Buying Into the Future


I enjoy reading newspaper ads for computers. Perhaps you have seen the type of ad I am talking about.

No down payment! MS-DOS compatible, 16-megahertz, 386 machine with 2 megabytes of memory, 80-megabyte hard drive, and 14" VGA color monitor. Only $-

The price may be under $1,000. The ad may be from a furniture store, a department store, or a computer store. For a somewhat higher price the same store may be selling a "486" machine running at 25 megahertz.

What's so interesting about such ads? First, these ads are in newspapers because there are literally millions of potential customers—and many are people who might buy a computer for home use. In the past year in the U.S., there were probably more than twice as many computers sold for home use as the total number of computers that are currently installed in all K-12 schools. The total sales of computers in the U.S. now exceeds 20 million per year and seems likely to reach 30 million per year within five years.

It seems clear that people who have money and a need for computers are quite willing to buy them. Of course, K-12 students and their teachers have the need, but they don't have the money!

Perhaps more interesting, however, is what current computer sales portend for the future. Intel is the company that developed the original 286, 386, and 486 CPU chips. These chips came into mass production in 1983, 1986, and 1990 respectively. Nowadays, it does not take very long from the time a CPU chip enters mass production until the time that "popularly priced" computers using this chip are being widely sold across the country.

At the current time, the Intel 586 chip is nearing mass production, the 686 chip should enter mass production in 1994, the 786 chip in 1996, and the year 2000 may see the 868 chip in mass production. The Intel 786 chip will contain about 20 million transistors and will be rated at 250 millions of instructions per second (MIPS). This may be contrasted with the 130 thousand-transistor Intel 286 chip that was rated at 1 -MIP, or the 500 thousand-transistor 386 chip that is rated at about 5 MIPS.

In the past, predictions five years into the future have proven quite accurate on chip technology. Based on current forecasts, it seems quite likely that a 32-megabyte memory chip will be in mass production by 1997. Thus, a few years later (say in the year 2000) we can expect that annual sales of 32 or 64 megabyte machines based on the 1996-97 technology will exceed 30 million in the US.

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The trend of rapidly increasing computer power is apt to continue well into the 21st century. Right now Intel has some expectation that in the year 2000 a 100 million transistor, 2 billion MIPS chip will enter mass production! It may contain four CPUs and a considerable level of fault tolerance (ability to continue to function when some components fail).

How do these computer capabilities compare with the computers that your students are currently using in your school? More importantly, are you preparing your students to conceptualize and solve problems, to be a productive adult citizen, and to readily adjust to such continuing changes in the high-tech world of tomorrow?

Many people have observed that computers haven't made a great deal of difference in our schools so far. What they tend to mean is that learning of "traditional" materials, as demonstrated by traditional tests, has not been significantly affected.

I feel that this completely misses the main point of computers in schools. Increasingly, the traditional materials and traditional tests are irrelevant. The knowledge and skills needed to pose and solve problems in a high-tech environment are substantially different from those needed in a paper and pencil environment.

The implications seem clear to me. A few components of our school curriculum have been substantially changed because of computer technology. However, the majority of the curriculum content remains virtually unchanged. As long as this situation continues, the impact of computers on schools will be, at best, only moderate.

Think about the alternatives. Pick a discipline, such as math or writing (in a hypermedia, desktop publishing environment) and consider how computer-related technology has changed how practitioners function in that discipline area. What would it be like for a student to grow up in a math or a writing environment in which a powerful computer was always available, the teacher and curriculum materials were geared to availability of such facilities, and all assessment took into consideration such facilities?

Of course, the answer is that we don't know. The necessary research has not been done. The same could be said about schooling at the time reading and writing were being introduced, or at the time that universal literacy was deemed desirable. We should not be deterred by such a lack of research.

The world outside of education is changing far faster than the world of education. A large part of our curriculum is archaic. It even seems to me that the gap between our school curriculum and the world outside of school is widening! We cannot solve this problem by "tweaking" the curriculum-by making minor changes. We need massive restructuring of the curriculum content, pedagogy, and methods of assessment. This should be based on the assumption that our forecasts of continuing improvements in computer related technology are correct. We should be taking immediate action.