate for group brainstorming activities when it is necessary to present the whole picture.

The tool image is perhaps the most popular one among the three. It is often employed by the technology utopianists as a defense position when their over optimistic *deus ex machina* image is challenged. To a degree, the tool image is a less ideological, less obvious version of the *deus ex machina* image. It seems neutral, while in reality it endorses the view that technology is the solution. Consequently, the logic is that since the question is no longer whether technology should be used but how it should be used, we should invest in technology to figure out its proper uses in education.

VIEWS OF TECHNOLOGY IN STATE TECHNOLOGY PLANS

What is it?

Despite the simultaneous co-existence of multiple views, "technology," when not explicitly defined, seems to have always been used in most educational technology discussions to mean the most recent technological innovation. This is well evidenced in the technology plans we examined. We have found that although the plans may make a deliberate effort

to include more tools than just the newest innovation when they first define technology, in their discussion and implementation sections, technology is often reduced to mean globally connected computer networks, in essence the information superhighway or the Internet (see Table 3). Highlighting this connectivity focus, a number of the plans we examined (e.g. Georgia, Mississippi, and Connecticut) have the same graphic of a computer network that connects schools, the community, local businesses, and library as their covers(3).

Table 3: Portrayal of What technology Does in State Technology Plans

State	Stand-alone computers	Computer technology as network
Alaska	**	Y
Connecticut	**	Y
Colorado		Y
Georgia	**	Y
Illinois		Y
Indiana		Y
Kansas		Y
Kentucky		Y
Maryland*	Y	Y
Michigan		Y
Mississippi		Y
Nebraska		Y
New Mexico		Y
Texas		Y
Vermont	**	Y
Total %	33	100

** = Image noted but little elaboration
Y = Image very prominent and detailed in technology plan
*The Maryland technology plan was only one of a small number of those we examined that referred to research. A number of pages in the plan are devoted to a review of research on the socio-emotional and

cognitive benefits of computer assisted instruction (CAI) as the research basis for their current drive to put networked computers in the schools. This over generalization of CAI research is the basis for our categorization of Maryland being the only state explicitly conveying a stand-alone image of computer usage as central in it's technology plan- even if inadvertently.

What does it do?

Not surprisingly, the neutral cognitive tool is the dominant portrayal of technology in state technology plans. All fifteen state technology plans present technology as a powerful potential fix for current and future educational problems, representing a very strong technological utopian tendency. Technology is often associated with such phrases as "catalyst for reform," "imperative," and a "must." The linking of technological innovation to school reform was consistent across state technology plans. Clearly stated in each state plan was how technology would transform the teaching and learning landscape. For example, the Alaska Goals 2000 Technology Plan, obviously influenced by federal policy, states that:

> The technology plan is to be developed by a technology task force and will describe how the state will use technology to support systemic reform and achievement of high standards. (Alaska State Board of Education, 1991, p. 1)

In a similar fashion, the Maryland Plan for Technology in Education asserts that:

> Technology offers tremendous potential for strengthening Maryland school reform efforts; from enhancing school improvement planning by providing site-based school improvement teams with on-line access to and analysis of state and local performance data, to expanding the instructional options and information opportunities of students in resource-poor, low performing schools . . .. The primary mission will be to *enhance the educational system* and improve delivery of instruction to all learners through a technology and communication network that will interface seamlessly with daily life and provide universal access to practical knowledge. (Maryland State Board of Education, 1995, p. 5) [emphasis in original]

Technology is touted as an all-purpose, flexible tool that can be used in all educational contexts to support all types of learning. The following excerpts from the technology plans of the States of Indiana and Illinois can be easily found in other state plans:

> Extensive research suggests that effective applications of technology will make education: more responsive to individual, personal, and special needs by providing a greater range of options for learning; more accessible to all learners through telecommunications; more powerful through multi-sensory/multimedia involvement that can help learners understand real world events and processes. (Vision Team for the Educate Indiana Tech Plan, 1996, p. 1)

> It is incumbent upon us to intelligently use the tools of the 1990s to open up the world of the classroom to relevant, meaningful learning activities. It is not enough to merely ensure equitable, universal access to technologies and information across networks. Learners must know how to ask probing questions, access and analyze sources of information, construct meaning from the data, and communicate their ideas with others. Furthermore, schools should instill in students a love of learning, an underlying capability that makes it possible for us to be lifelong, flexible learners, capable of changing and developing new skills as the world around us changes. In this era of education reform, technologies must be both catalysts for change and

core building blocks of a new system of public education which ultimately bring
much higher performance from children and youth. (Illinois State Board of
Education, 1996, p. vii).

Technology is most often presented in a rather naive fashion in policy documents. What
gets emphasized is the view of technology as either a neutral tool or technology as clay in
that its effects are determined by its users, ignoring the built-in propensities of technology.
What is missing from all technology plans is the image of technology as a complex social
practice that is "...involved in many ways in the construction and use of power." (Bromley,
1998, p. 2).

Technology is portrayed overwhelmingly as a communicative and networking tool in all
policy documents (see Table 3). The connectivity potential of the new computer-mediated
communication technologies is evident across all state plans. Thus, in contrast to previous
waves of computer technology innovation the prevailing image, as the Internet permeates
every aspect of the society, is of computer technology as network(4) instead of the stand-
alone computer. This shift can be summarized as a move from ITs to ICTs - that is,
information technologies to information and communication technologies.

What does it mean?

The views of the implication of technology convey a strong sense of inevitability. One
prominent view is that technology has changed and is continuing to change society
dramatically. For example, the Connecticut document launches into its rationale about the
imperative of adopting the new technologies by noting that "The only constant in life is
change" (p. 2). The Maryland Plan for Technology in Education states that:

Technology will *keep pace with rapid change* through continually upgrading
resources. The system will be open, flexible, and capable of growth and adaptation
to changing needs (Maryland State Board of Education, p. 5) [emphasis in original]

Similarly, Michigan's State Technology Plan states in its opening page:

Education is about the future. The word itself is derived from the Latin "educare,"
meaning to lead out from. This implies a constant state of change and renewal.
Nowhere is this more visible than in the area of technology, where generations come
and go practically overnight, and capabilities only dreamed of five years ago are now
commonplace. Children enter a world today in which many of the careers they will
pursue do not yet exist. (Michigan Department of Education, 1998)

Technological changes will create a new society that needs technologically competent
citizens. Thus, schools must provide opportunities to prepare their students for the future.
Another apparent view of the implication of technology is the *deus ex machina* view:
technology as the god from the machine will provide solutions to difficult educational
problems. The following excerpt from the Vermont technology plan exemplifies both views:

Information technology will play a pivotal role in developing the new life skills
needed for the 21(st) century. It should be considered a necessity--not a luxury--in
the classroom. The purpose of education is to help students think, learn, and
perform in and across disciplines. Information technology will help students, in all
subject areas, to develop and nurture the ability to access, analyze, and
communicate information (Vermont State Board of Education, 1996).

Contrasting the range of possible views of technology with those endorsed in the state

technology plans, we found that state technology plans seem to favor "new" technologies over "old" technologies. While we appreciate the fact that these policy documents need to project the future, it is nonetheless a mistake to discard existing technologies, which only a few years ago were awarded as much value as the new ones. This view represents a naïve and damaging conception of educational technology -- computing power equals educational power and technology innovation equals educational innovation. It leads schools and teachers to chase the latest development in technology instead of spending their limited time and resources on working out ways to make effective use of their existing technologies such as cable TV, video, and old computers. This obsession with the "cutting-edge" can lead to undesirable consequences. For instance, in a statewide educational technology grant program for teachers, researchers found that, most proposed projects vowed to use the latest technology. But because new technology is inherently less reliable and demands more support than is readily available, projects that attempted to use newer technologies were found to be less successful (Zhao, 2000). Another example is the all too common complaint among educators that technology changes too fast, which is a, if not *the,* consequence of such obsession.

State technology plans are also found to leave out and devalue the more skeptical views of technology. None of the plans we examined mentions any concerns about the potential negative social, ethical, and educational consequences of technology innovations. Virtually all plans suggest that technology will bring dramatic changes to our society and education, but the changes are often considered positive and progressive like the vast array of educational reform documents over the last one hundred years in the USA (Tyack & Cuban, 1995).

VIEWS OF STUDENTS

Possible Views of Students in the Context of Educational Technology
Students have been viewed very differently over the last few hundred years (Cleverly & Phillips, 1986). Recently, the portrayal of students in the various waves of educational technology in schools has also changed. Early uses of both television and radio in classrooms viewed the student as the respondent to the stimuli provided by technology. Here, the image of students was essentially passive empty vessel eventually leading to students as bearers of knowledge transmitted via focal technologies. The many drill and practice type computer assisted instruction (CAI) modules designed for school use are typical of this vision of educational computing and the image of students as receptacles. Underlying this view of students is a receptive-accrual epistemology and behaviorist psychology.

As the "cognitive revolution" began in education, the passive student image did not disappear but another image began to crystallize-that of an active solo learner. There was talk of individual students "constructing" knowledge with technology (e.g. Papert, 1980). The important emphasis here is on the solo learner based on individual constructivist psychology (e.g. Piagetian). In the last number of years, learning theories have begun to view the learner as an active social inquirer. Specifically, with regard to computers in education the "community of learners" image of students is typical of this approach (Brown, Ash, Rutherford, Nakagawa, Gordon, & Campione, 1993; Scardamalia & Bereiter,

1991). Contemporary images of small groups of students clustered around a computer terminal, compared to past images of the solo computer user, remind us of the change in the views of learning. Underlying both the individual and social versions of constructivism is a cognitive-mediational epistemology.

The views described above reflect particular epistemological stances, focusing on the process of learning. Gardner (1991) presents three outcome-oriented views: the intuitive learner, the traditional student and the disciplinary expert (or skilled person) each with its typical performance patterns. The intuitive, natural or naive, learner is naturally and superbly equipped to learn language and other symbolic systems. Performance for the naive learner although fluid and serviceable often entails immature and misconceived understandings "of mind, matter, life and self" (p. 9). The traditional student (scholastic learner) seeks to "master the literacies, concepts, and disciplinary forms of school" (p. 7). Performance for the traditional student is generally what schools accept and could be termed "rote, ritualistic, and conventional." Such performances, while correct, "do not preclude genuine understanding; they just fail to guarantee that such understanding has occurred" (p. 9). The disciplinary expert is an "individual of any age who has mastered the concepts and skills of a discipline or domain and can apply such knowledge appropriately in new situations.... their knowledge is not limited to the usual text-and-test setting, and they are eligible to enter the ranks of those who 'really' understand" (p. 7).

VIEWS OF STUDENTS IN TECHNOLOGY PLANS

First, the portrayal of students in state technology plans tends to focus on outcomes rather than processes of learning. For instance, The Texas plan states:

> This plan recognizes the need for graduates to demonstrate mastery of technology conveyed in the Texas Essential Knowledge and Skills (TEKS) as both a course of study and as applied in other content areas. Students today need appropriate technological skills and knowledge to achieve academic success and to become productive members of society. (Texas Education Agency, 1996, p. 23).

In a similar fashion, the Vermont plan emphasizes that the ultimate goal of educational technology is to ensure the achievement of the state's education vision: "*High Skills for Every Student, No Exception, No Excuses.*" [emphasis original] (Vermont State Board of Education, 1996). The view of students as test takers, achievement test candidates, or as providers of evidence about rising educational standards or improved academic outcomes is constant across the technology plans. This view becomes apparent in the technology plans through the emphasis on standard based educational reform in the context of technological innovation. According to this view students will blossom as learners (i.e. reach new standards of academic excellence) under the reformed practices of teaching brought about by technology, the fruits of which shall be weighed and calibrated via achievement tests. The Georgia plan (Georgia State Department of Education, 1997) lists seven educational priorities, two of which are related to student achievement and accountability:

o   improve student learning and school effectiveness
o   utilize technology to ensure student, staff, school, and statewide accountability

In this regard, the image of students in the technology plans is like Gardner's (1991)

conception of the traditional student: a learner who will perform the traditional conventions of school. Given the stress on accountability in current educational reform efforts, exemplified by the focus on system outputs and accountability, it is no surprise that what is envisioned is that students will take tests to display their enhanced learning as a result of innovative technology. This view of students was interwoven with standards-based reform (Goertz, Floden, & O'Day, 1995; Smith & O'Day, 1990) in many technology plans. For example, the Alaska Technology Plan states:

> The Educational Technology Standards were developed through the Alaska Standards movement, a state and federal mandate to improve the quality of education by developing rigorous standards for student performance in all academic areas. (Alaska State Board of Education, 1991, p. 4)

Likewise, Maryland, Indiana, Texas, Kansas, Georgia and Michigan were among the other states that stressed the importance of incorporating standards with technological innovation.

Second, although the technology plans do not devote much discussion to the process-oriented views of students, we were able to identify some through the words they use and programs they recommend. While the portrayal of solo learners was apparent (see Table 4) in technology plans, the pervasive portrayal throughout the documents was the social, interactive or connected student. This was conveyed by frequent uses of such terms as 'academic villages', 'community of learners', and co-operative learning with networked computer technology. The following statements in the Vermont plan exemplify this view:

> By creating an information technology-rich environment, a community of lifelong learners will be equipped with the skills to succeed in an information age characterized by constant change.
>
> …
>
> If statewide planning is implemented, critical education reforms will be supported and delivered through a powerful information technology infrastructure. As teachers, administrators, school staff, and parents collaborate to improve their schools, they must strive to provide students with the new skills necessary to compete in an information-based global economy. Through the use of information technologies, all learners can be empowered to seek and create their own knowledge, to think more critically, to solve problems more creatively and analytically, and to communicate effectively. They can become dynamic life-long learners capable of responding to a constantly changing world. (Vermont State Board of Education, 1996).

This view is apparent in a number of documents that proposed a paradigm shift in learning often stressing co-operation over competition and social over individual conceptions of learning (e.g. Illinois and Michigan technology plans). For example, in the State of Illinois K-12 Information Technology Plan (Illinois State Board of Education, 1997), under the title of *Six Essential Learnings With Technology* with an inset photo of an elementary school student, the image of student is "information navigator, thinker/analyst, communicator, technician, knowledge constructor, and knowledgeable, responsible citizen in the information age" (p. vii). Discussing these images of the learner the Illinois plan's social constructivist focus is clear in its emphasis on heterogeneous grouping, interactive modes of learning, and student collaboration. This emphasis on the social nature of learning with

computer technology is a significant departure from the solo learner focus in CAI.

Table 4: Portrayal of Students as Learners in State Technology Plans

State	Passive 'vessel'	Active solo learner	Active social learner
Alaska		Y	Y
Connecticut			Y
Colorado		Y	Y
Georgia			Y
Illinois			Y
Indiana			Y
Kansas			Y
Kentucky			Y
Maryland		Y	Y
Michigan			Y
Mississippi			Y
Nebraska			
New Mexico			Y
Texas			Y
Vermont		Y	Y
Total %	0	26	93.33

Consistent with this move from both traditional reform and learning models, for example, the State of Illinois K-12 Information Technology Plan specifies how its technology plan is based on a "reengineered" vision of reform and school learning. Whereas, the "traditional" model emphasizes the input model, competition, subject areas, content variables, and teacher responsibility for student learning, the "reengineered" model focuses on performance, teaming, integrated learning, time variables, increased student responsibility, and application.

We were not surprised to find that the state technology plans prefer outcome-oriented

views of students, as measured by standardized tests since one major function of these documents is to convince the public that technology will be able to improve education. And educational improvement, in the public eye, should be indicated by standardized tests. However, given that the technology plans seem to favor modern educational concepts (e.g., cooperative learning, active learning, interdisciplinary learning--see Vermont's Technology Plan), we were surprised to find that few plans directly address any of the important epistemological assumptions about student learning. The technology plans were notably sparse in their description of the learning process or epistemological assumptions whereas technology or teacher professional development issues were outlined in detail in one or more chapters or sections. One notable exception to this paucity of attention to the learning processes and epistemology was the Illinois technology plan, which we discuss later.

VIEWS OF TEACHERS

Possible Views of Teachers in the Context of Technology

The portrayal of teachers in relation to technology has changed considerably over the last few decades. Changes in the ways teachers have been portrayed reflect reconfigurations of the relationships envisaged between knowledge, teachers and technology. Three views are apparent over time: teachers as Luddites, as gatekeepers, and as designers. The image of teachers as Luddites, who for fear of being replaced by technology, actively resist the introduction of technology, fit very well with traditional images of the teacher as the preeminent source of information. Portrayals of technology laden teacher free classrooms brought about by the information dispensing efficiency of radio, television or computer assisted instruction (CAI) characterize this view. In this scenario, teachers and technology were natural adversaries with teachers also doomed to lose the information transmission competition because information technology was considered to be a more reliable source of more updated information than teachers. It was also believed that information technology can more economically and effectively transmit the information.

Early hopes about how efficient innovative technologies would replace the teacher were dashed, however, by a realization that teachers actually decide what technologies may enter the classroom and whether and how they could be used (Cuban, 1986; Noble, 1996). Research in technology adoption, thus, suggests a different view of the teacher-teacher as gatekeeper. According to this view, teachers decide whether, what, and how technology gets used in classrooms (Cuban, 1986; Office of Technology Assessment, 1995). In addition, research in cognitive psychology has supported this notion that teachers were active decision-makers (Clark & Peterson, 1986; Morine-Dershimer & Corrigan, 1997; Shavelson, 1976). This view of the teacher as decision-maker or filter heralded an appreciative but also exasperated view of the role of teachers in relationship to technology. On the one hand, there was an appreciation of how teachers were important interpreters of the way technology ought to be used in classrooms to promote student learning (Bruce, 1993). However, on the other hand, there was exasperation at how teachers often foiled the best-laid plans of how technology could improve student learning because of their inability or unwillingness to use technology in their classrooms (Cuban, 1986).

A more recent view of teachers in relationship to technology sees teachers as designers. In this view teachers, rather than taking on the role of knowledge dispensers or just adopting

existing technologies, design their own teaching environment with a variety of technological tools to facilitate knowledge construction. In this view, teachers, like an architect, actively engage themselves in exploring the possibilities and constraints of technologies and other materials to construct the best environment to fulfill their pedagogical expectations. Technology is no longer considered a cure-all tool, but rather a component of the pedagogical ecology. From this perspective teachers are not only adopters or implementers of technology, but also developers, evaluators, and designers.

Views of Teachers in Technology Plans

> "Technology will never replace teachers. Technology may, though, serve a pivotal role in displacing ineffective, unwilling teachers. When coupled with appropriate peripheral equipment and excellent software, technology will assist teachers in many ways that are not imagined currently. All Mississippi educators must stay alert, though, to ensure that teaching is conducted properly." (Mississippi Department of Education, 1996, ch. 8.1)

The above excerpt from the Mississippi plan exemplifies a stance shared by many state technology plans. Teachers are portrayed as gatekeepers or adopters across all states rather than as Luddites or designers (see Table 5). This conclusion, while it may seem a rather banal observation, is important to note in the context of previous waves of technological innovation in education, which have sought to replace teachers. The view of teachers in the plans was more positive than the image of teacher as intractable Luddite. Images of teacher as convertible Luddite but primarily as gatekeeper were evident in the technology plans (see Table 5). A few plans, for example, anticipated that a minority of teachers might be resistant to technology. Common across the three views of teachers in the technology plans is the sense that teachers, whatever attitude they hold toward technology, need training in technology, as stated in the Georgia plan: "educators must simultaneously be challenged and supported in order to develop expertise with new technological innovations and to implement the new learning in their classrooms." (Georgia State Board of Education, 1997, p. 39).

Providing training to teachers serves different functions depending on the view of teacher one holds. For those who believe teachers are convertible Luddites, the training is expected to convince teachers that technology will assist them rather than replace them, that computers are "allies," not "aliens." For those who view teachers as gatekeepers, the training is expected to convince the teachers to open their doors to technology and teach them appropriate ways of technology integration. Most technology plans seem to stop here in terms of training and professional development. Except for the K-12 Information Technology Plan for the State of Illinois, we did not find any plan that viewed teachers as designers, for whom the training should provide opportunities and resources for exploration, construction, and design.

Table 5: Images of Teachers in State Technology Plans(a)

State	Luddite	Gatekeeper	Designers
Alaska		Y	

State	Luddite	Gatekeeper	Designers
Connecticut		Y	
Colorado		Y	
Georgia		Y	
Illinois		Y	Y
Indiana			
Kansas		Y	
Kentucky		Y	
Maryland		Y	
Michigan		Y	
Mississippi	Y	Y	
Nebraska		Y	
New Mexico		Y	
Texas	Y	Y	
Vermont		Y	
Total %	13.33	93.33	6.66

(a)Luddite = teachers viewed as completely resistant to technology
Gatekeeper = teachers viewed as central decision-makers in technology adoption and usage. As primary filters they need to be trained to use technology
Designers = teachers viewed creative and imaginative designers of technology usage in school settings

This view of teachers as workers in need of training was sometimes based on a deficit model of teacher knowledge. Nevertheless, teachers were viewed as central players and gatekeepers in technology adoption. The Texas technology plan emphatically stated that:

> To provide quality education to all learners, the training and retooling of the current educator workforce in using technology tools to teach and learn must be identified as a priority. (Texas Education Agency, 1996, p. 31)

However, professional development is not descriptive enough of what is entailed for teachers:

> This staff development is not merely short term. Instead it is a re-tooling of a statewide workforce of more than 250,000 professionals. (Texas Education Agency, 1996, p. 18)

"Re-tooling" projects an outright jettisoning of older tools and full-scale introduction of new

tools. Conspicuously absent from this vision of teachers in need of retooling is an appreciation and acknowledgement of teachers' knowledge of various existing technologies and their relationship to student learning and classroom processes.

Driven by the belief that knowledge about technology and its potential educational benefits would help convert the Luddites or loosen up the gatekeepers, the state technology plans consistently stipulate that teachers must meet certain technology competency requirements. Underlying this stipulation was often a decontextualized notion of learning whereby teachers would learn and then apply technology in their teaching. The Texas technology plan tried to hedge its bets in this regard at one point stating that teachers need to <u>first</u> learn technology: "teachers must first be competent with the technology applications that facilitate their work and support student learning" (Texas Education Agency, 1996, p. 23). This approach implies delivery of skills prior and separate from context of usage. However, later the document states that teacher professional development will adopt a just-in-time rather than a just-in-case model. Just-in-time professional development "rejects the standard of often irrelevant or ill-timed professional development presented just in case one ever needs it" (Texas Education Agency, 1996, p. 32).

VIEWS OF EDUCATIONAL GOALS

Possible Views of Educational Goals

Labaree (1997) suggests that "three purposes have shaped the history of American schooling-democratic equality, social mobility, and social efficiency." (p. 70).

> From the *democratic equality* approach to schooling, one argues that a democratic society cannot persist unless it prepares all of its young with equal care to take on the full responsibilities of citizenship in a competent manner...Therefore schools must promote both effective citizenship and relative equality. (p. 42)

Labaree further suggests that the purpose of democratic equality has taken three operational forms in schools: the pursuit of *citizenship training*, *equal treatment*, and *equal access*.

A second defining goal for American education, according to Labaree, is social efficiency, which is directly rooted in the concerns that our economic well being is dependent upon our ability to prepare the next generation to competently play useful economical roles in the future. A major goal of education is "to prepare workers to fill structurally necessary market roles." (p. 42). The third goal, social mobility, views education as a commodity. Its sole purpose is to equip students with skills and abilities that give them "a competitive advantage in the struggle for desirable social positions." (p. 42). For our purposes, Labaree's last two goals can be merged into one, which we term *economic competitiveness*, because both focus on preparing students to enter the future economic market with competence.

Views of Educational Goals in State Technology Plans

The state technology plans clearly favor the economic aspects of education (see Table 6). All plans are very concerned about the prospect that new technologies are changing the job market, placing new demands on future employers in the preparation of a productive and adaptive employee pool or technological workforce (Cuban, 1997).

Table 6: Images of Educational Goals in State Technology Plans

State	Economic progress	Equity
Alaska	Y	**
Connecticut	Y	**
Colorado	Y	**
Georgia	Y	**
Illinois	Y	Y
Indiana	**	**
Kansas	Y	**
Kentucky	Y	Y
Maryland	Y	**
Michigan	**	Y
Mississippi	Y	**
Nebraska	Y	**
New Mexico	Y	**
Texas	Y	**
Vermont	Y	Y
Total %	Y = 86. 66 ** = 13.33	Y = 23.66 ** = 73.33

** = Image noted but little elaboration;
Y = image prominent in technology plan.
Although many plans mention providing equal access along with preparing students for the 21st century, the goal of democratic equality is seldom elaborated as concretely as the goal of economic competitiveness. Nor is it anchored in as many implementation activities as economic competitiveness. For example, the executive summary of the Connecticut (Center for Educational Leadership and Technology, 1996) educational technology plan states:

Study findings indicate that Connecticut schools lack the technology resources necessary to ensure equitable educational opportunities to its citizens and to prepare

students for the 21st century. According to the U.S. Department of Labor's SCANS report, the demand for technologically literate workers will increase threefold by the year 2000. When school systems are able to produce effective knowledge workers through the integration of learning technologies, their communities create a rich climate for economic development. (p. 1)

The Georgia plan makes an almost identical statement (Georgia State Department of Education, 1997). The bias toward economic competitiveness as the chief educational goal is even more obvious in Vermont's (Vermont State Board of Education, 1996) state technology plan:

The Information Age is here and Vermont schools are poised to create information technology-rich learning environments which will prepare students for the 21st century. If our young men and women are to stay in Vermont and thrive here, the state needs to develop each student's capability to use emerging technologies. Only then will new businesses choose to locate in Vermont, drawn to its world-class labor force and unwavering commitment to educational excellence as well as to the state's breathtaking beauty and unique character.

This is not, however, to suggest that the state technology plans do not consider democratic equality an important goal (see Table 6). Quite the contrary, as mentioned before, virtually all state technology plans view technology as a great equalizing tool that can provide equal access to everyone. Connecticut's state technology plan quotes from the vision statement of the Joint Committee on Educational Technology (Center for Educational Leadership and Technology, 1996):

[T]he effective use and integration of educational technology is the key factor in improving education and achieving equity, contributing to an enlightened citizenry, producing a competent and technologically literate work force and promoting economic growth in Connecticut for the 21st century (p. 2).

What is interesting, and conspicuous by its absence, is the lack of further elaboration of this goal in the rest of the documents (e.g., See Table 6 and compare the relative emphasis and centrality accorded economic progress versus equity as goals in technology plans.). While very often the goal of economic competitiveness is translated into concrete terms in implementation strategies and measurable academic standards, the goal of democratic equality is at best repeated in slogan-like statements or reduced to the issue of access to equipment, often measured in terms of the student/computer ratio in schools. Thus, rather than addressing equity in terms of access, process, and outcomes (Sutton, 1991) technology plans reduce equity to one important but minimalist definition of equity.

CONCLUSIONS

Thus far we have presented our findings of the views of four major dimensions of educational technology evident in 15 state technology plans. We presented these views in light of a wide range of possible views derived from the literature on educational technology to point out what views are missing. We use this final section to summarize our main findings and address the implications of our major observations of the state educational technology plans.

To summarize, we have come to the following conclusions based on our analysis of state technology plans along what we identified as four significant dimensions - technology,

students, teachers, and educational goals. First, in terms of technology, we found that state technology plans seem to favor "new" technologies over "old" technologies. Furthermore, the portrayal of the inevitability of change as a result of technology adoption was a pervasive theme throughout the technology plans. Second, in terms of students, we found that the plans more often than not focused on technology's capacity to improve student test scores, while paying little attention to important epistemological assumptions about student learning. Third, in terms of teachers, our reading of the technology plans suggests that the plans do acknowledge that teachers are important in technology adoption but do not go as far as to identify ways in which teachers can be resourceful, knowledgeable, and purposeful designers of educational technology. Fourth, in terms of educational goals, the plans privilege the goal of economic progress or social efficiency over democratic equality.

Cutting across the views embraced in the four dimensions is the skillful use of sales techniques which capitalize on our fear of being left behind, hope for quick and simple solutions to complex problems, dream of a utopian future, and desire for practical and measurable outcomes. The following excerpts from Texas' educational technology plan (Texas Education Agency, 1996) epitomize such techniques:

> **Imagine a home...**
>
> ... where every parent regardless of native language or socioeconomic background can communicate readily with teachers about children's progress, improve parenting skills, and get a degree or job training without leaving home or work.
>
> **Imagine a school...**
>
> ... where every student regardless of zip code, economic level, age, race or ethnicity, or ability or disability can be immersed in the sights, sounds, and languages of other countries; visit museums; research knowledge webs from the holdings of dispersed libraries; and explore the inner workings of cells from inside the cell or the cold distance of outer space from inside a virtual spacesuit.

Who, in their right mind, would refuse to work for such a wonderful future! The seductive image painted in the above excerpts sets in motion a sales pitch, typical of the other state educational technology plans we reviewed. Each, in similar ways, was trying to sell technology by projecting a tempting vision. Each, in trying to sell technology, skated lightly over any need to present research about the intricacies of meeting the promised land or outcomes of such multi-million dollar investments. Each, in trying to win customers, relied more on exclamation about the benign nature of technology, singular, rather than explanation about the constraints and possibilities of various technologies, plural. Each, in trying sell a politically fair plan, relied more on sloganizing about equity than, elaborating on ways of redistributing resources in favor of those traditionally marginalized in past waves of technology innovations in schools. Each focused more on future possibilities than present constraints and past failures. In sum, state technology plans privileged an innovative over a social practice discourse (Bruce, 1993). This privileging of an innovative discourse was nowhere more apparent than in the conception of positive, ceaseless, inevitable educational change as a consequence of adopting the new technologies.

It is no surprise for the state technology plans to take the form of idealistic vision statements because such statements are needed to rally political support. However, the

pattern of privileging innovative over social practice discourse in state technology plans is problematic for a number of reasons:

- It downplays serious inequities in the U. S. education system that will impinge on access and opportunity to learn from technology as a function of racial, social class, geographic, and gender stratification (Beasley & Sutton, 1998; Berliner & Biddle, 1995; Bromley, 1997; Sutton, 1991);
- It underestimates the complexity of social change inherent in educational reform by overselling technology as *the solution* or *deus ex machina* for education (Cohen, 1987, 1988; Fullan, 1991: Sarason, 1993);
- It is guilty of technocentrism which both dupes us into believing in technologically-driven progress and eliminates a conversation about the possibilities and constraints of computer hardware generally, and specifically about the variety of software packages available, each with its own constellation of possibilities and problems (Zhao, 1998), and
- It simplifies the challenges of students developing complex understandings of their social and natural world and blinds us to the contextual nature of technological innovation. In not attending to the "complex iterative interaction between innovation and social context" (Bruce, 1993, p. 31), state technology plans lead us in the direction of thinking of interactions "between a fixed innovation and a static social context" (Bruce, 1993, p. 31). What remains paramount then is a desire to measure the "effect" of technological innovation at the expense of viewing "innovation as transaction among ideas, cultural values, sentiments, institutional structures, social practices, and the structure of the innovation" (Bruce, 1993, p. 31)

In summary, state technology plans skillfully and conspicuously utilize innovation-focused discourses served by compelling visual images to project a technological utopia for education. To some extent, these images are, consistent with current thinking about student learning, teacher professional development in many ways, and school reform. They are, however, overstated and naive in that they portray technology as the sole cure for many societal and educational ills. In other words, by highlighting the potential of technology, more often than not in a decontextualized fashion, they scotomize (Sacks, 1995) other important dimensions of education.

NOTES

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(2) For example, <u>Advanced Telecommunications in U.S. Public Elementary and Secondary Schools</u> (National Center for Education Statistics, U.S. Department of Education, 1997); <u>Beyond Bells and Whistles: How to Use Technology to Improve Student Learning</u> (American Association of School Administrators, 1996); <u>Computers and Classrooms: The Status of Technology in U.S. Schools</u> (Policy Information Center, Educational Testing Service, 1997); <u>Fostering the Use of Educational Technology: Elements of a National Strategy</u> (RAND,1996); <u>Getting America's Students Ready for the 21st Century: Meeting the</u>

Technology Literacy Challenge (U.S. Department of Education, 1996); Report to the President on the Use of Technology to Strengthen K-12 Education in the United States (President's Committee of Advisors on Science and Technology, Panel on Educational Technology, 1997); The School Technology and Readiness Report: From Pillars to Progress (CEO Forum on Education and Technology, 1997); State Strategies for Incorporating Technology Into Education (National Governors Association, 1997); Teachers & Technology: Making the Connection (Office of Technology Assessment, Congress of the United States, 1995); Technology and the New Professional Teacher: Preparing for the 21st Century Classroom (National Council for Accreditation of Teacher Education, 1997); Technology Counts (Education Week, 1997).

(3) It appears that the three states contracted the same firm to help produce their technology plans.

(4) It is important to distinguish between 'networked computers' and 'computer technology as a network'. The technical basis of the difference is between "local area network" (networked computers) and the Internet, in which computers are the medium for a network that links people globally serving both informational and communicative functions.

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What's just the latest incarnation of this idea came in the form of Massive Open Online Courses, or MOOCs. In fact, the New York Times declared 2012 the Year of the MOOC! A lot of the early forms were just videos of lectures from famous professors. Educational technology is the process of integrating technology into education in a positive manner that promotes a more diverse learning environment and a way for students to learn how to use technology as well as their common assignments. Related terms. Early 20th century abacus used in a Danish elementary school. Given this definition, educational technology is an inclusive term for both the material tools and the theoretical foundations for supporting learning and teaching. Keywords: big data in education, data-driven education management, digital education infrastructure, electronic repositories of educational data, national databases of educational statistics, methodology, and technologies for analyzing educational data. Introduction. The technology of big data analysis transforms the organizational principles of the development of socio-economic spheres, including education. International Analysis of National Databases of Educational Statistics and Analysis of the Technologies' Educational Data in Countries of the. World. J Adv Pharm Edu Res 2020;10(3):90-101. Classroom in 1917 - what's changed really? File:1917 - Allentown High School Mechanical Drawing Classroom Allentown PA.jpg. It is more likely that innovators from outside the system will introduce the changes needed. Classroom in 1917 - what's changed really? File:1917 - Allentown High School Mechanical Drawing Classroom Allentown PA.jpg. It is more likely that innovators from outside the system will introduce the changes needed. There are many schools, including public/state-run schools, that are working with this approach, but they are not necessarily supported by the systems in which they run. Students who attend PBL schools typically don't do as well on achievement tests such as the Australian NAPLAN (NAP - Home.) or high-stakes end-of- secondary examinations.