# Taking Control of Educational Technology: How to Use Computers Productively and Progressively

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> There is no such thing as a *neutral* educational process. Education either functions as an instrument which is used to facilitate the integration of the younger generation into the logic of the present system and bring about conformity to it, or it becomes "the practice of freedom," the means by which men and women deal critically and creatively with reality and discover how to participate in the transformation of their world. --Richard Shaull (1)

One of the central debates in education is how to prepare students to meet the needs of a technologically oriented society. A companion question concerns the ways technology should be used in teaching traditional subjects. These issues are usually discussed in terms of efficiency of one teaching method versus another or in terms of how the limited time within the curriculum should be allocated. But prior to addressing those questions, we need to consider a more basic question about the role of computers in education: Are computers going to make education more of an instrument for bringing about conformity or can they assist "the practice of freedom"?

This article takes a practical approach to addressing the latter question. It considers what computers are and how they might be used most productively in education. The examples show, among other things, that the distinction between learning about computers and learning other subjects through the use of computers is not that useful. More importantly, they are intended to suggest some ways to think about both progressive uses of computers in education and the creation of social and political environments in which such uses are more easily realized.

## What Role Should Computers Play in Education?

Many people see computers as ideal for the present educational system. In fact, computers are seen as useful in that they smooth the rough edges: they protect against "cheating;" they ensure that children don't read materials they are not ready for; they monitor student progress along pre-defined lines; they limit the impact of the "teacher variable" (i.e, the power and importance of the individual teacher); and, perhaps most importantly, they reduce costs (assuming teachers can be replaced by machines).

The alliance of these considerations with the profit motive has resulted in a tremendous push for computers in schools. Last year, for example, major computer manufacturers, led by Apple, sought substantial tax breaks in return for massive installation of computers in schools. Large school districts are now purchasing computers en masse. Boston, for instance, recently reached an agreement with IBM to purchase 800

computers for its schools (2). Much of this movement goes on with little understanding of the eventual uses and consequences of computers in schools.

The legitimate concern of parents about jobs for their children has also fueled the current computer mania. Many parents believe that if their children learn how to program they will automatically become eligible for high-paid, high tech jobs, not realizing that most of the employment in the high tech field is low-paid, non-union factory work.

In contrast, others, such as the Crabapple group, have taken decidedly negative positions with regard to the current push for computers in schools. They argue that there are far more pressing societal needs than turning every classroom into a high tech center. Moreover, they see the emphasis on computer programming as a misleading, promise about jobs that will not be there [Department of Labor statistics]. They also see computers emphasizing piecemeal learning, rather than supporting more holistic, critical or creative education.

Finally, some feel that the use of new technologies in schools needs to be encouraged precisely because it fosters progressive education. For example, the International Council for Computers in Education, (ICCE), a group based in Oregon that publishes *The Computing Teacher*, promotes the use of computers in education. While critical articles are published (the April 1984 issue focuses on equity) the general thrust is not to question, but rather to encourage greater use of computers in schools. At various conferences on computers in education, many speakers go far beyond the ICCE in insisting on the value, even the need, for computers in schools. They lament the "resistance" that others in education still profess.

The problem with all of these views is that they tend to locate the source of the computer's power to affect education in the computer itself. Thus we hear that "Computers will teach children to read", or "Computers will turn schools into assembly lines". In fact, computers per se do nothing; they are simply tools which can amplify the power people have. In that sense, either the positive or the negative aspects of computers could in principle be realized, since any force for change in education can make use of computers to accomplish its ends.

## *What Kind of Tool is a Computer?*

Although we often associate computers with numbers and the repetitive calculations needed by banks, insurance companies, manufacturers, and so on, the essence of the digital computer lies not in adding columns of numbers but in its function as a tool for creating, manipulating and communicating symbols, in short, as a tool for language and thinking. Many teachers have begun to see this and to use the computer as a tool for expanding children's opportunities to solve problems (using programming languages such as Logo), to develop ideas (using "microworld" simulation programs), to gain access to information (using computer networks and public databases), to explore scientific questions (using statistics programs and computers connected to measuring devices, such as thermometers), to write and to share their writing (using text editors, publishing programs, and networks). The symbol tool view emphasizes function-- creating contexts in which meaningful activities are encouraged and supported. Specific skills are then learned first in the contexts in which they are most appropriate.

The prevalent view of computers for the classroom, however, still seems to be one in which the computer "teaches" by controlling information and managing student efforts. Such uses of the computer curiously negate it principal value; worse, they limit rather than expand children's possibilities for learning. Within the restricted view, computers are seen as useful solely for teaching specific concepts or skills: punctuation, spelling, simple arithmetic calculations, state capitals, subject-verb agreement, etc., or for managing the process of instruction. If we are to go beyond this view we need to rethink some assumptions about how to use computers in the classroom.

One study (3) found that teachers who had a chance to study computer software for use in the classroom argued for software that allowed the student to use the computer as a tool for learning rather than for software that put the computer in the dominant role, with the student pressing buttons on cue. The "teachers saw the enormous pedagogical differences between apparent user control and real user control, between answering questions and formulating them, between recognizing someone else's ideas and creating your own."

Why then do so many classrooms use the computer as a manager or a drill master? One reason, of course, is that much of the pressure to install computers in schools comes from a desire to automate the classroom, to make it more "efficient." This means, in the view of its proponents, that the teacher's role must be diminished and circumscribed; new management controls need to be introduced. Thus, the computer becomes a device to channel student efforts, to measure and control what students do in school. A corollary of this is that teachers are kept out of the decision making that directly affects them and the students in their classrooms.

## *Some Ideas for Putting the Computer in its Place*

The attempt to make computers into the shop foremen of the classroom has not been universally successful. But there is little support from the educational system or the available software, books, and articles for using computers in creative, more open-ended ways. By using the computer in the most restricted way we let the computer become the center of attention rather than the student. Below are some observations about how computers relate to education that might help teachers, parents, or learners redress this imbalance and put the computer in its place. (One consequence of these observations is that choosing among specific software products is far less important than understanding categories of programs and their contexts of use. As a result, I've avoided endorsing any programs here and named only a few where necessary).

**The computer's effect on learning:**

We often discuss computers in terms of their technological aspects--speed, memory size, functions, etc. and neglect to consider how they fit into a social context. Yet the biggest impact of computers in classrooms may be in terms of the ways they contribute to the social organization of a classroom rather than on how they "teach" specific concepts.

For example, it is often asserted that the use of word processors by children will help them become better writers. The argument is that since good writing depends on developing revision skills, a tool which makes revision easier will encourage children to

practice revision more. This may well be true, but careful observations of classrooms where word processors are in use (4) have revealed that other factors are also at work.

In a classroom in Hartford, Connecticut, a great amount of revising did occur. But the reasons were not purely technological. Because the computer was a limited resource, students tended to "mill around" the computer waiting for their turn to use it. During that waiting period they would read what others had written and decide to modify their own early drafts. Also they tended to value highly what was written on the computer and felt it was worth the effort to revise. Both of these factors--the opportunity to read others' writing and the value placed on computer writing--contributed to an increased amount of revision, which may, in the end, have helped the children become better writers. Understanding the process that was occurring in that classroom a teacher might conclude that overall the computer had a positive impact on learning. But it would be important to remember that it was not the computer alone which brought about the changes, but rather the way the teacher and the students organized themselves for learning.

The major prerequisites for successful use of the computer are not characteristics of the software or hardware, per se, but of the classroom, the teacher, the principal, and the curriculum. Teachers who have a clear idea of what they want to have happen in the classroom can find software that facilitates it, but choosing software without thinking of educational goals and particular classroom needs first is likely to be ineffective at best.

**Expert advice:**

The software evaluations published by various organizations, such as the Educational Products Information Exchange, (EPIE), and the reviews in magazines such as *Classroom Computer Learning* and *Electronic Learning* provide useful information but should never be taken as the sole guide for selecting software. The problem is not just that the expert may have a different educational philosophy and sensibility about computers. Nor is it just that every expert has a limited sample of the thousands of programs currently available. The core problem is that evaluations of software cannot take into account all the ways that software might be used. The recommendations of experts can be useful for assessing a program's potential as well as its limitations, but the real worth of a program is determined by how it is used in a particular classroom.

**The floppy disk cover:**

Programs are not always successful at teaching what the disk cover claims, and some of those that are focus on rapid performance of skills out of context without helping children in any significant way to become better problem solvers or users of language. A basic problem is that most software is produced to meet profit goals first, and educational goals second, if at all. Most software designers are not educators and may have poor intuitions about how children learn. Educators who design software may likewise do a poor job if they are not familiar with what a computer can do. Thus, what appears from the cover to be a useful program for teaching may be of no use at all.

On the other hand, some programs not presented as "educational" may be ideal for teaching. For example, general communications tools, (often catalogued as "administrative aids"), such as data base programs, text editors, and electronic mail can

give students the chance to use language in expanded ways for real communication. Programs that plot data or help in constructing tables may be useful in learning scientific methods even though they are not strictly defined as educational. And, general purpose programming languages can be used for other purposes than developing "computer literacy." For example, a language such as Logo (5) can be used to study language structures or mathematical relationships (as well as to draw pictures, its major claim to fame).

Finally, a program that appears to be useful for one educational task may have unsuspected uses. There is a text editor now being marketed which comes with a speech synthesizer that can say each letter or word as it is typed (6). The justification for the program is that it helps young children learn to read and write. But a teacher of older students might find that such a program would be useful in teaching the concept of symbol-to-sound rules. This could be valuable in learning a foreign language or might be a useful adjunct to teaching general linguistics.

**Recommended uses:**

Experiences with Quill (7), a program for teaching composition, reveal in a direct way to me how decisions about the use of computers in schools must be informed by the needs of students and teachers. For example, we (a group led by Andee Rubin and me) designed a part of Quill to help with the planning aspects of writing. We saw it as a tool to help in organizing a first draft of writing piece. Although it has been successfully used in that way, we've found that some teachers have used the same program more productively in ways we only dimly anticipated.

One teacher had students use it as a tool to create interview forms. The students used these forms in doing community studies--interviews with elderly residents about food, clothing and housing needs. (They could use the computer to revise the forms easily as needed.) Another teacher used the program to create a tool for doing science lab reports. Students then used the computer to record data (from a table-top greenhouse project) using diagrams in their science textbooks to help in analyzing what was happening. The computer became a tool for facilitating the connection between their real world observations of plant growth and the abstractions of their books. These uses of the computer were successful because they grew out of real classroom needs and were not restricted to the suggestions for use given in the teacher's guide. If we had assumed that our vision alone was sufficient, we might have stifled creative, classroom appropriate uses of the computer.

**Creating computer learning activities:**

Teachers who are not programmers can nevertheless create their own computer learning activities in a variety of ways. They may as suggested above, find new ways to use existing software, especially the more open-ended variety.

Alternatively, teachers can use general purpose software, such as word processing programs, to mimic many of the packaged programs being marketed. For example, one new program is a game in which one student inserts a sentence into a pre-existing text and a second student tries to guess the added or "suspect" sentence. This game helps students become more sensitive to such things as textual coherence and authors' style.

A teacher, or better yet, students could devise a procedure for using a text editor which retains the significant aspects of this language game. (It is relatively easy with most text editors to insert a sentence and reformat the paragraph so that it is not obvious that a sentence has been added.) Having the students select texts to use and devise scoring procedures could be as educationally beneficial as playing the game itself.

Students can also use programming languages to create their own learning activities-- science simulations, bulletin boards, Adventure games (8), and so on. This last approach has the added value of narrowing the artificial gap now established between learning about computers and learning other subjects through the use of computers.

## *Conclusion*

The computer is a powerful tool that can be used in truly contradictory ways. On the one hand, it can be used to limit children's access to information, to control the way they read and write, and to restrict their modes of learning. Alternatively, it can allow children to communicate easily with others and to access information in a way that greatly expands their world. If computers are to be worthwhile tools, we must never let computer needs or faulty educational ideas embodied in computer programs come before the needs of children.

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