

## A RESPONSE TO COMMENTARIES BY ALEXANDER, LAW, MIYAKE, AND YOUNG

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We want to thank the authors for responding to our paper and for apprising readers as to the effects of the new information technologies in Asian educational settings. We think Miyake has characterized our argument very accurately and succinctly. As she points out the equity issues we raise are exacerbated in Asia because the resources available through new technologies are mostly in English. But we would add that information technologies offer many opportunities for enhanced learning, as well as raising concerns about the possibility of greater inequities in education.

Because the respondents focus on the effect of information technologies on schools, we want to emphasize that we think there are several deep incompatibilities between school and the new technologies that are coming to dominate the information age:

***Uniform learning vs Customization.*** Deeply ingrained in the structure of schooling is a mass-production notion of uniform learning. This belief stipulates that everyone should learn the same things. Courses are structured so that everyone studies the same texts and has to pass the same examinations. But one of the great advantages that technology brings to education is customization. Computers can respond to the particular interests and difficulties that learners have. As computers spread throughout the society and the Web becomes richer and richer with tools and information, education will move beyond the lockstep of required courses and basic skills. But to do this it has to go outside of the school where uniform learning is woven into the very fabric of daily practice.

***Teacher as expert vs Diverse knowledge sources.*** Schooling is built on the notion that the teacher is an expert, whose job is to pass on their expertise to students. Teachers do not like to see their authority challenged by students who find contradictory information to what the teacher states or who ask questions that go beyond the teacher's expertise. Textbooks support teacher expertise, because teachers can safely assume that information not in the textbook is off limits. In contrast, video, computers, and networks provide many different sources of expertise. Video offers a variety of films and programs that present different worldviews. Computers and networks exacerbate the problem even more. Soon children will be able to download all the videos and written materials they want into their bedrooms. Adult authority can no longer derive from their greater expertise, since children have access to a wide variety of different sources. This undermines the very nature of school as we know it.

***Standardized assessment vs Specialization.*** The assessment technology that is employed in evaluating students uses multiple-choice and short answer items, in order to provide objective scoring. But this form of testing requires that every student learn the same thing. And so our assessment system is leading us away from any kind of specialization by students in their learning. The twin effects of customization and diverse knowledge sources, which technology fosters, is at the same time enabling people to go their separate ways in what they learn. To the degree technology encourages students to go off in their own direction, it is in direct conflict with the standardized assessments pervading schools. So it is in the interest of schools to strictly limit the use of computers and networks to those activities that support students doing well on standardized tests.

***Knowledge in the head vs Reliance on outside resources.*** There is a deep belief among teachers and parents that to truly learn something, it is critical to do it on your own without any reliance on outside resources. Therefore, when tests are given, students are usually not allowed to use books or calculators, much less computers or the Web. It is deeply embedded in school culture that using outside resources is cheating. The opposite is true of adult life, and technology supports people in their use of outside resources. Technology undermines the need to know things yourself, as long as you know how to find the information and help you want. Hence, technology and school culture are at odds as to what it means to know and do.

***Coverage vs The knowledge explosion.*** School pursues the goal of covering all the important knowledge people might need in the rest of their life. As knowledge has grown exponentially, textbooks have grown fatter and fatter. It has become more difficult to cover all the important material, and so curricula have become 'a mile wide and an inch deep.' School is fighting a losing battle with the knowledge explosion, but it is deeply ingrained in its culture. And so schooling is caught in a cycle of adding more and more required things to learn. Given the explosion of knowledge, people simply cannot learn in school all they will need to know in

later life. And so they need to learn how to learn and how to find the information and resources they need. This requires them to learn how to exploit the Web to find the information and tools to accomplish meaningful tasks. Not only do they need to be able to find information and tools, they need to know how to integrate information from different sources, to evaluate the reliability of those sources, and to use the powerful computational tools available to them to analyze the information and present it to others. But this is an agenda at odds with the school agenda of covering all the important material needed for later life.

*Learning by assimilation vs Learning by doing.* Deeply embedded in the culture of schooling is the notion that students should read, listen to, and absorb a large body of facts, concepts, procedures, theories, beliefs, and works of art and science that have accumulated over the centuries. An educated person is one who understands and appreciates these great intellectual products of human history. In contrast, the kind of education that technology fosters is a more hands-on, activity-based education. Computers are highly interactive and provide the learner a wide assortment of cognitive tools to accomplish meaningful tasks. Hence, they are much more aligned with the “learning by doing” view of education, than with the “assimilation of cultural knowledge” view of education that permeates schooling. So technology is likely to take education in a different direction, towards design and construction of artifacts and analysis of complex problems and situations. This is vastly different view of education than pervades the culture of schooling.

Because of these deep incompatibilities, it is not likely that the new technologies will penetrate the core of schooling anytime soon, even in places like Singapore and Hong Kong with their small, highly educated populations and high-level dedication to reforming education, and despite the efforts described by Nancy Law. But as technology-based education spreads to other venues, there will be pressure on schools to adopt those uses of new technology that are successful in other venues. Whether schools can resist those pressures is an open question, but we suspect that some schools will adopt a learning-center model in order to accommodate the new technologies in their midst.

We agree with Alexander that the critical issue is how the new technologies are used. Alexander claims that the new technologies “are equally suited to supporting transmission models of teaching, as they are to more innovative approaches.” Because of the flexibility of new technologies, it is certainly possible to use them in a transmission model of teaching. But we think the power of the new technologies is that they enable us to create new kinds of customized and highly interactive learning environments, where the learner is in control. Given the option, learners will prefer to learn in these kinds of environments. If education moves into new venues, as we argue in the paper it is clearly doing, then learners will have the option to choose the kinds of learning environments they prefer. This choice is what is driving the revolution in education, and the divorce of the traditional coupling of schooling and learning, that is currently underway.

We hope that schools will adapt to the changing environment, and that societies will address the issues of equity and citizenship that arise when people go out to purchase the education they prefer. Our paper and a forthcoming book (Collins & Halverson, in preparation) are meant to raise awareness of the problems societies face in this new circumstance. But recognizing the situation we face is only the first step in developing a wise educational policy.

## **Reference**

Collins, A, & Halverson, R. (in preparation). The second educational revolution: From apprenticeship to schooling to lifelong learning.