Why Computers Are Failing in the Education of Our Children

Clifton Chadwick

Introduction
In this modern world, we live in an information-bloated environment full of images and attitudes, a society of show, spectacle, exhibition, an immense system of symbols, signs, representations, and simulations, which shape the mental habits of almost everyone who lives today. It is a hectic and frenetic world, full of names and places, junk and valuables, experts opining through sound-bites, young people talking and singing incessantly, sexual complications with more infidelities than fidelities, cartoon characters trying to protect the future of the world, cloned sheep scaring the religiously conservative, and a constant movement, activity, motion, of people who are fundamentally bored because their needs are more than sated.

The media provide information, but in this new world most of that information is transitory and unstable and rarely complete. We sound-bite our information at almost all levels. Part of the result is that many people feel half-crazy with anxiety, possessing information without understanding and wisdom, opinions without principles, decisions without belief systems. The information overload is infinitely greater than at any time in the history of the human being, raising the question of our nervous system’s ability to absorb it.

Now the educational community has been bombard with exaggerated messages about the “information superhighway” and all its presumed meaning and potential. Supposedly the new technology will revolutionize education, resolving, in a cyberspark, all our problems. Some of the typical comments include:

- “Technology can stimulate children’s capacities, revolutionize their ways of thinking and working and give them new access to the world.” (Peck & Dorrico, 1994)
- “The information era will help students to acquire information in forms congruent with their natural learning styles.” (Bett, 1994)
- “...children can learn to use computers masterfully and learn to use them to modify how they learn everything else.” (Papert, 1980)
- “...we are seeing an authentic revolution in the field of education, new technologies—including virtual reality, nanotechnology, and artificial intelligence—which, when combined with fiber optics, will produce an industrial revolution capable of rivaling with the 19th Century, and from all of this will arise a serious alternative to the conventional classroom, the virtual classroom.” (Tiffin & Rajsingh, 1995)

Confusing Means and Ends
According to the law of the hammer, if you give a five-year-old a hammer, he or she will discover that everything in the immediate environment needs to be hit. As Einstein (1996) so clearly signalled, one of the great problems of modern times is the confusion between means and ends. We find the same phenomenon in education, particularly in relation to mass media (our hammers). We see the enthusiasm with which education has embraced cinema, radio, and television. Each new medium has been seen as the final answer, the great panacea, for resolving education’s myriad problems. Notwithstanding, usually only a few years after its arrival, the medium turns out to be ineffective and ephemeral. For the past few years, we have been looking at a new medium of considerable importance, apparently with great potential, so much so that people even talk about the “information era.” Every new medium is a solution looking for problems to solve, and almost always someone tries to implement the medium without adequately taking into account the nature of the ends which are being sought.

The computer is a powerful instrument in terms of influencing people’s perspectives. As we work with it, it works on us, molding our minds to adapt them to the computer’s more powerful, but more limited, narrower capabilities. It expands our capacities in the areas of logic and mathematics. But it might be doing that at the cost of other forms of thinking, such as intuition, emotions, and spiritual beliefs. We do not put all of our own resources, our being, into the computer because it does not have the capacity to react to them, and is not interested.

It is not enough to be able to manage computers and the information. It is more important to know the

Clifton Chadwick is Vice-President, Research, Cambridge Consulting Corporation, McLean, Virginia, and President, Educational Council, The Chadwick School, Santiago, Chile (e-mail: cliftonchadwick@hotmail.com).

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meaning and value of the information and how to use it for appropriate means.

It is true that the computer offers an almost endless amount of information to students, but what good is all that information if they cannot give it meaning, if they do not have the background, the structure, and the judgment required to interpret and apply the information? Today we see many young people who know how to use the technology, know how to get information from the Internet, who know how to program, and much more. If we ask them how to get to a page on the Web, they take us there immediately. But don’t ask them to explain what they have found, because often they lack the necessary culture to adequately interpret and apply what they see.

Education presumably wishes to develop all of the potentialities of the human being. It proposes to help the person broaden his or her perspective, search for the truth, understand the great ideas of our world and our culture, use rational judgment, achieve emotional maturity, generate new and original ideas, and, even, hopefully, continue the search for wisdom.

The critical question is how the computer can help students to develop their creativity, their perspicacity, and their judgment, as education has always aspired to do. Is there some way to manage the power of technology to help students in their search for meaning and understanding in their lives? It seems that few are asking this question, and no one is answering it.*

Without a good education about the great (and not so great) ideas that give substance to information and form the cultural context of life, what computers and the Internet are offering will not be much help for students.

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Two Preoccupations

Currently, I have two principal worries about computers in education. The first is the depth of processing involved in the management of information received through mass media, that is, how well it is managed in terms of learning. The second is the ecological relation engendered between the person and the environment when he or she is operating a computer.

Depth of Processing

One of the principal metaphors of cognitive psychology is to view acquisition of new knowledge as a processing event, similar to what is done by computers. Obviously, the conditions under which this processing is effected are very important and will have influence over the results.

The absence of active and conscious processing which occurs when the individual relies on the underlying structure of a meaningful situation has been defined as mindlessness by Langer (1984). Mindfulness, to the contrary, requires active distinctions and mental elaborations instead of use of easily available categories. Mindlessness is similar to what Craik and Lockhart (1972) have called superficial processing. For Langer, mindlessness during processing means ignoring information perceived to be already known. Mindfulness means to fully take into account that information. For both Langer and Craik and Lockhart, mindful processing is more attentive, deeper, involves more mental elaborations of the information provided, and leads to better learning and subsequent performance.

Mental elaborations can range from the merely automatic and effortless processes dominated by external stimuli to those processes which require more effort and greater control. These latter efforts require that new information have more contact with existing mental schemes and therefore leave more tracks, more prints in the memory. It has been shown that memory and application of new concepts are improved when the student is asked to increase his or her elaboration, particularly when the student would not do it alone. It is presumed that increasing elaboration will improve non-automatic learning, for example, the generation of inferences. The same increase in effort would have no impact in incidental learning nor in non-guided acquisition efforts done automatically, episodically, or involuntarily.

Given that processing effort is directly related to learning achievement, it is feasible to say that the amount of mental effort that the student invests in his or her learning will be a good predictor of achievement, as Salomon (1984) has confirmed. He has shown that the perception that the task is more complicated leads to the investment of more effort, better results, and afterward a better perception of one’s own efficacy.

There are clear differences between text and television. Television is perceived as being more entertaining and serves an escapist function, while text is perceived as being more educative and informative. Television is seen as more real, more truthful, closer to life, and young people treat realistic material more superficially than they do more complicated material, so that it is presumed that television is assimilated with less mental elaboration. For example, children generally produce more inferences when they are read a story than when they see the same story on television (Meringoff, 1980). It is probable that they use less mental effort because they perceive the television as sufficiently complete, and it does not require further effort. In an experiment in which different groups had to complete a short story which they had begun through television, radio, or by reading, Watkins and

* I would enjoy and appreciate any references, suggestions, or contributions on this point.
Coulombe (1981) found that the most cryptic and less elaborated endings came from the group which had seen television. The minimum level of effort (the base) required by written material is higher than that required by television, and the maximum possible effort (the ceiling) is also much higher (Singer, 1980). The observations of these authors suggest that children do not, voluntarily, go beyond superficial processing of televised material, even though they could have, if they had been instructed to do so.

Salomon (1984) tested some of these suggestions and showed that self-perception of successful reading comprehension was seen as the readers' responsibility (internal locus of control), while successful comprehension of television was primarily attributed to the medium (external locus of control). He also found that when the students perceive the materials as "natural" and therefore "easy" and they perceive themselves as effective learners, without realizing it, they invest less mental effort in elaboration, do more superficial elaboration, and learn less.

The results of the use of computers in the classroom are not very encouraging, but are quite congruent with the worries I have expressed. For example, a report published after eight years of Apple computers in the classroom came to this conclusion:

Test scores indicate that at least the students were learning as much from the computers as they would without them, and some students were learning much more. (Dwyer, 1994)

After many years and much money, the students learn as much as they would have learned if they had not had computers! Some students learn much more! Of course: in a variable distribution, some students learn more, some less. How do they justify the costs if the results are not better? These results do not surprise us if we review the comments about depth of processing. Probably these results come from the fact that processing was not more profound, something which is inherent in the medium.

The use of televised media has two immediate results: students process at a more superficial level, which works against developing more elaborations and more inferences, and they attribute their results to external factors, such as the nature of the medium. To the degree that the computer (and Internet) is quite similar to television, we should sound an alarm about these results. We should suspect that contact with the small screen does not adequately stimulate deeper processing, nor the development of more detailed elaborations, particularly since the so-called interactivity is so weak and superficial.

Experience, Nature, and Mediation

The second worry is similar but at a broader level: it is about the effects of mediated experience on people. Technologies are ecological: their introduction sends waves which change the internal relations of the whole system. The examples of Gutenberg's press, the invention of the clock, the automobile, and shopping malls, are quite noticeable. Technologies not only achieve their original objectives but change our ways of acting, thinking, and seeing the world. If I go from my house to my office by car, what I see will be different from what I would see if I walked to the office. Walking will stimulate my heart, make my blood circulate better, I can hear birds sing, say hello to my neighbors (if they are not in their cars!), and appreciate numerous details of the environment. The car is totally different: faster, but more isolated, less sensitive.

Technology separates the person from his or her reality. It is a way with which to arrange the environment so that we do not have direct experience. The media help us approach the world, take us to other places, other times, other levels of thinking, as is the case with a good book. Computer technology and telecommunications distance us from real life, notwithstanding that they seem so realistic. The virtual classroom simply is not virtual, not manifest, and cannot be. It is artificial because we are separated from direct contact with life and experience. Imagine some simple examples of virtual situations, like a virtual massage, a virtual meal, or a virtual mass. In the case of the mass, everything would be almost the same as a real mass, except at the moment of eating the wafer, when we realize it is not the same. Nourishment from a virtual meal would be quite limited.

Contemplation used to be seen as a key process in cognitive development, useful to assimilate received knowledge, to comprehend personal experiences, to develop one's own ideas, all of which gave a person's life meaningfulness. The principal capacity of the computer is to access and manipulate much information. But we must not confuse information management with the core of human learning, which is the transformation of the information through the use of higher-order mental skills, like the use of reasoning. An excess of information can even impede development of new ideas, leaving young minds distracted by quantities of information. Anyone who has used the Internet can understand this problem. How do we insure that while we are finding much information, we are truly elaborating new meanings based in experience and ideas? We run the risk that the objective of education is transformed into accumulating information, instead of developing reasoning, critical analysis skills, and solving problems. Where is the wisdom lost in knowledge or the knowledge confused with information? (Questions presumably raised by T. S. Eliot several decades ago.)

Computer and telecommunication people talk about "information" almost like a mantra. Computer and telecommunication projects are almost always
oriented toward the accumulation and interchange of information. Sometimes that is useful. But placing too much emphasis on computers in formal learning can distance the student from real, live experience in reality. Learning about flowers from computer software is not the same as manipulating flowers. If direct experience is possible, it should be given preference over mediated experience. We should not permit technology to impede direct experience with our world. This is one reason why I think that learning to read through a computer program is ghastly.

The computer helps us obtain much information about many things, but when extracting and summarizing the information, people decontextualize from the richer world of direct experience. Therefore, use of the computer is justified only in those cases where direct experience is not possible. Which ones? Many rich experiences result from reading, the principal source of cognitive development and entertainment. Reading stimulates a person's imagination and creativity in an almost irreplaceable form. (Consider the two new movies, Harry Potter and the Lord of the Rings, which have had to follow very closely the original books because they are visual interpretations of previously read material.) Also, as we can see, reading activates much deeper mental processing. Obviously, we should not teach reading through the computer, but that does not stop many companies from offering software for that purpose. Certain experiences can be derived from television, particularly in sports and entertainment and some aspects of history and geography, but we must be careful because the richness of the stimuli of these media awakens very little imagination and creativity.

Computers and related technology have positive effects in increasing the appreciation of efficacy and efficiency, objectivity, order, rationality, measurability, and progress toward the accumulation of much data and information. These things are important. But they do not contribute to other capacities, such as understanding of great ideas, the generation of our own ideas, the discovery of the meaning of experience, the use of good judgment, the development of a positive and balanced sense of self, solidarity with others, the value of spirituality, and the development of wisdom. When one talks with “computerists,” one does not hear anything said about these profoundly human goals.

What one sees is the transformation of goals. Instead of the search for truth or the mastery of the research process, we have the search for better skills. No longer are we after deeper understanding of great ideas, but rather the compilation of them (the more, the better!). Instead of generating one's own ideas, we see the sophisticated promotion of the ideas of others. Instead of discovering meaning, we search for more resources. Instead of the search for wisdom, now we look for immediate success. Certainly, it would not be bad to include some of these objectives: the problem is that they are replacing other, more important ones.

Fed by movies and television, we are not accustomed to demanding any complicated intellectual work. Television more than satisfies our needs for light trivialities, banalities, stupidities. The pace of electronic media is more intense, more hurried than that of books, more hurried than life itself (as we see in action movies). We are telespectators, Internet magazine readers, sound-bite gobblers, newswatchers, and CNN and Fox addicts.

Although a child's character is not formed by one TV program, one movie, a video game, or computer, the interminable electronic assault leaves its mark on the child's mind. The media subtly increase the child's demands, pressuring him or her to go further (more violence, more sex, more action), creating and satisfying new and prohibited areas, such that the child never develops at his or her own natural pace; rather, the child must adapt to the conception the media have of him or her. Although parents control the experiences which their children have with the media (and how many really control?), children share everything among themselves, playing the game that the media establish as the one to be played, exciting themselves with pieces of truculent violence and vulgar sex found here and there. The media attack from all sides, breaking barriers that parents presume to fit in place.

The child survives but becomes ironic. The child knows that what he or she gets from the media is transitory, fleeting, ephemeral, and often false. All of television is just for the moment, chewing gum for the eyes, and children grasp this, realize that nothing is serious, all is show.

In a country where the media establish many of our values, fear of appearing ridiculous can easily intimidate parents from establishing good standards for their children. Almost everything that children hear from their friends and the media is transformed into “culture,” and serious learning becomes boring, nerdy, or a joke. For adolescents, knowing something—apart from computers and popular music—is not “cool,” is rarely valued. At school, an adolescent must hide his or her intellectual curiosity (if he/she has any) if that individual does not want to be the target of the laughter of classmates.

Software that is supposedly educational usually is not prepared by educators. One learning theorist, Roger Schank (1995), says that “most educational software has been written by computer scientists who know little about education and prepare programs like shoot the verb when it crosses the screen!”

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**Teachers and Computers**

The use of computers in education sometimes seems to represent a desire to reduce learning to what is
material, mechanical, and measurable. While we are stuffing schools with computers and Internet connections, it is important to understand what the computer does to one when it begins to participate in learning in order to decide what teachers should take to the computer party. Since the computer distances us from reality and distorts us from trying to achieve higher-level goals in education, teachers become even more important, because they can help us to keep in mind these higher goals. Teachers should compensate for the mechanical tendencies of the computer and ensure that the medium does not distort educational ends, and that all of the potentialities of the person are involved in the process of learning. This is a task which can only be brought about by a careful, reflexive human, dedicated to improving the internal lives of students.

Using computer technology correctly in human learning is especially difficult in terms of helping students to achieve their true human capabilities (including emotional intelligence). Given the complicated task of integrating the computer with more traditional oral and print modes, now is not the time to suggest that the teacher “stand to the side” of the machine, as some fanatics suggest. Teachers have the responsibility for identifying what is valuable in tradition and ensuring that it is not lost in the middle of the information revolution.

What we need is a decent synthesis of what can and cannot be done with computers, what they are good for, and where they are possibly dangerous. Using computers in education goes far beyond plugging them in and looking for software. It definitely is not a technical activity. Giving each student a console and a Web connection does not mean educating the student. We are supposed to be trying to help each child achieve full development. The goal is real growth, not apparent progress. Teachers should protect their students from the commercial-technological alliance that seems to see the schools as another market. This does not mean to resist change in a Luddite fashion. Rather, it is to insist that the basic purposes of education are always the centerpiece of any media-oriented incursion. Let us worry about the children’s needs, not those of the salespeople. Changes should include the participation and, if possible, leadership of teachers focussed on the learning process and their students’ needs.

Conclusions

In a certain sense, it does not matter what we think of them: computers have arrived and seem to be taking a part in education. The big question concerns whether or not we know how to use them correctly. Will they be part of mechanical classrooms focused on accumulating information? Will they be sources of rich and textured images which can lead to profound comprehension, thereby helping our thinking and reflecting lives? Can we integrate the machines into a wider environment, or will we end up sacrificing ourselves and students to a more restricted idea of education?

We hear a lot of talk about integrated systems of learning by computers, but I am not convinced. I have not seen that integration. I have seen a few promising experiences, but bad integrations are more frequent. The question is not how broadly we should integrate computers into education; rather, it concerns when should we use computers for which goals and objectives. For example, it may be as important to keep children in first to fourth grades away from the computers, while they are still developing their relation with the physical world, as it is to achieve a good and healthy integration for older students. A childhood enriched with many physical experiences might help to inoculate the student from the dehumanizing and mechanical aspects of a high-technology society.

The successful integration of computers in education requires two things that are seriously lacking: (a) more careful and profound research about the true nature of this thing called a computer, and (b) more active participation of psychologists, educators, and classroom teachers.

So far, almost all educational programs have been developed by technicians, programmers, engineers, or specialists in media, all of whom master their areas but seem to have rather poor ideas about what is education. They think that any answer or activity done by the student can be called “interaction.” They do not realize that basic, linear communications models (maybe important in the world of communication) are not appropriate for education, where the message is not just words but the active participation and personal and social construction that are seen as key elements in learning (the same situation, the application of narrow communications models, caused the failure of educational television). We need more research about how to achieve true and effective interactivity, which will break the student’s tendency to process superficially. We also need research which will show us how to reduce the tendency toward external attribution of control when interacting with television and the computer.

It is urgent that teachers and educators take roles of critical and concerned leadership, if there is to be any possibility of achieving integration and synthesis. With our students’ well-being in play, it is not acceptable to simply presume that the domination of the computer is inevitable. If we do not get involved, we will end up like the technicians, transforming education into mere instruction. If we truly wish to enrich our students’ lives, we must direct the computer toward its true role,
achieving goals and objectives of the highest level for human beings.

References


What Is Educational Technology?

As covered in Educational Technology, The Magazine for Managers of Change in Education, the term Educational Technology refers to the application of science-based knowledge to educational and instructional planning and to the solution of basic teaching-learning problems. Technology in this sense is applied science. It is concerned with education processes as well as hardware and software systems.

Thus, hardware configurations, which often are used to implement technology, are only the “tip of the iceberg.” While some authors continue to look only at this one element of technology, Educational Technology probes deeply beneath the surface to offer our readers insight into today’s most significant educational thought and practice.

When educational technology is covered in a sufficiently broad context, previously “impossible” educational problems become amenable to rational solution. Branches of science which previously had nothing to say to educators and trainers now are able to offer their ideas to us. A whole new order of educational practice becomes possible.

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The magazine has been published since 1961, long before the debut of other periodicals now dealing with the field of technology in education and training. The same foresight that led its Editors to initiate publication in those early days of the ed tech movement is available today. The magazine continues to lead all others in its insights into the future.

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