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Education Letter

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Integrating ICT in Teaching and Learning

INFORMATION AND COMMUNICATION TECHNOLOGY

Catching the Third ICT Wave

Information and communication technology (ICT) has not trickled gradually into the schools but has come in waves. The general character of these waves is obvious to most observers, but interpretations differ.

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The following is our interpretation:

Wave 1

Technology as an imperative. The reigning belief was that schools must become computerized and networked in order to prepare students for the Information Age (also in order to satisfy parental demands and to avoid seeming out-of-date). Governments drew up ambitious technology plans; vast sums were spent on hardware for the schools; ubiquitous training programs aimed to overcome teachers' anxieties and resistances. Larry Cuban's *Oversold and Underused* (2001) aptly described Wave 1 as it crested in the wealthy nations, while just starting to roll up the beaches in many poorer ones.

Wave 2

"It isn't the computers; it's how you use them." The imperative is not just to adopt ICT but to use it in educationally appropriate ways. The method of choice, promoted through books, workshops, and web sites, is "projects"—preferably, projects that make conspicuous use of multimedia and Worldwide Web resources. In Wave 2, the curriculum regains importance, but ICT is like the unexpected important guest at a dinner party, for whom a place must be found.

Wave 3

ICT as affordances. Educational ideas are primary; secondarily, various ICT affordances may serve in realizing a particular idea. We use the term "affordances" here in Norman's (1999) sense of *perceived action possibilities*. Experienced Wave 3 educators never ask, "How can I integrate ICT into this activity?" Instead, they think about how the cognitive and social dynamics of their classroom could be improved, how the class could evolve into a more successful knowledge building community. They are sufficiently aware of the affordances and limitations of the ICT at their disposal that it figures naturally into their planning and problem solving. They will be on the look-out for technology whose affordances are more closely aligned with their educational aspirations.

Wave 1 was almost entirely an initiative of bureaucrats, administrators, and vendors. Its effect at the classroom level was epitomized by the teacher who said she kept her computer running because it provided just the right

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"Wave 3, it would appear, has reached few classrooms beyond those actively involved with learning scientists. For latter-day practitioners of the "activity method" Wave 2 is the limit."

…continued from page 1 temperature for her pot of African violets. Wave 2, however, which is only beginning to abate, has been focused directly on classroom activity, and teachers have been under considerable pressure, both official and informal, to "integrate ICT into the curriculum." Where resources permit, computers have been moved from computer laboratories into the classrooms, thus making integration into the curriculum a more realistic possibility, while discouraging the sort of "computers for the sake of computers" activities designed for scheduled visits to a computer lab.

Wave 3, it would appear, has reached few classrooms beyond those actively involved with learning scientists. For latter-day practitioners of the "activity method" Wave 2 is the limit. For them a positive response to ICT consists of replacing some traditional learning activities with different ones or enriching traditional activities through the resources of ICT.

A common Wave 2 phenomenon is updating the traditional school "project" by incorporating ICT. Here we are not referring to "project-based science" (Marx, Blumenfeld, Krajcik, & Soloway, 1997), where there is serious, question-driven knowledge development. Rather, we refer to what has typically been treated as a language arts activity, in which students, working individually or in small groups, identify topics, gather relevant information, organize it, and present it – traditionally in the form of a hand-written report illustrated with magazine clippings. Updating the traditional project may include retrieving information from the Web or from reference sources available on CD ROM, downloading graphics from similar sources or incorporating digital photos, and composing the report using a word processor or presentation software (Moss, 2000).

As Bransford and Schwartz (1999) have suggested, the main value of school learning is the facilitation of further learning.

Instead of using ICT to produce objects for display of information, students in Wave 3 classrooms use ICT to create knowledge (Scardamalia & Bereiter, 2003). They produce theories, models, proofs, problem formulations, interpretations, histories, critiques, and the like. These function for them as conceptual tools that they use in making sense of the world. As Bransford and Schwartz (1999) have suggested, the main value of school learning is the facilitation of further learning. Wave 3, we believe, is about this dynamic. ICT is relevant because of the roles it can play in supporting a process of sustained knowledge advancement.

Most educators are philosophically favourable to Wave 3. It is associated with a number of generally "good words": inquiry, constructivism, collaboration, curiosity, higher-level thinking skills, and so on. Why, then, is it so slow in making its way into practice? In our experience, the three most commonly encountered barriers are these: first, the test-driven curriculum, which tends to drive all those "good words" to the sidelines; second, a tendency of adults to be so impressed with young people's ICT skills that they enshrine projects that enable students to show off those skills; third (and most deeply engrained) a lack of belief that children really can function as active members of a worldwide knowledge-creating culture. Proving that they can do so has been the major educational mission of our Institute for Knowledge Innovation and Technology (www.ikit.org).

Resources of Interest

Ben Schneiderman (2003) *Leonardo's Laptop: Human Needs and the New Computing Technologies.* MIT Press.

Queen's Faculty of Education IT and Teaching blog
http://itandteaching.org/index.html

John Olson, *Information technology in schools: Should the product be marked hazardous.* Volume 1, Issue 2, 2005. http://seminar.net

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