Computers Mediate Knowledge, Computers Win

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Educators could leave Larry Cuban's respect for institutional inertia to stand or to fail the test of time. But he salts his text with suggestions to policy makers that they should go slow in trying to use information technologies as a wedge opening schools to reform and change. That's wrongheaded. Here's a counter argument.

Do not grant too lightly that schools are singularly resistant to technologically driven change. Cuban opens with telling statistics -- "the 80,000-plus public schools across the nation, where over two million teachers teach over 40 million students." Now a little grubbing in the *Digest of Educational Statistics* will take us back some sixty years and the sentence would read "the 270,000-plus public schools across the nation, where over 800,000 teachers teach over 25 million students." Factor out the 150,000 schools with one teacher: clearly there were fewer teachers, fewer students, but many more schools. Classroom met school bus, school bus won.[1]

Schools respond to technological change when the technological change is educationally significant. The school bus was educationally significant, allowing for curricular enrichment combined with cost economies. In his prognoses for the interaction of computers and classrooms, Cuban ignores the school bus and concentrates on more explicit harbingers of the digital transformation. He observes that telephones, movies, radio, and television had little direct effect on the work of the classroom and extrapolates that the effects of computers are likely to be the same, with a minor hedge. The hedge lies in the fact that proponents of computer-based innovation, unlike those who ballyhooed film and TV, have allied with educational reform movements. This changes the equation somewhat, making it possible, over time, for significant effects to emerge in elementary schools, where established classroom routines are more malleable. In high schools, where routines are imperious and well-reinforced by deep public expectations about what teaching and learning consist in, computers are destined to be handmaidens to the *status quo ante*.

Schools have much inertia, but they also have a *raison d'être*, which is complicated. It turns, nevertheless, on the need for culture and knowledge that besets both persons and polities. Telephones, movies, radio, and television were wondrous communications innovations, but they had little effect on the way the knowledge important in twentieth-century life has been created, stored, or transmitted. They are incidental to mathematics, history, economics, biology, physics, metallurgy, medicine, law, accounting, and on through the ever spreading panoply of significant specialties. Telephones, movies, radio, and television deeply affect practice in many walks of life, but the knowledge deployed in that practice has remained largely book-knowledge and the work

[1] The percent of students transported at public expense rose from 7.4% in 1929-30 to 60.7% in 1989-90. One-teacher elementary schools dropped from just under 150,000 to 630.

and life of schools has therefore largely remained untouched.

Are computers different? Cuban suggests that they are not. He makes this suggestion seem plausible by insinuating two points -- the adoption of computers in schools has been very slow and the process is a bounded process taking place in K-12 public education. Both these points embody serious errors of perspective. Let's contemplate the question of pace first.

Speed is relative. The public rarely stays the course with educational reform because it insists on absurdly short-term measures in testing the speed of educational change. The emergence of digital technologies has been remarkable, not for its speed, but for the duration -- fifty years and much still to count -- of intense innovation in the field. That innovation -- on the levels of hardware, of software, and of whole systems -- has not begun to abate. A hardware cycle takes five years or so to mature; a software cycle a decade; a systems cycle a quarter century, plus or minus. In each there are many cycles of innovation still to come. And increasingly, digital information technologies are deeply transforming the production and transmission of knowledge, and the transformations in knowledge have only begun to play out their potentialities.

What is slow and what is fast? The full cycle of education, taken from the beginning and carried by an individual to its full completion, lasts over twenty years, with the expectation that there will be periods, short and long, of recurrence through the lifetime. Historically significant transformations of educational institutions should be expected to play out over two or more of those cycles -- fifty years or more. As a fundamental technology, digital information technology will have a period of sustained, introductory innovation lasting on the order of a century, from 1940 to 2040, plus or minus. These technologies mediate more and more branches of knowledge, in both their daily practice and in their most advanced reaches of creative practice. Computers now increasingly pervade the practice of law, of medicine, of architecture, of engineering, of astronomy, of chemistry, of physics, of economics, of environmental studies, of climatology and weather forecasting, of government, of.... And much is yet to come.

In all these fields and endless others, they affect not only ordinary practice in the manner of the telephone, but more significantly, they increasingly mediate what can and cannot be known in each field. Here is where Cuban's second point about the process of introducing computers in education goes awry: the discussion cannot be confined to K-12 public education. Cuban argues that the public understanding of what teaching and learning involves in high schools is deeply rooted and a powerful buttress to existing arrangements. These expectations seem solid only if bracketed from other domains of the educational system. By bracketing the high school, Cuban comes up with precisely the wrong prognostication -- that computers will primarily affect elementary schools while being largely tangential in high schools.

Computers are now affecting higher education with an accelerating pervasiveness and they will soon start hitting the high school with a transformative force that will startle those who exaggerate the inertia of the system. The fulcrum for these effects will be the college entrance process.

When the undergraduate intellectual experience becomes unmistakably one of learning to participate in a computer-mediated structure of knowledge, the degree to which digital technologies have pervaded the college preparatory process will become a significant criterion of selection for college entrance. At that point, and it is not far distant in time, public expectations about what students should learn and how it should be taught will change rapidly and thoroughly. Such is the rationale of expectations directly counter to Cuban's.

Will computers so mediate knowledge? Certainly if we simply look at current rates of usage in the production and transmission of knowledge in various fields, the traditional means of print still predominate. To understand the potential for change, however, we need to look not simply at the rates of usage, but at rates of acceleration or deceleration in the rates of usage. A technological impetus has been accelerating the rate at which diverse persons working in diverse fields choose to conduct their intellectual work with the aid of digital information processing tools. There is no reason to expect the technological impetus to this change to abate in the near future. How far will it carry? How fast will it work? Children entering first grade this September will be entering college in 2005. By that time, the use of digital technologies throughout the higher learning will be far more pervasive than now. Will it then be irrelevant to the college entrance process? To expect high schools to then be complacently recapitulating their past seems a poor bet to me.

Why do all these prognostications matter? Policy makers in education have far too few agencies of effective action. The educational research establishment is a veritable babel. Educational authorities -- local, state, and federal -- are a paralysis of countervailing power. Publishers package school curricula to maximize, not cultural achievement, but the rate of return on capital. Schools of education work with a glacial cycle of restaffing of the teaching corps. Given the possibility of significant interventions for the betterment of education, there are very few means for causing their adoption throughout the system, except for those temporary means that emerge in the exceptional historic junctures in which educationally significant technological innovations spread through human culture. Rarely do educators command any social, historical power. Quite possibly in the emerging digital information technologies, an historical agency of sufficient power to effect substantial educational change is within our grasp. It would be a tragedy to persuade ourselves of its insignificance at the very moment when we might seize and use it for the good.

Critics of educational technology like to remind us that all technologies have a politics implicit in them and that no technology is blandly neutral. How true! A politics is an agency for selecting and implementing public purposes. Let us make sure that the politics of information technologies in education are powerful, as powerful as we can make them, and that we do our best to use them to effect a humane and democratic culture.