Feature

# Global Perspectives

## Innovative Technology Integration Practices from Around the World

*By Robert B. Kozma*

**Subject:** Integration strategies, international examples, research on technology integration

**Audience:** Teachers, technology coordinators, library media specialists, teacher educators

**Grade Level:** 5–12 (Ages 10–18)

**Technology:** All

**Standards:** *NETS•S* I–6; *NETS•T* I–IV (http://www.iste.org/standards)



What do classrooms look like when technology is integrated into the curriculum? What are teachers and students doing differently in classrooms where computers are used regularly? How is technology being used to support these changes? These are the questions that motivate my research.

I have other concerns as well. For example, I am concerned about the digital divide between countries that have easy access to a lot of sophisticated technology and those that have little. We are fortunate in this regard in the United States. Virtually all of our schools now have computers, in fact approximately one computer for every five students, according to the National Center for Educational Statistics. Furthermore, 98% of our schools and 77% of our instructional classrooms have access to the Internet. Increasingly this access is high bandwidth. This compares to Lithuania with 133 students per computer or Cyprus with 210 students per computer, according to Pelgrum and Anderson's 1999 report *ICT and the Emerging Paradigm for Life Long Learning.* In Cyprus, only 11% of schools have access to the Internet, and only 4% of the Russian lower secondary schools have access. In less developed countries, access is so low that systematic studies are not warranted.

The gap in access concerns me a lot. But of even greater concern to me is the gap between the promise that technology holds for changing education and the lack of change in many schools. And this divide does not follow along the world's rich-poor fault line. All of us have heard about technology-rich schools where computers sit unused or where students use powerful hardware to do rather mundane tasks. Yet when my colleagues and I evaluated the World Links for Development program for the World Bank, I saw how even modest computers and limited Internet access could be used to make impressive changes in teaching and learning in developing countries. (For more see *World Links for Development 1998–1999* and *1999–2000.* Find complete citations under Resources on pp. 53–54.)

My interest in understanding how even modest technological resources can support significant educational change is what motivated me to direct the Second Information Technology in Education Study: Module 2 (SITES M2). (***Editor's note:*** See Resources for this and other URLs as well as information about the report of this research—*Technology, Innovation, and Educational Change*—published by ISTE and the research results published in the *Journal of Research on Technology in Education*.) In this study, we examined how information and communication technology (ICT) was used to support innovative classroom practices in 28 countries. SITES M2 was a project of the International Association for the Evaluation of Educational Achievement (IEA) that involved research teams from countries in Europe, North America, Asia Pacific, Africa, and South America. An International Coordinating Committee (ICC) of six scientists from the United States, Canada, and The Netherlands coordinated the project, and the Center for Technology in Learning at SRI International in Menlo Park, California, directed the study.

We found a number of excellent examples of how teachers are integrating technology into their classes to affect educational change.

**Study Design**

The ICC worked with the national research coordinators (NRCs) from each of the 28 countries to design the study. We first addressed the definition of *innovative use of technology in the classroom.* This is a tricky task, because what may be innovative in one country may be old hat somewhere else, so we wanted some customization in the definition. But we also wanted some standardization so we could look across cases from different countries. Consequently, we decided that each country would select cases in which:

- significant changes in teaching, learning, *or* curricular practices occurred
- technology played a significant role in supporting these changes
- the changes resulted in positive outcomes for students and/or teachers
- the changes could be sustained and transferred

In addition, each country would give its own definition of what constituted "innovative" changes. To do this, the NRC in each country formed a national panel to define "innovative" and use the criteria to select practices to be included in the international study. The panels consisted of researchers, teachers, school administrators, and policy makers. More than 240 people altogether were involved in the process. The panels used these criteria to review more than 220 final nominations and select 174 cases for the international study.

It is important to keep in mind that these 174 cases are in no way representative or "typical" of what is happening in these countries. Rather, the cases can be viewed as representing what national panels saw as the best practices in their countries and as models for what other teachers could do.

Research teams in each country then collected information on each case from a variety of sources that included interviews of administrators, teachers, students, and parents; classroom observations; and analysis of documents, such as teacher lesson plans and samples of student work. The researchers then used a standard template to write up each case report. The ICC analyzed these cases and wrote a cross-case report. Though the final report also looked at curriculum, school context, and policies, in this brief article I want to focus on specific ways technology is integrated into classroom practice.

**General Trends in Classroom Practice**

A large majority of the cases reported that teachers were engaged in advising and guiding their students' work as part of the innovation. They created structure by organizing student activities and actively monitored or assessed performance while the students were engaged in the innovation. In more than half of the cases, teachers collaborated with other teachers as part of their innovation. But in only a few did teachers collaborate with people outside the class, such as scientists or business people. A large majority of the cases reported that students collaborated with each other, either in pairs or small groups, as part of the innovation. In many cases, students were actively engaged in a range of activities that included searching for information, publishing or presenting

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the results of their work, or designing or creating products. But as with teachers, only a minority of the cases reported that students collaborated with people outside the classroom.

A large majority of the innovations used productivity tools, Web resources, and e-mail. Many used multimedia software, some used Web design tools, and a few used tutorials. Very few used specialized educational software such as simulations and microcomputer-based laboratories. In other words, what made these cases innovative was not the use of high-end, innovative technology but that teachers and students did innovative things with pretty basic technology. In a majority of these innovative cases, students used multimedia software packages to create products or presentations, Web browsers or CD-ROMs to search for information, and e-mail to support communication.

We also looked at the outcomes of these innovations; however, we did not have the resources to measure them directly. We would have liked more detailed data on student learning than was available, but we did ask administrators, teachers, students, and parents what they thought was the impact of these innovations. Unsurprisingly, the largest number of cases claimed that students acquired ICT skills as a result of the innovation. A large majority of cases also claimed that students developed positive attitudes toward learning, acquired new subject matter knowledge, or acquired collaborative skills. But fewer than half of the cases reported that students acquired new skills for studying, communicating, handling information, or solving problems.

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**Special Patterns of Classroom Use**

Though the trends I have described so far look across the entire group of cases, we were also interested in how certain kinds of practices more often occurred together. We coded and analyzed teacher practices, student activities, and technology use to identify eight clusters. Raymond McGhee and I describe these clusters in great detail and give examples of each in the chapter we co-wrote on classroom practice for *Technology, Innovation, and Educational Change.* But here I want to focus on just two clusters: (1) the Student Collaborative Research Cluster and (2) the Information Management Cluster. Cases in these two clusters more than any other were likely to report that students acquired problem solving skills, collaboration skills, and—in the case of the Information Management Cluster—communication and information management skills. These are the kinds of skills included in the National Educational Technology Standards for Students and ones that teachers often try to teach with technology. So I thought I would describe these two clusters in some detail and give you a few examples of what these cases look like in the classroom.

As the name implies, all cases in the Student Collaborative Research Cluster involved students working together in pairs or small groups. Students typically collaborated on research projects often collecting and analyzing data, more so than all other clusters. In all cases, teachers supported their students by giving advice, structuring their activities, and monitoring student progress. Interestingly, teachers frequently lectured as part of the innovation as a way to structure their classes. In all cases, students used local area networks and e-mail, they frequently used multimedia, and occasionally Web design tools and laptops, more so than in other clusters. In this cluster, ICT practices were more likely to include the use of simulations or modeling to support research and students' collaboration.

A case that illustrates the practices in the Student Collaborative Research Cluster is the Grange School, a primary school of about 650 students in suburban Adelaide, Australia. The principal and teachers in this school see ICT as a way to implement innovative approaches to teaching and learning. Within the school, 160 computers are distributed in a variety of ways: 2–3 computers per classroom, four pods of 6–8 computers throughout the school, a mobile pod of 8 laptop computers using wireless technology, and a computer room with 16 computers. As a group, the staff of the school established a set of curricular goals for their students that included improving:

- the quality of students' thinking and problem-solving processes
- students' critical engagement with and analysis of information being created and explored
- the independent and collaborative skills of all learners
- supporting students in their learning how to learn

Part of the innovation we studied in this school was a set of student

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research activities associated with the Jason Project—a series of real-life, Internet-based science explorations designed for students. The students followed the project researchers as they explored the geology and biology of a group of isolated islands in Hawaii, they traced the migration paths of the diverse peoples who settled these islands, and they explored the cultural tapestry of modern Hawaii. Students picked a research topic and worked with the school's computers and various software tools to conduct their research. Working in teams, students used Inspiration to organize their initial research findings and PowerPoint to construct the final presentations of their completed research. Students used digital still and video cameras and iMacs to capture source material and produce movies for their presentations. A panel of students assessed each presentation using a rubric the class had agreed on. The rubric assessed the presentation in terms of student performance, shared roles, researched content, and technical details of the presentation. Each student had to play the role of assessment panel member at some stage in the session.

Another case in this cluster is a private all-girls secondary school in the Philippines. The school staff said the goal for ICT use was to enhance the development of critical thinking skills through hands-on investigation, in-depth verification, exploration, and discovery of science concepts and processes. The specific goal for the innovation was to enable students to learn physics experientially. In addition to designing and developing her own modules, the teacher served to guide the students in choosing and setting up parameters for the problems to be studied, and provided direction when necessary to facilitate the investigations. For 1 hour and 40 minutes each week, the 36 physics students were divided into teams of three or four and assigned to one of the laboratory's 12 computers, each with a personal science laboratory microcomputer-based lab kit that they used to collect and analyze data. Students used a variety of probes to measure temperature, distance, motion, and acidity. The actual conduct of the experiments was the students' responsibility, with work shared equally among the team members. An example of an investigation was The Murder of Mr. Blue, in which the students needed to use the probes to solve a hypothetical murder case. Student performance was assessed using such standard measures as quizzes, periodical examinations, and class participation, as well as their ability to use probeware to conduct the experiments.

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Innovations in the Information Management Cluster involved both students and teachers in finding information, analyzing it, organizing it, and using it to create a variety of digital products. For example, teachers designed materials more in this cluster than others. In all of the cases, teachers and/or students used ICT to plan and organize instruction and to create products or presentations. ICT was used to monitor or assess students in a large majority of the cases in this cluster. ICT course management tools were used more often in this cluster. Productivity tools were used in all cases and Web resources were used in almost all of the cases. Students searched for information in all the cases, and they published or presented results, solved problems, and assessed their own and/or each others' work more often than in other clusters.

## A large majority of cases also claimed that students developed positive attitudes toward learning, acquired new subject matter knowledge, or acquired collaborative skills. But fewer than half of the cases reported that students acquired new skills for studying, communicating, handling information, or solving problems.

An example of cases in this cluster is an upper secondary school in northern California called Future High School. This technology-rich school with a diverse student population was redesigned from the ground up around technology and project-based learning. The school was organized like a high-tech start-up business in which students had real-world projects consisting of complex tasks with long-range due dates for which they had individual and shared responsibilities. Curriculum goals included developing students':

- technology literacy
- collaboration
- written communication
- oral communication

Six of the school's nine teachers paired up to teach integrated courses: math and science, literature and history, government and economics. By team teaching, teachers shared the load of creating curricula and organizing class activities, and students had more time to explore a topic in depth. ICT was integrated throughout the curriculum and students used computers on a daily basis for everything from research on the Internet to multimedia projects. The school's 240 students had access to 250 computers, all of which were networked. All students had e-mail accounts and could access a course database to retrieve syllabi, assignments, rubrics, and other instructional resources. As a standard part of their course work, students used Microsoft Office, Filemaker Pro, Lotus Notes, PageMaker, and Photoshop to create a variety of reports, Web pages, business cards, stamps, posters, letterhead, and multimedia products. Students completed an online portfolio that was assessed by a panel of staff and community members. One of the teachers commented that students in the school "search for answers, instead of us giving them the answers. … They really come up with questions that are relevant and the problems that need to be solved." Another teacher commented, "Because it is a project-based environment, because of the group participation, they do learn collaboration, they do learn presentation skills, they do learn how to get up in front of their peers."

Another case in this cluster is a primary school in Hong Kong. Their project called My Pocket Money asked students to learn how to:

- handle the work of a financial organization
- cooperate with other people as a team
- search for, organize, and analyze information and present their findings

This project consisted of a series of activities in which students collected information from others in their class so that they could understand how students made use of their pocket money. The 40 Grade 6 students divided into teams and used their five computers and Word and Excel to collect and analyze the data. They used what they learned about their spending habits to set up a small business selling items to other students in the school. Students used Paintbrush to create posters that advertised their products. With the money they made, they conducted a service day in a neighborhood senior center that included a talent show, games, and a prize drawing. They used ICT to organize and schedule the events. Finally, students used WebPage to make a homepage as a record of the project. The students were very active throughout the project. The teacher said, "My main role is to ensure that the whole project runs smoothly. … Usually [the students'] role is that of listening to the teachers talk. But in this project, they have to ask questions and listen to advice from others. They have to give others advice at appropriate times." Students commented that from this experience, they recognized the importance of working with others as a team. They said it was enjoyable to learn on their own and not be limited to the knowledge they could get from books. Teachers indicated that ICT was an important part of their learning activities.

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## Final Thoughts

These examples illustrate that it is not having a lot of technology or even the most sophisticated technology that matters most for educational change—it's how you integrate it into the curriculum. In these cases, teachers used ICT to collaborate with their colleagues, connect multiple subjects, provide students with structure, and monitor and assess progress. Students worked together using computer tools and resources to search for information, conduct research, and create products.

I am pleased to say that it was not just the high tech schools in the United States, Australia, and other industrialized countries that appeared in our 174 cases. Teachers in the Philippines, Hong Kong, Lithuania, Thailand, Chile, South Africa, and other developing and economically distressed countries did innovative things to integrate modest technological resources into their teaching and support educational change. I invite you to explore these cases yourself at the Second Information Technology in Education Study Web site.

## Resources

International Association for the Evaluation of Educational Achievement: http://www.iea.nl

Jason Project: http://www.jasonproject.org

Kozma, R. (Ed.). (2003). *Technology, innovation, and educational change: A global perspective.* Eugene, OR: ISTE. (See, in particular, the chapter "ICT and Innovative Classroom Practices" by Robert B. Kozma and Raymond McGhee, on pp. 43–80.)

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## Students commented that from this experience, they recognized the importance of working with others as a team.

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Second Information Technology in Education Study: http://www.sitesm2.org

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