Hi-Tech Schools: The Path of the Paddle

J. Dale Burnett

I often begin an article such as this with a quotation. I would like to begin this with a name—Mr. James Grieve. He was my high school physics teacher in Jasper.

My primary interest is education, which I care about more deeply than I could ever have imagined. I am watching a system evolve that is increasingly unresponsive to the needs and desires of individual teachers and learners, while, according to the rhetoric, "this is the best of times" for our system. Technology per se is not the problem, but in the hands of unphilosophic kings it is an awesome weapon. However, unlike atomic weapons, which seem to have few redeeming social values, computer technology may have two sides to it.

I will highlight a few issues related to the use of technology in education. This is an important article because I am trying to influence you. I may or may not succeed, but I can assure you that I want to succeed. I would like to raise the level of discussion and debate on these issues because I consider them important in the evolution of our society.

We are approaching an era in which computing hardware is close to meeting our every wish. The question then becomes, so what? (It is true that thoughtful educators have been asking this since the 1960s; Bushnell and Allen 1967.) We also have telephones, television, automobiles, aircraft and weapons technologies that have been developed to a high degree, yet have had minimal impact on classrooms. We usually do not criticize educators for failing to adopt these technologies. Should we criticize them for failing to adopt computer technology? Are all forms of technology inherently irrelevant to education? Or is computer technology somehow different?

An earlier form of this article was presented as a paper at "Curriculum at the Centre," a national conference on curriculum, instruction and leadership, in Montreal in 1989.

Upstream: The Last 10 Years

Microcomputers have been with us for about a decade, although today's micro looks very little like the machines of just five years ago. The response of the educational community to this development was generally positive and enthusiastic. Two basic themes prevailed. One, it was politically desirable to have at least one microcomputer in every school. Two, a new set of courses was created, with names like Computer Literacy, Computer Studies and Informatiques. The basic content of these courses focused on the history of computing and on programming, usually in BASIC. Software developers produced a plethora of products, most of the drill and practice variety. In just a few years we have realized that having a computer in a school can be more of an embarrassment than a source of pride. Computer literacy courses are also on the ropes. It is becoming clear that computer programming is not a necessary skill for the profitable use of computers —in many ways it is actually an impediment because it ties up student time that might be better spent learning to use application packages such as word processors, data base systems and spreadsheets. Most of the claims from the software developers have a hollow ring today. There were widespread calls for increased teacher training, but little was actually done, except by those self-motivated teachers who became involved on their own time with their own money.

I view the last decade with a sense of pride, even though most of the "solutions" have not turned out too well. The pride comes from noting the sense of willingness to try new ventures. In the long haul, the results from the first few outings may not be as important as knowing you are playing the game. However, it would be naive to think that we have the techniques under control.

Around the Bend: The Impossible

Davis and Park (1987) have edited a delightful book of essays on what is impossible in various disciplines. The topics include mountaineering, biology, medicine, chemistry, computer science, technology, physics, mathematics, law, politics, economics, psychology, education, poetry, music and philosophy. It is worth listing these topics, if only to remind ourselves of the wealth of diverse activities that constitute human knowledge and are thus part of the educational enterprise. The chapters on technology and education are particularly relevant to considerations of future educational milieus. The technology chapter (Sturge 1987, 120) considers limits to computers and concludes:

> The principles of a reversible quantum-mechanical computer have been sketched out by Feynman. Its performance is not limited by quantum mechanics or by thermodynamics. Unless the particular technology by which the computer will be realized is specified, no level of performance can be ruled out as "impossible."

It is important to recognize that this conclusion refers to the machine, not the software or the human use of the machine, aspects of the total picture to which I will return for a second glimpse.

Iano (1987, 256) begins his chapter on the impossible in education:

> Everyday living is filled with the uncertain, the unpredictable and the ambiguous. The same is true of the everyday world of educational practice. Yet many educators have been trying to turn this uncertain world of educational practice into a world of definitive knowledge.

Iano proceeds to show why such definitive knowledge is impossible. A similar conclusion is arrived at by Dreyfus and Dreyfus (1986) in their review of artificial intelligence and expert system approaches. Today, one of the difficulties facing a person who is interested in the role of technology in education, is that of obtaining a balanced perspective between the various claims and counterclaims of different authors, who often have a vested interest in the outcome.

The Map: Where Are We Going?

Most of us realize that to arrive at a destination it is not only important to move but also to move in the right direction. I have extracted some illustrative goal statements from Alberta Education's policy documents.

> The aim of education is to develop the knowledge, the skills and the positive attitudes of individuals, so that they will be self-confident, capable and committed to setting goals, making informed choices and acting in ways that will improve their own lives and the life of their community. (p. 7)
>
> . . . develop the ability to think conceptually, critically and creatively, to acquire and apply problem-solving skills, to apply principles of logic, and to use different modes of inquiry. . . .
>
> . . . master effective language and communication skills, including the ability to use communications technology. . . (p. 13).
>
> (Alberta Education 1985)

I would like to contrast these statements with the following table:

Mathematics 163
MWF 10 Sec. 3B 301 Manse
Prof. R. B. Smith TA: F. Jones
Final Exam

Student ID	Grade
072-36-7345	78
140-47-7262	75
149-87-4850	88
241-01-5033	62
362-22-8625	91
384-98-9098	75
509-15-5143	94
522-17-1276	88
791-35-0107	79
798-45-6063	55
807-89-0229	72
936-01-3145	85
987-03-2678	82

Av	= 78.769231
Sigma	= 10.821303
Median	= 79.000000

(Davis and Hersh 1986, 55)

The starkness of the chart is frightening. It would make a fitting epitaph for Education 1992. We must continue to reflect on our educational goals. A job not worth doing is not worth doing well.

A series of three books have appeared on successful management practices in the United States. I think of them as The Excellence Trilogy. *In Search of Excellence* (Peters and Waterman 1982), *A Passion for Excellence* (Peters and Austin 1985) and *Thriving on Chaos* (Peters 1987) have all become best-sellers. Not without their critics, these books nonetheless

appear to have an important message for educators as well: listen to your customer. A quote from the middle book gives one the flavor of the authors' message. Commenting on a series of reports on mismanagement, they say on page xviii, "All [reviews] put the knock on mindless systems analysis and [the reviews] began the examination of a misplaced emphasis on paper rather than on people."

Maps are important. However, the map is not the river. Curriculum guidelines are important. However, guidelines are not the curriculum.

The Journey

On a river there are long stretches of calm water and deep pools. Many educators, including planners and administrators, prefer this type of situation. Control seems possible and even desirable. The curriculum remains relatively static and last year's plans still work. However, this view is not shared by all. A number of recent reviews of education have come to similar conclusions, such as "School is boring" (for example, Sizer 1984). Computer technology may become part of the solution, but not because of the glitz surrounding it—we have been misled by the arcade phenomenon. Rather, the appeal will lie in the intensity of the student's involvement with the ideas in the curriculum. Word processors permit the student to develop his/her own voice. We will have word processing across the curriculum, but it will not simply be the transferring of the term paper from one medium to another. It will be apparent (when each student has ready access to the technology) that it represents a totally new way of composing—not something to be handed in and graded, but a dynamic, flexible medium for clarifying one's thoughts. Even this paper, which may appear relatively lifeless to the reader, has been through a continuous state of change as ideas and points swirl about. For example, the canoeing metaphor emerged rather late in the process. Yet word processing is relatively benign. The content of the curriculum can remain much the same as before—it is just that students can play with this content more easily. I suspect that this is where the major impact of the technology will be felt. It will be subtle but pervasive, as we are all carried along in the current. A number of examples show that elementary school students have developed keyboarding skills that permit them to type faster than they can write, often in excess of 20 words per minute. Thus they are now free to concentrate on the content.

We must be alert to hidden hazards lurking just below the surface and capable of tipping the canoe at a moment's notice. I call these hazards preformed curriculum packages. Not all rocks are hazardous, but those that provide mindless, repetitive exercises (even though they are coated with technological moss such as flashing, colored graphics and loud sounds) should be approached with caution. Whirlpools may also capture the unwary. Software packages abound that presume that learners all learn in essentially the same way and will thus respond in a desired manner to carefully constructed and sequenced screen displays. Do not be misled by the claims that the programs branch to different displays depending upon the response. The criteria for such branches are usually superficial, and the student feels that he is trapped in a vicious circle of preplanned activities, from which there is no escape.

Then come stretches of white water, where the current is faster. Here the curriculum is changing more rapidly. This is best represented by the integration of spreadsheets, data bases and computer-based simulations into the curriculum. It is much more exciting out here. Burnett has outlined potential spreadsheet uses for mathematics (1987) as well as across the curriculum (1988a, 1988c). Schwarz, Lademann and Christmas (1989) have pulled together a set of materials for teachers on the use of data bases in the curriculum. Computer-based simulations have received a lot of publicity and promise to be an area in which many will practise their white-water skills. As intimated earlier, new topics are also emerging: Logo (Burnett 1988d), Lego-logo, fractals, chaos, turtle geometry and perhaps even low temperature fusion. The technology also provides new ways of looking at familiar topics (Burnett 1988b; Clayson 1988; Goldenberg and Feurzeig 1987).

However, even the experienced canoeist can run into difficulties. Hoyles (1988) has outlined ways in which gender role stereotyping can creep into computer-based activities. Quiet students may remain quiet, and thus escape the attention of the teacher (Pye 1988). Anxiety surrounding the technology, although more apparent with older people, must also be addressed. Because access to computer technology is related to money, the children of more affluent parents are likely to benefit more by having computers in the home.

The Canoe: Invisible and Empty

The dominant use of computer technology in the next decade should be with systems that are

invisible and empty. Invisibility is important. We want learners to be able to focus on the topic of interest and not be diverted by features of the environment. The medium should not be the only message. Invisibility is closely tied to the idea of "ease of use." We are slowly beginning to realize that most people do not want to think like a computer. They want a computer that responds to normal human signals, much as another human would. This is not a perverse desire: we simply have more experience communicating with one another and want to draw on that experience. Communicating with other life forms and with machines is not our strength. Pointing at an image on a screen is a genuine improvement over typing and having to be concerned with strange syntactic conventions. We want to focus on ideas inherent in the topic, not to have to pose questions like "How do I get the computer to do this?" which detract from important trains of thought. An invisible computer is one that is so easy to use we are not aware of its existence.

Emptiness is an even stranger concept for educators. Curriculum developers abhor a vacuum. Yet, for many reasons, an empty computer may be preferable to a full one. Rather than providing a student with a computer packed with curriculum materials, the idea is to provide the student with a sophisticated tool for placing, organizing and manipulating his/her own understandings. Potential examples include word processors, spreadsheets, data base programs, graphics packages, statistical packages and programming languages. An invisible, empty computer is a device that facilitates playing with student-generated ideas.

The Paddler

Even more paradoxical, in one important sense an empty teacher may be preferable to a full one. Let me now recount a story from my high school days. In my last year of high school, a new teacher was assigned to teach us physics. He was an excellent, experienced teacher—but not in physics. Physics was as new to him as it was to us. Of all the courses I took in school, this one stands out as the best. Why?

Reason, not authority, carried the day. Everyone was encouraged to share their view of why a particular idea or approach was appropriate in a given context. The teacher had his say but was comfortable with having it overturned by a better explanation from someone in the class. Knowing there was no authority, we had to work harder at making sure that we really understood because if we had a misunderstanding we would likely carry it with us into the departmental exam. Looking back on it, I think Socrates would have approved of this class. Another memory of this teacher is also vivid. We lived in a small town, and when we kids used to walk home after a movie and a coke, we passed the high school. Every night, and I do mean every night, we saw this teacher working in his classroom, preparing for the next day's class. What did I learn in his physics class? Some physics, definitely. But much more. By total accident I met this teacher in 1988 after 25 years. It was just like yesterday for both of us.

The teacher is the key.

Postscript: Mr. James Grieve died in 1990.

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