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# First Principles:

# Designing Effective Education Programs Using Information and Communication Technology (ICT)

## Digest

Credit: American Institutes for Research

Over the past 20 years, country governments and donor agencies, including USAID, have made substantial investments in education technology. These initiatives are complemented by numerous smaller-scale efforts by local NGO and businesses and by those of school committees. All these efforts are underpinned by the shared beliefs that information and communication technology (ICT) has enormous potential to transform education and that schools will fall into irrelevance if they are unable to incorporate technology into their operations, especially into teaching and learning. The increasing importance of the knowledge economy challenges education systems to improve their performance overall and to integrate new competencies, new procedures, and new ways of interacting into both their own operations and students' learning.

The scope, scale, and diversity of efforts to enhance learning through the use of technology is stunning. Countries as different as Mexico and The Gambia have launched programs that rely on broadcast technologies such as radio or television. Other countries, including Argentina, Armenia, and Chile, have established (or are establishing) web portals to disseminate learning resources and teacher resources and to promote collaborative learning. Peru, Rwanda, Uruguay, and others have launched one-to-one (1:1) initiatives using low-cost laptops to provide all children with access to computers. In addition, donor agencies, governments, and other organizations have launched hundreds of other pilot projects to test approaches to using technology, while school committees and parents around the world have used their own resources to give their children access to computers and the Internet in schools. (For information about these and other programs, refer to the *First Principles: Designing Effective Education Programs Using Information and Communication Technology (ICT) Compendium.*)

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# 10 Key Principles for ICT in Education

The principles that follow are intended to guide conceptualization, design, development, and implementation of education programs using ICT.

## 1. Use ICT to achieve education and development goals.

Technology is a cross-cutting resource that should be seen as a sustainable, accessible, and valuable means of supporting efforts to improve teaching, learning, and school operations and in particular to address areas where system capacity is poor. Technology can be used to disseminate resources, connect students to information, enhance teachers' practices and students' performance in all subject areas, improve school management, and support data-driven policy making.

Core strategies include the following:

**Address areas of high need.**

Given the range of areas where technology can support improvement, projects can target essential gaps in student learning, barriers to effective teaching, limitations in information management, and other areas where capacity and performance are low. Mali's PHARE project uses Interactive Radio Instruction (IRI) to mitigate the impact of teachers' poor knowledge of their subjects and to improve learning outcomes by broadcasting lessons that provide instruction directly to students.

**Conceive of technology as "education infrastructure."**

Projects that establish the use of technology in schools—whether radio, video, mobile phones, or computers—contribute to the strengthening of a school system's education infrastructure by improving the dissemination of learning resources, providing professional development to teachers and direct instruction to students, and bringing teachers and students together in online forums.

**Use ICT to support comprehensive change.**

The cross-cutting quality of technology can enable comprehensive approaches that extend to many core components of the education system, such as information management, school leadership, teacher development, learning-resource distribution, classroom practice, and direct instruction.

## 2. Use ICT to enhance student knowledge and skills.

ICT can be used to help students build knowledge across all areas of the curriculum and to help them build literacy and numeracy skills, plus information literacy, independent-learning skills, and other higher-order skills that contribute to achievement in later life.

## About This First Principles

This *First Principles: Designing Effective Education Programs Using Information and Communication Technology (ICT) Digest* provides important overview guidance for designing and implementing education programs that use technology. The principles and indicators are primarily meant to guide program designs, including the development of requests for and subsequent review of proposals, the implementation of program activities, and the development of performance management plans, evaluations, and research studies. The *First Principles* are intended to help USAID education officers specifically, as well as other stakeholders—including staff in donor agencies, government officials, and staff working for international and national non-governmental organizations—take advantage of good practices and lessons learned to improve projects that involve the use of education technology. The guidance in this document is meant to be used and adapted for a variety of settings to help USAID officers and others grapple with the multiple dimensions of ICT in education and overcome the numerous challenges in applying ICT in the developing-country contexts. The last section provides references for those who would like to learn more about issues and methods for supporting the education of the underserved. This document is based on extensive experience in, and investigation of, current approaches to technology in education and draws on research literature, interviews with USAID field personnel, and project documentation. It also includes profiles of projects funded by USAID and others. This *Digest* version is a brief overview of key considerations in the planning and implementation of education technology projects. For those who are interested in knowing more, a longer companion piece called a *Compendium* provides greater depth for this topic.

Core strategies include the following:

**Help students build reading skills and basic skills in all subjects.**

IRI and other specific-use tools have proved their ability to improve basic skills. In Guinea, the Fundamental Quality and Equity Levels (FQEL) project used IRI to reduce the gap between rural and urban students in French-language skills.

**Help students build 21st-century life and learning skills.**

When education-technology projects involve student or teacher use of technology, project designs should focus on meaningful improvements in instruction and learning. For example, the Decentralized Basic Education 2 (DBE2) DALI program in Indonesia helps primary-grade teachers guide their classes through interdisciplinary learning activities in one-computer classrooms.

**Focus on learning outcomes.**

Project designs should focus on meaningful improvements in instruction and learning. A study of activities of the Discovery Channel Global Education Partnership (DCGEP) in Romania, a project that combined video and broadcast programming content with teacher development, found a significant impact on students' written-language competencies and their inferential and creative thinking skills.

**Expand the use of computers and the Internet beyond the "IT curriculum" and ICT skills for teachers.**

Although students do need to develop computer skills if computers are to be used for learning, these skills can be built in combination with mastery of school subjects. The IT curriculum—sometimes spanning six years of classes and monopolizing computer use in schools—is a poor means of building IT skills.

*Credit: Edmond Gaible/The Natoma Group*

## 3. Use ICT to support data-driven decision making.

As of 2010, USAID was supporting Education Management Information Systems (EMIS) and data-driven school-improvement initiatives in countries that include Djibouti, El Salvador, Ethiopia, Guatemala, Jamaica, Liberia, Tanzania, Uganda, Yemen, and Zambia. Many of these initiatives focus on improving data collection at the school level by providing training on spreadsheet-based reporting forms; others address central management of school information to support policy and planning; and still others address how schools themselves use data.

Core strategies include:

**Keep tools simple at the school level.**

Data-collection tools that require too much technical expertise or high-quality Internet connectivity can create challenges at the school level and reduce overall participation. The SDS (School Data System) implemented in Indonesia under DBE1 is a simple spreadsheet-based reporting form.

**Collect data that address goals.**

Data should be relevant to sector objectives and activities. In Egypt, a partnership between USAID and the Ministry of Education led to the development of a targeted set of 36 National Education Indicators (NEI).

**Ensure that data can be easily accessed and shared.**

When multiple data-collection efforts are taking place, or when several databases are maintained, care must be taken to avoid conflicting data formats and to ensure that databases are interoperable—that they can share their data.

**Develop information-management tools in stages.**

Effective EMIS and other information-management tools must support the needs of central policymakers and decision makers, conform to the way the education system operates, and be integrated into school routines. Achieving a comprehensive and effective system that also meets the needs of users in schools is best accomplished through stakeholder consultations, field trials, and many iterations, a process that is now under way as part of a USAID-supported effort to improve Tanzania's Education Sector Management Information System (ESMIS).

**Support the use of data in schools and communities.**

Schools can compare their own information in combination with information about other schools to assess their current situation, make plans, enlist community and government support, and gauge subsequent progress. In Tanzania, additional development of the ESMIS will enable school data to be output as school report cards to be used locally.

## 4. Include all short- and longer-term costs in budget planning.

Estimating full capital and operating expenses of technology projects in schools requires considering all equipment and activities needed to ensure that hardware and software are installed, operated, maintained, repaired, and replaced and that teachers and other personnel have the skills and resources they need to use their new tools to meet project goals. Even when capital and donor-funded operating costs are correctly estimated, the effort to mainstream operating costs into the regular education budget can still pose challenges.

Core strategies include:

**Base program budgets on the total cost of ownership (TCO) of the technology to be used.**

Operating costs in technology projects frequently include Internet connectivity; electricity; security; maintenance and repairs of hardware, software, and networks; training or professional development; and replacement costs of hardware. Tools developed by CoSN,[1] GeSCI,[2] and SchoolNet Africa[3] provide support for calculating these costs.

**Ensure capacity to conduct effective procurement.**

Many ministries of education in developing countries, as well as some ministries of finance, lack experience and capacity in the large-scale procurement of technology goods and services. Challenges are often compounded by overreliance on vendors' sales representatives.

**Investigate hardware and software alternatives that reduce costs.**

Alternatives to new, standalone desktop computers can offer equivalent or appropriate features at lower cost. Such alternatives include deploying thin-client networked

1 Consortium for School Networking (http://www.cosn.org/tco/).

2 Please see http://www.gesci.org/knowledge-tools.html#tco for more information about GeSCI's Total Cost of Ownership Toolkit (accessed August 2010).

3 SchoolNet Africa. http://www.schoolnetafrica.org/english/index.htm (accessed May 2010).

computers, which rely on a server for their processing power; netbooks (small, low-power laptops); and refurbished computers. At Computers for Schools Kenya (CFSK),[4] student volunteers refurbish and redistribute computers donated by local businesses and in the process build their own technical skills.

**Establish budget and capacity for maintenance and repairs.**

On-site maintenance services and technical support help ensure that technology is working properly in schools. Periodic on-site maintenance of local networks, anti-virus software, and backups can be performed by private-sector technicians; by IT teachers and coordinators, if they have capacity; or in some cases by students.

**Plan and fund disposal of e-waste.**

Improper disposal of computer hardware results in toxins such as lead, mercury, cadmium, and copper entering water supplies, food chains, and other parts of the ecosystem.

## 5. Explore technology alternatives to find appropriate solutions.

Innovation in tools and approaches is accelerating in both developed and developing countries. These innovations, including low-cost/low-power computers and mobile broadband, challenge project developers to think creatively about emerging opportunities.

**Core strategies include the following:**

Use technology that is appropriate to the available infrastructure.

Tools are most likely to be effective when they are appropriate to electrical supply, connectivity, other environmental factors (such as dust or heat), human capacity, project financing, and purpose.

**Use technology that is appropriate to teachers' skills and capacities.**

IRI and other solutions that use broadcast technologies require less skill to be used effectively. Over the last 35 years, more than 30 countries, including Bolivia, the Dominican Republic, Honduras, Lesotho, South Africa, Thailand, and Zambia, have implemented IRI programs, primarily to provide direct instruction to students in schools where teachers have few skills.

**Take advantage of what is familiar and what is already in use.**

When familiar tools—radios, telephones, cameras, even television—are used, professional development can focus on improvements to teaching, learning, and school management rather than on basic ICT skills. Teachers in 150 Bridgeit schools in Tanzania use smart phones to search for and download 5- to 7-minute videos. Because the technology is familiar and easy to use, professional development can address ways of integrating those videos into classroom instruction.

**Use technology that is appropriate to education objectives.**

IRI has proved effective at helping students build language and numeracy skills; however, its reliance on direct instruction does not build mastery of more extensive bodies of knowledge or more complex cognitive skills. The Innovations in Technology-Assisted Learning for Educational Quality (INTALEQ) project in Yemen uses Intel Skoool interactive-multimedia learning resources to support the development of 21st-century skills such as digital literacy, problem solving, and critical thinking, among others.

Credit: Edmond Gaible/The Natoma Group

4 www.cfsk.org

**Be cautious about relying on new or unproven technologies.**

EduTech 2000 in Barbados, in an innovative pilot program that aimed to deliver 1:1 computing to schools, installed innovative technologies that were compromised before the project started to deliver services. Although EduTech 2000 has made impressive progress since these initial challenges, its early history is a reminder of the risks posed by unproven approaches and tools.

## 6. Focus on teacher development, training, and ongoing support.

Professional development and training are essential to teachers' abilities to inspire and instruct students. Professional development is also critical when teachers are asked to integrate new tools into their classroom practices.

Core strategies include:

**Design professional development to meet teachers' needs and program objectives. (Avoid focusing on basic ICT skills!)**

Teachers benefit from building basic computer skills when those skills help them approach their professional activities. Activities can include planning lessons, preparing presentations, or even completing attendance records.

Credit: CEdmond Gaible/The Natoma Group

**Connect professional development to recognized teacher standards for technology use.**

Standards for teachers describe what teachers should know and be able to do. Influential standards include the UNESCO ICT Competency Standards for Teachers (CST)[5] and the ISTE[6] National Education Technology Standards.

**Complement teacher professional development with training for school leaders.**

Professional development or orientation for school administrators and leaders can help ensure that those personnel will be supportive as teachers work to incorporate new tools and approaches into their existing practices.

**Build technology-focused professional development around hands-on methods.**

Professional development that involves building new technology skills should be based on "learning by doing" models, not on "learning by hearing" abstract concepts or theoretical information. Meaningful, active, hands-on learning is best for children *and* adults!

**Synchronize professional development with the roll-out of technology to schools.**

When professional development is delivered prematurely, teachers' new skills can fade, requiring costly refresher training. When professional development is delayed well past the arrival of technology, teachers are less likely to make the effort to participate or to make desired changes to their current practices.

**Use ICT to provide follow-up to and support for professional development.**

The effectiveness of technology-focused professional development can be increased through technology-*supported* professional development. Action research, narrative reflection, and other crucial forms of follow-up can be supported via education portals, email, SMS (texting), and other means.

5 http://cst.unesco-ci.org/sites/projects/cst/The%20Standards/Forms/AllItems.aspx

6 International Society for Technology in Education (http://www.iste.org/standards.aspx)

## 7. Explore and coordinate involvement of many different stakeholders.

Education-technology projects frequently cut across several sectors; they can also entail great expense as well as technical and organizational complexity. Valuable contributions can be made by international and local organizations, including those in the private sector.

Core strategies include the following:

**Seek out dynamic local NGOs that can contribute to program success.**

Engaging local NGOs can draw on their expertise and energy while enabling those organizations to expand the scope and scale of their activities and impact. In Costa Rica, the government-supported *Fundación Omar Dengo* (www.fod.ca.cr) assumed responsibility for the design and implementation of a nationwide roll-out of computers, learning resources, and professional development.

**Explore the potential of local private-sector technology firms.**

Similarly, local and national technology and training firms can undertake installation and on-site maintenance of hardware, software, and networks; perform repairs, including repairs covered under warranties; and ensure that sufficient numbers of teachers gain basic ICT skills at the outset of a project.

**Engage with national and international private-sector firms.**

The interests that larger private-sector firms have in education, economic and social development, and community relations (as well as interests in specific provinces, cities, and towns) can help motivate these companies to support education-technology projects. Such support is often part of programs in Corporate Social Responsibility (CSR).

**Take advantage of USAID's Global Development Alliance (GDA) program.**

Key GDA education partners include Cisco Systems, Microsoft, and Intel. These three GDA partners have established programs that specifically address the needs of education-technology projects in developing countries.

*Credit: Edmond Gaible/The Natoma Group*

**Weigh the benefits and risks of private-sector contributions of products and services.**

Decisions about education-technology hardware and software can be distorted by market trends and corporate objectives. Multimedia education software, tablet computers (such as the iPad), interactive whiteboards (or smartboards), and implementation models such as 1:1 computing are currently receiving attention in education systems worldwide. None of these solutions is appropriate for all education environments, however.

**Build appropriate mechanisms for coordinating stakeholder efforts.**

As additional stakeholders become involved in projects, requirements for coordination increase. In Pakistan, the Punjab IT Labs project received contributions from many international and national private-sector companies, enabling the installation of computer labs in 4,286 schools in 110 days. Such contributions increase the requirements for overall coordination.

## 8. Develop a supportive policy environment.

Policies, plans, and central agencies that shape the use of technology in education can help ensure that initial expenditures and activities support government objectives and that successful projects receive ongoing funding.

Core strategies include:

**Facilitate the development of education technology policies and achievable plans that align with national objectives.**

Policies in ICT in education should be developed in relation to broader national policies, plans, or strategies for development.

**Support policy development that frames education-related goals.**

Framing goals in relation to students' activities and competencies helps keep project designs open to the best possible tools, solutions, and activities.

**Explore enfranchisement of a central agency for education technology.**

Central education-technology organizations, including the Korean Education & Research & Information Service (KERIS) in Korea, *Enlaces* in Chile, and *Fundación Omar Dengo* (FOD) in Costa Rica, among others, have played vital roles in the planning and implementation of technology use to support education in their countries.

**Guide policy development and planning toward broader and longer-term goals.**

There is great danger in considering computers and the Internet as "magic bullets" that will radically improve low-performing schools and lead to jobs that do not yet exist.

## 9. Integrate monitoring and evaluation into project planning.

Education-technology projects can be complex and costly and can involve multiple stakeholders in multiple sectors. Planning (and budgeting) for monitoring and evaluating education-technology projects should begin during the first phase of project design.

*Credit: Edmond Gaible/The Natoma Group*

Core strategies include:

**Support outcomes-based evaluations as well as performance metrics.**

In education-technology projects focused on teaching and learning, impact indicators (sometimes referred to as "outcomes") frequently center on the actions of teachers, including their classroom activities as instructors and facilitators; on students' learning behaviors; and on students' learning outcomes.

**Link indicators to project objectives and policy goals.**

Properly structured outcomes-based indicators should reflect project objectives, which can (and should) in turn reflect the broader goals articulated in national policies.

**Make evaluation a participatory process.**

Evaluations should engage all stakeholders, ranging from students to teachers, principals, and families to key individuals in ministries and among the broader array of stakeholders. Broadening the scope of evaluation can help increase the accuracy and reliability of findings.

**Include formative assessments.**

The introduction of new tools and new pedagogies can encounter unanticipated barriers and challenges; formative evaluation can identify such obstacles early. Examples of challenges that can be revealed in formative evaluation are teachers who do not have enough time to address all units in the curriculum and engage in project activities; schools that stop paying for Internet connectivity; and radio lessons that are broadcast at inconvenient times.

**Use evaluation results in decision making.**

The results of evaluations should strongly influence decisions about whether and how projects should be scaled up or mainstreamed into ministry budgets.

**Share findings broadly and transparently.**

Evaluation is about learning, about improvement, and about the future. Sharing and transparency are essential.

## 10. "It takes capacity to build capacity"—System strengthening must precede system transformation.

In many developing-country school systems, the scale and intensity of problems are great, ranging from poor teaching and lack of learning resources to inadequate facilities and public infrastructure. In such circumstances, school systems must first address these fundamental problems directly. In many instances, however, technology can be valuably deployed to address issues of access, equity, and the quality of instruction.

Core strategies:

**Build on "appliance style" use of technologies.**

When technologies are introduced into schools as appliances—devices to be used to accomplish specific, education-related tasks—implementation and adoption challenges are minimized and specific teaching activities and learning outcomes can be supported. The simple design and limited feature-sets of dedicated word processors, for example, can help students, teachers, and school leadership build skills and practices that can later support their use of more complex tools.

**Scaffold approaches to technology integration.**

New tools are sometimes best used to enhance the teacher's traditional instructional practices, helping the teacher build confidence and capacity.

**Develop ICT infrastructure to improve systemwide capacity.**

When school systems lack foundational capacity, ICT can be used to establish education-technology infrastructure—school hardware, Internet connectivity, and human capacity—that can support incremental school improvements.

Credit: American Institutes for Research

## Challenges and Limitations

The impact of ICT in schools can be lessened by limitations that lie outside the areas of teaching, learning, school management and sector management, the areas that are directly affected by the use of ICT. Those limitations include:

Credit: Edmond Gaible/The Natoma Group

**1. Technology increases complexity in education systems.**

Technology adds an additional layer of complexity to school systems—a layer that encompasses more than the tools themselves, such as new skills, new activities, and new interactions. Ordering this layer of complexity to deliver educational value requires new organizational structures—to train teachers and students, create and disseminate resources, assess progress, and procure, install, and maintain the new tools.

**2. Education-technology projects are subject to political and marketplace pressures.**

Decisions about introducing ICT into schools on a large scale or nationwide are frequently influenced by factors outside the education system—most notably, political and commercial interests. Decision makers responding to election cycles can sometimes influence project designs to "fast forward" technology roll-out, accelerating timelines beyond the system's capacity for new practices or change.

**3. There is no "magic bullet"—the impact of technology is constrained by many factors.**

Constraints on the impact of education-technology projects, such as cost, infrastructure, teachers' skills, and organizational capacity, work in combination to limit what can be achieved in the short term.

**4. Educational improvement takes time.**

In some instances, overcoming constraints requires waiting for actions outside of schools. Resolving connectivity in schools, for example, can require improvements to national or international Internet backbone infrastructure. Realizing the enormous potential of technology to support system strengthening is the work of years, not of a single project.

# Suggested Indicators of Success

The indicators in this section can help frame areas for investigation in the assessment of education-technology projects. Such indicators should be finalized in relation to program design and objectives, the preexisting education environment, and other factors.

### Access indicators

Access to technology in schools can be a significant hurdle, limiting a project's impact in relation to student learning and other essential outcomes. Frequently used access indicators include the following:

- Availability of grid-based or mains electrical power
- Availability of alternative electrical power
- Number and type of devices
- Type of Internet connection, bandwidth, and number of devices connected
- Percentage of students using school computers per week, and hours of hands-on time per computer-using student

### Output indicators

Output indicators are valuable in addressing changes in teaching practice and learning behavior that rely on technology or that meet objectives of technology-supported professional development. Examples of such indicators include the following:

- Students use educational software resources.
- Students engage in technology-supported collaborative activities.
- Students conduct independent research, write reports, and make presentations.
- Teachers display media resources to their classes.
- Teachers use technology to search for, find, and use lesson plans or other resources.
- Teachers use technology to communicate with other teachers.

Programs that focus on deploying EMIS or using school report cards can assess outputs in relation to participation in reporting activities and use of information for school improvement:

*Credit: Edmond Gaible/The Natoma Group*

- School heads complete monthly, quarterly, annual, or other reports.
- School heads share results of the school report card with a parents' committee.

### Impact indicators

Impact indicators (or outcome indicators) in education-technology projects are often similar to impact indicators in other education projects: Did students develop the intended competencies? Did participating students perform better than students in classes that did not participate in the project? These questions can be answered by standardized assessments, such as national exams, or by dedicated assessments that are developed specifically as part of the project evaluation. Technology's effect on student motivation (and on teacher motivation), as demonstrated in attendance and school completion, can also be assessed.

Impact indicators can also address the specific features of a given intervention. For example, when students use talking word processors (such as the NEO keyboard), they might be evaluated using these indicators:

- Using the word processor, students write more (e.g., longer essays) and make fewer spelling errors.
- Students make fewer mistakes on spelling quizzes (using pencil and paper).

Similarly, an evaluation of an IRI program in English-language instruction might include these impact indicators:

- Student pronunciation improves.
- Student comprehension improves.
- Student test scores improve.

Assessments of learning outcomes need to be conscientiously designed to eliminate confounding factors. (Improvements in students' test scores could, for example, improve if schools were open more days during the term.)

School report-card projects might include impact indicators related to school resources and school heads' abilities to mobilize funding from outside sources:

- Improvements to school facilities (e.g., new room, Internet connection)
- Increased learning resources (e.g., mathematics manipulatives, science resources)
- Increased contributions from parents' committee

In addition to input, output, and impact indicators, evaluations must also account for the broader array of factors that have the potential to influence the outcome of education-technology projects. Those factors can include the national telecommunications infrastructure, the levels of technology use and technology literacy, and the relative costs and impacts of alternative approaches, among others.

*Credit: Edmond Gaible/The Natoma Group*

## Conclusion

The introduction of technology into processes of education change carries risk and great potential benefit. In some instances, technology is the only feasible and cost-effective means of improving education across all of a nation's schools. Broadcast and networked communications and easily reproduced digital materials can help provide high-quality resources or direct instruction to students, information that school leaders and decision makers can use, and opportunities for teachers to enhance their skills. However the skills and knowledge needed by the organizations charged with guiding technology projects in schools are often earned through difficult—and costly—experience.

The ten principles that have been presented here are guideposts that can enable project planners and implementers to benefit from the experiences of others and from the history, more than two decades of it, of ICT projects in schools in developing countries. Intense focus on education goals, on students' skills and knowledge, and on teachers' professionalism is essential if real impact is to be achieved. Without such focus, without projects designed to achieve significant impact, the risks involved in education-technology projects will not be outweighed by benefit.

### Essential Reading

*The reports, books, and websites that follow represent a very short list of essential resources on ICT in education.*

**Seminal works, surveys, and anthologies**


*Anzalone, S., and Bosch, A. 2005. Improving Educational Quality Through Interactive Radio Instruction. Washington DC: The World Bank. http://www-wds.worldbank.org/servlet/main?menuPK=64187510&pagePK=64193027&piPK=64187937&theSitePK=523679&entityID=000160016_20060410163243*

*Cuban, L. 2001. Oversold and Underused: Computers in the Classroom. Cambridge, Mass.: Harvard University Press.*


**Regional surveys**


*Farrell, G., Isaacs, S., and Trucano, M., eds. 2007. Survey of ICT in Education in Africa, vols. 1 and 2. Washington, DC: infoDev. http://www.infodev.org/en/Publication.353.html*

*Farrell, G., and Waccholz, C., eds. 2003. Meta-Survey on the Use of Technologies in Education in Asia and the Pacific. Bangkok: UNESCO. http://www.unescobkk.org/education/ict/online-resources/e-library/key-resources/metasurvey/*

*Gaible, E. 2009. Survey of ICT in Education in the Caribbean, vols. 1 and 2: Regional Trends and Analysis. Washington DC: infoDev. http://www.infodev.org/en/publication.441.html*

*PriceWaterHouseCoopers. 2010. Information and Communication Technology for Education in India and South Asia. Washington DC: infoDev. http://www.infodev.org/en/Project.103.html*


**Key web resources**

*EduTech: A World Bank blog on the use of ICT in education - http://blogs.worldbank.org/edutech/*

*EduTech Debates: Exploring ICT and learning in developing countries (Supported by infoDev and UNESCO) - http://edutechdebate.org/*

*ICT in education: UNESCO Bangkok - http://www.unescobkk.org/education/ict/*

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- Community Engagement
- Early Childhood Development
- Gender
- In-Service Teacher Professional Development
- School Health
- Standards and Assessment
- Curriculum and Instructional Materials Development
- Education for Underserved Populations
- ICT in Education
- Pre-service Teacher Education
- School Management and Leadership Development

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