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Getting Real About 21st Century Education **Marlene Scardamalia**

A popular online newsletter titled “The Rapidly Changing Face of Computing” (<http://www.compaq.com/rcfoc>) reports on a weekly basis the most amazing advances in information technology, from the latest in wearable computers to stereolithography (turning 3D computer models into real physical models). Whenever the author, Jeffrey R. Harrow, speculates on a technological advance that is in the offing, somebody writes to inform him that it has already happened. Compared to the rapidly changing face of information technology, the rate of change in schools appears several orders of magnitude slower than snail-paced. This evident gap has caused anxiety among school people and impatience in the surrounding society. The result has been great pressure to wire the schools, train the teachers, and even, according to a report in the *Globe and Mail* (January 24, 2000), to “improve Internet literacy by requiring school children... to pass an internationally recognized Internet test to ensure they know how to drive on the information highway.”

There is more than one rate of change, however, and comparing what is going on in schools to what is coming out of the IT industries is to compare the wrong rates. Four different rates can be recognized:

1. The rate of technological innovation: Very fast.
2. The rate of adoption of technological innovations: Slower, but highly variable. Fast for some consumer products, such as portable CD players, much slower for innovations that require institutional adoption, such as teleconferencing. Most of the modernization effort in education is focused on speeding up the rate of adoption.
3. The rate at which practices change as a result of new technologies. Much slower. Change in practice has been slow in education—new technology has been mostly used to enliven traditional drill and practice and to put multimedia gloss on to the traditional “project”—but it is not certain that change in practice is slower in education than it has been in other fields (once allowance is made for getting a late start).
4. The rate at which results improve as a result of using new technologies. Very, very slow. For instance, in manufacturing industries in the U.S., computer-using industries showed lower productivity than non-computer-using industries from 1958 through 1979; then productivity soared until, for the period 1990-1996, productivity in the computer-using sectors was more than double that in the non-computer-using sectors (Siegel, 1998). But that’s after 20 years of negative results! By that standard, we should not complain that education is advancing too slowly.

It is, however, the rate of improvement in results that counts in education. The question, “Will educational institutions, within their present structures, be able to adapt sufficiently to meet the needs of the information age?” only makes sense as a question about the ability to achieve changes in educational outcomes.

Yet despite all the talk about the need to gear up education to meet 21st century needs, efforts to improve educational outcomes are in disarray. Two naive beliefs have pushed thoughtful educational planning to the sidelines. One naive belief is that getting computers and the Internet into schools and training teachers in appropriate use of them *is* gearing education up to meet 21st century needs. The other naive belief is that high-stakes testing and standards based on what is testable will drive up knowledge and skills to the level required in a knowledge-based economy. Most school systems are trying to implement both naive ideas simultaneously, and together they are using up all the resources that ought rightly to be going into pursuing a new order of educational achievement.

Because we appear to be entering into a period of radical change, the question of how best to prepare for it ought to be receiving the most serious kind of educational thought. What is wrong with the “get wired” and the “raise test scores” solutions is not that they are categorically bad but that they tend to short-circuit thought. They become objects of debate, while deeper questions suffer neglect. Three educational goals that tend to be either glossed over or ignored in a discourse dominated by technology and assessment issues are

1. *Depth of understanding*. This is what assessments of student knowledge and beliefs in mathematics and science reveal to be most seriously lacking. Deep understanding is one of the hallmarks of expertise (Bereiter & Scardamalia, 1993; Feltovich, Ford, & Hoffman, 1997), and it is regarded by most serious educational thinkers as what ought to be the core of schooling (Egan, 1997; Gardner, 1991, 1999). Although curriculum standards give a nod to it, when it comes to specifying in detail what is to be taught and tested, understanding is typically replaced by factual knowledge. Internet-based projects gravitate toward superficial fact-gathering as well, because that is what Web searches most readily support (Moss, 2000).

2. *Knowledge creation and knowledge stewardship*. In the business literature, these are coming to be seen as the basis for sustained innovation. These could be the centre of the school world as well, but they have essentially no presence there. What takes their place is a collection of activities vaguely referenced as “constructivist.” “Constructivism” itself then becomes an object of heated controversy.

3. *Lifelong learning*. This has become a mantra. Its importance in a rapidly changing world is undeniable; but there is hardly any serious analysis of what, if anything, schools could do to promote it, other than equipping students with basic academic skills. The most obvious requirement for lifelong learning is outgrowing the need for a teacher, yet the transfer of epistemic agency from teachers to students does not figure in curriculum planning.

These three goals ought to be at the center of educational planning for the 21st century. Of course, students also need to acquire computer, Internet, and media skills, but these can be acquired incidentally in the course of work devoted to the three central goals (Scardamalia, Bereiter, & Lamon, 1994). Students need to learn cooperation, but this is not an abstract virtue. It needs to be learned in relevant contexts, and the most relevant contexts would be the pursuit of understanding, knowledge creation, and epistemic agency. There is a place for direct instruction in the development of basic academic skills, but the practice

that develops these skills to functional levels could, again, best be carried out in the context of pursuing knowledge building goals.

Real 21st Century Education

What is taking shape today as a result of the “get wired” and the “raise test scores” movements, is not education addressing the needs of the 21st century. It is 20th century, industrial age education supercharged by high-stakes testing and high-tech tools for doing 1920’s types of child-centered education.

The target of true 21st century education should be the advanced knowledge processes that scientists, scholars, and employees of highly innovative companies engage in daily. These processes must be built into the social fabric of communities, and into the technologies that support their work, so that creative knowledge work is as integral to schooling as it is to our most high-powered knowledge-creating organizations.

Students should not have to wait until graduate school to encounter the expectation that they be *contributors* to the creation of knowledge and not just learners. They can start in grade 1. There have been striking demonstrations that children that young can carry out serious, collaborative knowledge production that has most of the attributes of the mature process (Cobb, Gravmeijer, Yackel, McClain, & Whitenack, 1997; McDonald, Reeve, & Scardamalia, 2000). This means going way beyond collecting autumn leaves and making a bulletin board display. It means developing theories to explain the autumn changes, comparing and testing those theories, and *improving* them in the light of new findings. By grade 6, children educated in such an environment are more sophisticated in their approach to knowledge problems than the typical university undergraduate, have greater depth of understanding in the areas they have studied, and show much higher levels of epistemic agency and knowledge stewardship (Scardamalia, in press).

What can schools do to become part of the 21st century? There is not space for detailed recommendations, but here are a few pointers in the intended direction:

1. Take seriously the literature on knowledge-creating organizations (e.g., Nonaka & Takeuchi, 1995; von Krogh, Ichijo, & Nonaka, 2000) and aim to develop the school into that kind of organization (cf. Scardamalia & Bereiter, 1999).

2. Address external pressure for continually rising test scores through deeper subject-matter understanding rather than through devoting time to specific preparation for tests. Restrict preparations to familiarization with test item types. Involve students in planning how to meet standards.

3. Let computer and media literacy follow naturally from engagement in knowledge creation, with new technologies integral to knowledge work rather than treated as separate subject matter.

4. Adopt knowledge-building technology. Avoid the cafeteria approach and look for technology that provides intelligent, research-based support for advanced knowledge processes (Scardamalia & Bereiter, 1999).

5. Ensure a way into authentic knowledge work for all students. Don’t relegate some students to an idea-free curriculum on grounds that they are too young or differently-abled or that they have a different kind of learning style. Instead, capitalize on diversity.

6. Involve the larger community as participants in knowledge building rather than as expert consultants or aides (Scardamalia & Bereiter, 1996; O'Neill & Scardamalia, 2000).

Real 21st century education can be not only more powerful than 20th century education, but also be more exciting, more deeply rewarding, and more socially cohesive. But bringing it about takes courage, a willingness to reject simple solutions, and really deep and innovative thinking. In short, if schools are to become knowledge-creating organizations, school systems will have to become knowledge-creating organizations as well.

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