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ABSTRACT

This paper discusses the dangers of technological momentum. Technological momentum is defined as the increase in the rate of the evolution of technology, its infusion into societal tasks and recreations, society's dependence on technology, and the impact of technology on society. Topics of discussion include changes in response to user needs, instructional technology, opposition to ways educational technology is used, the background of technological momentum, the first computers, changes as a result of technology, technology in daily living and entertainment, competition, importance of control, dehumanization, loss of teacher and student characteristics, reduction of achievement levels, administration, and interaction. (Contains 15 references.) (AEF)

Title:

Too Much Too Fast: The Dangers of Technological Momentum

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For this discussion, technological momentum can be defined as the increase in the rate of: 1. the evolution of technology, 2. its infusion into societal tasks and recreations, 3. society's dependence on technology, and 4. the impact of technology on society.

Some may not like the use of the word evolution in relation to non-living things. Technology changes due to environmental stress, responding to needs or wants in society. Changes in existing technologies try to alleviate this stress. This fits the concept of evolution well, so that word will be used. Infusion is the use of and reliance on technologies by persons in the course of completing tasks or pursuing recreation where technology was not used before.

The use of the word technology should also be addressed. Technology can be looked at as either a process or a product. Although the first may be considered by many in the field of instructional technology as the more proper way of thinking, popular usage of the word has given the second as much or more weight. When technology is used to mean only a product, I will use the word product or hardware, which will mean both hardware and software for the remainder of this paper.

There are two facets to technological momentum. The first is *too much* technology. The second is gaining technology *too fast*, without fully understanding the impact that the technology will have. There are inherent dangers in each that technologists, instructional technologists in particular, need to take into consideration as they advance technology's influence.

Why do criticisms of technology exist? Is change bad? Is less work for the teacher bad? This paper is an expression of worry, fear, or concern dealing with a perceived flaw in something. Sometimes the criticism is constructive and meant to lead to the correction of the flaw. Just as often, the flaw is used as a reason to disregard or discredit the thought or product it is contained within.

Instructional technology has been talked about as a panacea for the ills of education and society in general. Not all, however, look upon instructional technology with favor. Many are opposed to the use of technology within education. Others, even educational technologists, oppose the way in which technology is currently used. Several of these criticisms focus on the idea of technological momentum.

It is often easier to identify problems from the outside of an issue. People not intimately connected with an issue can be more objective. This makes it important for insiders to listen to them. They often provide insights that no insider would generate.

Instructional technology is a part of technology (Heinich, 1984). It follows from this that the dangers and criticisms of technology in general are also valid for educational technology. This is of great concern to educational technologists. We must not only be aware of what we are doing, but also what people in other fields and disciplines are doing as well. In the public's mind, all technology is part of the same machine. All parts of the machine bear the blame when one part fails to work properly.

The fact that technology is gaining momentum is very easy to see when you look at history. The Stone Age, Bronze Age, and Iron Age have chronologically dominated humankind's history. Many significant advances were made during these periods. However, significant advances, such as the wheel and printing press, were few and far between. Changes in thinking or design were slow to develop and just as slow to spread.

Not so during the Industrial revolution. Complex, automated machinery began to be used. Society began to change from a rural, agrarian base to an urban, industrial base. The steam engine gave power previously undreamed of, making possible the steam locomotive and cotton gin, to name a few. The development of the assembly line ushered in a new age of industrial technique. Change followed change, each new product developing further or leading to new side-products.

In the 1970's, aproximately 200 years after the start of the Industrial Revolution, the world's dependence on oil and other fossil fuels was shown when OPEC imposed an oil embargo. This forced the United States and other countries to look at their use of oil-based and oil using products. In a relatively short period of time, society had developed and become dependent on such things as the internal combustion engine and plastic.

In the 1950's, the first super computers were shown to the world. They filled entire rooms and could follow only very limited instructions. In the 1970's, a scarce 20 years after their introduction, computers became small and inexpensive enough for personal and office use. In 1984, Apple released a computer that used a new idea, the graphical user interface (GUI). GUI provided a visual, intuitively understood way to communicate with the computer. Now, in the 1990's, nearly every college faculty and a good deal of the population at large has a computer a thousand times more powerful than the 1950's versions sitting on a corner of their desk. We are joined to each other around the world by invisible communications systems that can provide nearly instantaneous access to information stored almost anywhere in the world. We are now in an Information Age, but for how long?

Changes have become exponential as time goes on. Each new development breeds more new ideas. From these ideas spring forth even more ideas. On and on it goes, and *whether* it stops, nobody knows. Changes in early technologies were simple, often being a change in material or design. The Industrial Revolution saw the widespread impact of a different type of technological change, a change in the *way* something was done. Since then, the rate of change has grown exponentially. Hardware changes much more quickly than the thinking and concepts behind them, but both are changing rapidly even now. New hardware is often obsolete within five years, less with computers. There is an incredible drive for change within humankind.

Technology is often associated with the pursuit of progress, doing more things faster. As society changes, its needs change. The changes in technology are often responses to these needs. Sometimes the new technologies or products lead to the change in society's needs instead. Technology is a means to the end of progress. However, it should be remembered that progress is not always good.

The development of the cotton gin revitalized a crumbling slave-based economy in the South. In order to supply the world's need for timber and beef, we are cutting down enormous tracts of rainforest every day. Entire species and cultures are becoming extinct so that we can grab a Big Mac© at the drive-thru on our way home so that we don't miss our favorite television show.

What are we driving home in? An automobile powered by gasoline. What is gasoline made from? Gasoline is but one product that we get from petroleum, along with heating oil, rubber, adhesives, solvents, and plastics. In our need to keep all these machines going and make more of them, we drill into the earth in more and more places. Each drilling site upsets the natural balance of the immediate area. When oil spills occur, it upsets the balance over a wide area. Even more hazardous is the fact that oil spills destroy large amounts of plankton, the small ocean plants responsible for ninety percent of the earth's breathable oxygen. The strip mining that occurs to support the manufacture of products and the chemicals we make further damage the biosphere. As we use more and more machines, for more and more functions, these atrocities will grow. They are of great concern.

Remember that technology doesn't just respond to changes in society, it can drive those changes as well. The microwave oven is one of those products that has changed our lives greatly. The microwave oven was developed in response to the needs of the space program. It was only one very small part of the complex system required to put humans into space. Once it became available to the public, however, it became a focus of American cooking. No longer must we wait for our food. Preparation time has been drastically reduced, freeing time for other pursuits. Individual portions are more easily prepared, making large family meals a less frequent occurrence. Society's need for speed is spreading into all parts of our life. How long until it reaches our educational system?

There have been changes in our chosen forms of entertainment, too. Radio was the first non-written entertainment to enter people's homes on a wide scale. For the first time, large numbers of people could be reached at the same time over great distances. This was even more true of television, when it was introduced. At first people only had to choose between one or two radio or television stations. As their popularities grew, there were more and more stations. This meant more and more choices. Now, with cable, it is not unusual for there to be a choice between 30 or 40 channels, each with something slightly different, each competing for people's interest.

This competition for interest has become a race of who can have the funniest, saddest, most real, most exciting, or even bloodiest programming. To keep our attention, plots change rapidly. This has caused a noticeable drop in attention spans in students who are part of the "MTV Generation." Surely an unplanned for side-affect, but still a result of the rapid change in television.

Criticisms of technology have been around for a very long time. Mary Shelly's *Frankenstein* addresses the issue of humans losing control over their creations. Dr. Frankenstein seeks control over life and death itself, he wishes to create life. He is even successful, bringing to life a conglomeration of pieces from corpses recovered from the graveyard. Having found the secret to giving life to a being, Dr. Frankenstein only realized that he *could* do such a thing. He did not stop to think whether he *should* instill life where there is none.

These questions remain today, even with the above example. Cloning is a cutting edge field. Even today, court cases rage over the question of artificially prolonging a person's life through the use of machines and drugs. What medicine can do today would seem almost as wondrous as creating life to someone from just 250 years ago. In some instances it can be a very helpful thing. In others, it is unwanted and is hated. Many people believe that not everything can, or should, be controlled. This may be even more true in education than in other parts of society.

Control is a necessary part of technology and instructional technology. Control is needed over outcomes, procedures and evaluation. Without this control to define, the instructional technologist will fail

in designing an effective system. It is only when variables are eliminated or successfully manipulated that control can exist. Only when control exists can instructional technologists design an efficient system. However, control is something we are taking away from the teachers and technologists. It is being given to the students in the hopes of involving them in their own education, individualizing each student's education, and making each student's education relevant to their life. Without control over these things, are technologists going to be able to plan instruction usable by everyone?

This need for control is a limiting factor for instructional technologists. Certain subjects, like mathematics and physical sciences, lend themselves to the rational, logical organization that is the hallmark of instructional design. Not all subjects or outcomes fit in so nicely, however. It is very hard, perhaps impossible, to put attitudes, creativity, and understandings into behavioral objectives, another hallmark of instructional design. A problem of instructional technology is that objectives are often changed when instruction does not lead to the desired behavioral changes (Merrill, 1971).

> ... we adjust *what* we teach to what we *can* teach in a certain way, rather than adjusting our teaching to the human being. Though we all look forward to the day of more use of educational technology in freeing the teacher from tutoring, reviewing, drilling, and evaluating, we must also recognize the danger of de-emphasizing the development of children's imaginations, of creativity. (Driscoll, 1978)

This passage both praises instructional technology and warns against its use. The benefits of increasing technology in the schools are many. But will we limit our instruction to only those things we can control and define?

Most educational technologists don't design systems or instruction that they don't want used. These systems are used by people. The systems involve people. Therefore, the concerns that people have with technology and instructional technology in particular should be taken into consideration. As peoples' concerns with technology grow, so will their dissatisfaction with the educational system.

One of the major criticisms of instructional technology is dehumanization. There are certain characteristics that are regarded as being "human." Among these are creativity, feelings, compassion, individualism, passion, and understanding. When something other than a human possesses one or more of these traits, it is often personalized or given credit for being like humans. If a person shows a lack of these traits, they are said to be mechanistic, cold, or inhuman. There is a great deal of importance given to these traits, and anything that hinders or retards their development or expression is considered undesirable.

One of the greatest of the dehumanizing arguments is that technology seeks to treat every person the same way, disregarding individual attributes, abilities, feelings, and needs. Individual needs are only met when they meet the demands of the system (Streibel 1986). As the use of technology in education increases, there is the danger that students will be treated less as the individuals they are and more like interchangeable parts.

The students lose their individuality. They are treated as another variable in the system. This student-as-product ideology has been a major criticism of instructional technology. The concept of people as parts is offensive to many educators. This can make instructional technology very unpopular to the average educator.

Educators are also in danger of becoming interchangeable parts in the instructional system. The purpose of instructional design is the identification and manipulation of individual variables in the instructional process. To many instructional designers, teachers are just another variable. Individual teacher characteristics are disregarded. One teacher becomes just as good or as bad as any other teacher. The craft, or art if you prefer, of teaching will be replaced by the competency of teaching.

Bates writes of a cult of competency. It is described as "one current mechanism through which certain changes are being advocated in the professions and their associated education programs." The cult of competency is not an educational movement, it is a managerial movement with the goal of increasing efficiency between differing sections of society. The effect of this movement will be the deterioration of teachers' skills. (Bates, 1992)

> The overall result of the cult of competency, paradoxically, is likely to be a system that may well serve to restrict the development of expert professionalism, ...In constraining the open-ended nature of professional activity at this expert end of the scale we may well produce a competency based system in which substantially more professionals' performance will be reduced to the level of basic skills. We may well end up with the

very thing we do not want: professionals in education as elsewhere who are indeed barely competent. (p 7)

If teachers and students are reduced to interchangeable parts, another phenomenon will occur. The skills required, both by teachers and students, will be reduced to the barest technical levels.

As teachers are encouraged to adopt new technology, they will also have to adopt new roles and duties. Teachers will become interchangeable since their skills will be at a minimal mechanical competency. (Koetting, 1988)

> As the teaching profession has become an increasingly highly skilled technology with a primary emphasis on methods and outcomes, teachers have been rewarded for guiding their practice in ways amenable to their technology. As Macdonald suggests (1975), this notion implies that "teachers are potentially interchangeable," and leads to viewing productive activity as something learned and performed "mechanistically." Thus, any "good" teaching activity can be reproduced by any other teacher, and "...all productive teaching is measurable in terms of the criteria of the accountability in use"(pg446)

Diversity is an important idea today. Awareness of and appreciation for the differences among people is a focus of many educational reforms. It is the current theme for Kappa Delta Pi, an international educational organization. Tolerance for differences is not only a goal for our students, but for today's teachers as well. The accommodation of learning style and cultural differences is increasing its importance as an issue in teacher preparation programs and continuing teacher education. A result of this effort is the formation of a single global community. The idea of a diverse community is at odds with a technological approach to education. The conformity that is forced by designed instruction works to inhibit individual differences.

> Coupled with this faster rate of societal change will be an increasing homogenization of different nations and cultures. As the centralization of production grows, instructional units will become ever more standardized; whatever cultural differentiation takes place in programming to adapt to different audiences may be as much 'window dressing' as actual. This growing uniformity will speed the rate of global change and facilitate intercultural communication, but will also reduce the pool of diversity and pluralism on which the human race can draw. (Dede, 1981)

Technological advance is based on control and uniformity and being able to predict outcomes. Even as we begin to preach about the community and diversity, we advance the technology that may very well destroy these traits within us.

Adapting to new technology will become easier as time goes on. Speaking of a popular piece of technology, McPherson writes, "The more adaptable computers become to the requirements of human beings, the less human beings will have to adapt to the requirements of computers" (McPherson, 1984). The Macintosh's graphical user interface made it much easier to use computers. You no longer needed to know commands and codes that sounded and looked like Greek. This ease of use resulted in an increased use of computers in many areas: home business, and school. Now, hardware and software exist that can recognize an individual's handwriting and convert it to type. The addition of speech recognition and vocal control to computers will make computers even easier to operate. Soon, we will be able to talk to our computers on nearly the same level as another person.

The fact that technology is becoming easier to use leads to its increased use, whether it is needed or not. "A common, and often justifiable, criticism of instructional design is that it results in doing better what shouldn't be done in the first place" (Gustafson, 1971). Again, just because something can be done, does not mean it should be done or will have positive results.

The preoccupation of instructional technology with management theory and efficiency are often seen as weaknesses. It is not that educators are against efficient instruction, it is the degree and manner in which instructional technology uses these ideas.

The managerial approach of instructional technologists includes the students-as-products idea. This idea is disliked by many educators. The idea that students are components that move through the educational system, each being treated in the same manner, doesn't coincide with the view of teaching held by many educators. For many, teaching is an interactive process. This interaction is primary social

interaction between individuals or groups, i.e. other people. While instructional technology strives for interaction, it is interaction between people and machines. Replacing people with machinery is a very dangerous proposition. It is, however, the direction instructional technology is heading.

The increased use of managerial models in instructional technology relates to the control issue as well. As more technology is used in the classroom, educators at the local levels lose more and more control over what is taught and the method of instruction.

The control of instruction will mirror the change in control of production. (Bates, 1986)

> ...the development of industrial capitalism was based not so much on technical advances in production methods, but rather upon alterations in the management practices which removed control of the production process from the hand of artisans and relocated it in the hands of owners. Simultaneous with this process was the deskilling of the workers. (pp 4, 5)

Again, the history of general technology can be used to foretell the future of educational technology. Just as control of production was taken from the workers, so too will the control of instruction be taken from teachers. The control will rest with the instructional designer, who is often far removed from the classroom environment.

There is also the change of roles for educators. Educators will stop being deliverers of instruction and become managers of instruction. (Bates, 1986)

> What teachers may well be experiencing...is an intensification of pressure to conform with particular instructional models which are determined by researchers as "more effective." Principals and Instructional Leaders of various kinds are likely to be subject to increasing barrages of information on "successful" instructional techniques and be urged to ensure their adoption by teachers. Systems of sanctions and rewards (incentive systems) will be introduced to reinforce the adoption of the new techniques and to engineer a political apparatus of regulation which will parallel the particular organization of the tasks of educational production specified by the experts.
>
> Such developments are likely to lead both to an increasing emphasis on the logic of bureaucratic rationality (Rizvi, 1986) and to further restrictions on the responsible autonomy of the teaching profession. It may well lead to further development of what Webb (1985) calls status panic among teachers. Moreover, such developments are certain, in my view, to further develop a technical notion of educational practice which is devoted to managerial rather than educational ends. (pp 11,12)

Again, the switch to managing instruction eliminates much, if not all, of the interpersonal relationships that educators take pride in. Part of teaching has always been the challenge of communicating with the students, passing knowledge, skills, and thoughts to a new generation. Instructional technologists would reduce the complex interpersonal interactions to a cold, sterile overseeing of instructional tasks. Are we promoting an educational system where the terminal degree is an MBA, not an MSEd?

The fact is, technology is coming on too fast. Educators can't keep up with the rapid change taking place. Most schools don't have the knowledge necessary to integrate technology effectively into their system. How often, even in higher education, do we see brand new equipment sitting in an office or a lab, unused? Often, people simply don't know how to use the new products or methods. The tremendous advances in technological capability has not been paralleled by advances in training or ability at the level of our schools. Often, even our teacher training programs lack such instruction.

Schools often find themselves at the mercy of distributors and companies who want to make a profit. Administrators, School Boards, and teachers often purchase instructional materials or hardware that never get used. When methods or hardware that don't work are acquired, what is the solution? Apply more technology, of course. (Nichols, 1987) If a product or method doesn't work, it can be made to work if enough time and money is spent on making it work. The idea that another product, or even no product, could do as good or even a better job infrequently comes to mind.

Technology often breeds the need for more technology. Usually, the new technology is designed to overcome problems of or solve problems created by older technology. There is always the drive to do more, to do it faster, and to do it less expensively. This is a very dangerous idea. Take for example the technology of war. Each invention was never good enough at killing. Sticks and stones became swords and bows. Then guns and cannon were developed. Next came explosive shells, then missiles. Finally, the

nuclear bomb was developed. Were designers happy? No, they wanted even more destructive power. Where does it stop? Now think about this trend in relation to education, where will the instructional designers stop? Will all behaviors and actions be reduced to pat little formulas? Will every aspect of life become an equation?

The concerns stated in this paper are just that, concerns. They are not condemnations of technology. Technology has many advantages and is here to stay. We will not get rid of technology. Nothing we do will stop the evolution of the processes and products that are becoming integral parts of our society. Even if we could stop technological momentum, it would not necessarily be a good thing.

There is, and will always be that within humankind that craves and needs change. There is also that within humankind that fears change and will try to stop it. Envision the process of change as a river. The fear that inhibits change is a dam across that river. The pressure of the river builds and builds behind the dam. Finally, the dam breaks and there is a massive rush of water. Only for us, it is change. This power can be harnessed and used for productive purposes, just as a controlled flow through a dam is used to create energy. If it is held back for too long, though, it will eventually burst through, carrying us along whether we are ready for it or not.

We should try to direct and harness the power imbedded within technological momentum. The benefits that can be gained from technology are many. However, uncontrolled advancement will cause more harm than good. We need to listen to the concerns brought to us by the public, by educators, and by our peers. Let us address the issues facing us. Let us become ethical, responsible practitioners of instructional technology.

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