International Experiences With Technology in Education: Final Report

U.S. Department of Education
Office of Educational Technology

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U.S. Department of Education
Office of Educational Technology
and the
Office of Planning, Evaluation and Policy Development,
Policy and Program Studies Service

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2011

This report was prepared for the U.S. Department of Education under Contract number ED-04-CO-0040, Task 0009 with SRI International. Marian Banfield served as the project manager. The views expressed herein do not necessarily represent the positions or policies of the Department of Education. No official endorsement by the U.S. Department of Education is intended or should be inferred.

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August 2011

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Acknowledgements

This two-part report is the result of the U.S. Department of Education's International Experiences with Technology in Education (IETE) project, which was conducted under contract with SRI International. It was developed under the guidance of U.S. Department of Education staff from the Office of Planning, Evaluation and Policy Development and the Office of Educational Technology. Marian Banfield of the Policy and Program Studies Services was the project manager. Ray Myers of the Office of Educational Technology also advised the project. SRI staff that contributed invaluable assistance with data collection and analysis in preparation for this report include Natasha Arora, Nancy Chan, Yesica Lopez, Patrik Lundh, Gabe Novias, Allison Steele and Yukie Toyama. Mimi Campbell and Laurie Dunne provided editing assistance; Kate Borelli produced graphics and layout for the report; and SRI's consultant, Robert Kozma, who served as the principal scientist for the project.

The authors would like to thank the staff of the participating countries' Ministries of Education for taking part in the IETE data collection efforts. Twenty-one countries participated in the survey and follow-up interviews, and we thank them for their generously provided staff time, resources and expertise during the data collection process. Without participation from these countries, this report would not have been possible.

An external advisory panel provided assistance in reviewing study methods and materials as well as guidance regarding country contacts and methods to improve survey response rates. They also assisted with prioritizing issues to investigate. The advisory panel consisted of John Ainley, Deputy CEO of the Australian Center for Educational Research; Ronald Anderson, Professor Emeritus of the University of Minnesota; Charles Fadel, Global Lead for Education for Cisco Systems; Don Knezek, CEO of the International Society for Technology in Education; Keith Krueger, CEO of the Consortium for School Networking; Christian Monseur, Professor, University of Liege; Francesc Pedro of the Organisation for Economic Co-operation and Development (OECD); and Tjeerd Plomp, Professor Emeritus of Twente University. We thank them for the expertise, guidance and insights they so generously shared.

The study team benefited tremendously from recent, related studies, particularly the volume *Cross-National Information and Communication Technology*, edited by Tjeerd Plomp, Ronald E. Anderson, Nancy Law and Andreas Quale as well as Hans Pelgrum's work on ICT in education across the European Union.

Executive Summary

In a 2009 speech to education researchers, U.S. Secretary of Education Arne Duncan stated, "Just simply investing in the status quo isn't going to get us where we need to go…We're competing with children from around the globe for jobs of the future. It's no longer the next state or the next region." He challenged education leaders to focus on four areas of education reform:

- Adopting rigorous standards that prepare students for success in college and the workforce;
- Recruiting and retaining effective teachers, especially in classrooms where they're needed most;
- Turning around low-performing schools; and
- Building data systems to track student achievement and teacher effectiveness.

To help meet these challenges, the U.S. Department of Education issued the *National Education Technology Plan 2010*, which includes technology-related recommendations for states, districts, the federal government, and other stakeholders to use in helping to achieve these reforms. In an effort to learn from the experiences of other countries, particularly counties with high-performing education systems, the Department of Education funded this study, *International Experiences with Technology in Education* (IETE).

The IETE project focused on primary and secondary level education and was conducted in two phases in 2009-10. During the first phase, researchers conducted literature and Internet searches for multi-national data collections. The purpose of the searches was to identify methods, instruments, and available data on key government efforts to integrate information and communications technologies (ICTs) into teaching and learning. In the second phase of the IETE project, available data were updated and extended through a survey and interview of representatives of 21 governments (Exhibit E-1). This set of 21 countries is sometimes referred to as "participating" countries in the text that follows.[1]

[1] More detailed information concerning how governments were selected for this study can be found on p. 2. Researchers intended to include Germany, Ireland, Taiwan, and Switzerland in the study. However, multiple factors precluded the participation of these four entities, including staffing resources and state- or province-level (rather than national-level) policymaking and planning. Sufficient information was collected on Ireland to include a country profile in Part II of this report.

Exhibit E-1. Countries Included in This Report

Australia	Estonia	Netherlands
Austria	Finland	New Zealand
Belgium (Flemish Community)	France	Norway
Canada (Alberta)	Hong Kong (SAR, China)	Portugal
Chile	Iceland	Singapore
Denmark	Israel	South Korea
England	Japan	Sweden

Eighteen of these governments are countries, and three are governmental bodies that are responsible for setting educational policy within a defined region of a country. Canada and Belgium do not have national education ministries. The province of Alberta and the Flemish Community, respectively, were selected in these cases. Similarly, Hong Kong is a Special Administrative Region of the People's Republic of China. The selection of these three governments was based on the recommendations of the study's Technical Working Group and supported by the precedence of their prior inclusion alongside national governments in international ICT collections. For example, SITES 2006 featured Alberta as one of its participating education systems. And ICT indicators such as the Network Readiness Index typically include Hong Kong as a separate entity.

This executive summary provides a synthesis of key findings about national activities to promote the integration of ICTs in teaching and learning and their implications for future efforts to learn from other countries' experiences with ICT in education. Currency is provided in U.S. dollars using the average 2009 rate as published by the U.S. Treasury. Unless otherwise stated, data regarding country practices are drawn from survey and interview responses from country respondents identified in Appendix C.

Summary of Key Findings

Limitations of Past International Collections

Past international collections address a narrow range of indicators relative to current U.S. educational technology priorities as articulated in the current U.S. National Education Technology Plan. Although the study identified several relevant indicators regarding the use of ICTs for instruction in classrooms, few indicators are available from existing international collections to inform how technology is being used to deliver professional development to teachers. In addition, no indicators were identified that provide data on countries' investments in technology systems to monitor and manage educational performance for continuous school improvement.

Country participation in international collections is limited. Many of the international studies reviewed had a limited international scope. For example, Second Information Technology in Education Study (SITES) 2006 had limited participation with 22 education systems. The United States did not participate in the SITES study, and only 14 of the 25 countries initially identified for participation in the IETE study participated in SITES. The Eurydice and European commission eLearning Policy (ECEP) studies were limited to European Union participation; the Asian-Pacific Economic Cooperation (APEC) study was limited to the participation of Asian Pacific countries. Only the International Association for the Evaluation of Educational Achievement (IEA) through the Progress in International Reading Literacy Study (PIRLS), Trends in International Mathematics and Science Study (TIMSS) and the Organization for Economic Co-Operation and Development's (OECD) Programme for International Student Assessment (PISA) assessment studies had a broad base of country participation that addressed the policy needs of the United States. However, these studies are not focused on ICT indicators. Consequently, they have supplied limited information in the past that is relevant to U.S. ICT in education priorities.

Political and Economic Context Impacting ICT in Education

Even during the recent global economic crisis countries have continued to invest in ICT for education. Several countries recently invested in large-scale ICT infrastructure projects that will benefit educational systems and increase access to broadband Internet within schools and homes or increase hardware access in schools (e.g., Australia, Canada, Estonia, Israel, Japan, New Zealand, Portugal and South Korea). In some countries, however, plans for updating schools, including their technology, have been put on hold or severely cut back because of government budget cuts (e.g., United Kingdom).

Most countries that participated in the IETE study had national-level documents that provided a vision for integrating ICT into primary and secondary education. Whether in stand-alone documents or integrated into cross-sector ICT strategies, national educational technology plans are widely used to convene stakeholders and coordinate activities across levels of government. Of the 21 countries participating in the survey, nine countries (Canada, Australia, Austria, Belgium, Chile, Finland, Hong Kong, Portugal, and Singapore) reported active, comprehensive plans in place to guide policy and programs while six countries (Canada, France, Israel, Japan, New Zealand, and South Korea) were in the process of developing systematic national plans. Denmark, Norway, and Iceland reported embedding guidance for technology use in primary and secondary education in other curriculum documents or other national plans that incorporated education as an element of broader efforts. England had a plan in place, but a new government and austerity measures left the execution of the plan unlikely at the time of data collection. However, two countries, Estonia and the Netherlands, reported moving away from documents that lay out long-term goals and visions toward plans that are updated annually and include specific actionable initiatives that are supported with resources for implementation.

The private sector is involved in many aspects of countries' ICT in education programs. Private sector involvement in national educational efforts ranged from contributing in-kind resources (e.g., equipment and software) or direct financial contributions to explicit partnerships and service agreements between governments and technology companies to provide digital resources or maintain infrastructure. For some countries participating in the study (such as England, Iceland, Japan, Norway, Singapore, and Sweden), there was limited private sector involvement in the educational system. Cultural norms against the involvement of the private sector in public education (e.g., Japan) and smaller markets (e.g., Iceland) appear to limit the role of the private sector in these countries.

A majority of governments reported agreements with outside entities to develop educational resources for teachers and students. Eleven of the 21 participating countries reported having some type of formal incentive in place for the development of ICT-related materials for instruction. Of these, some incentives are intended solely for the private sector and others include university researchers and semi-governmental agencies. At the same time, some countries (e.g., Australia, Belgium) reported pursuing specific copyright agreements or copyright reform in order to make some existing digital materials freely available.

ICT Infrastructure for Supporting Education

Improving Internet connectivity in primary and secondary schools is a top priority in national efforts to improve education. Twenty of 21 countries surveyed reported that improving school access to the Internet was a major priority. Twelve of these countries have prioritized improving Internet connection speeds to extend access to quality instruction to underserved populations and regions. Iceland and New Zealand reported exploring ways to use technology to better serve geographically isolated communities, and Canada, Belgium, and the Netherlands are focused on extending the learning environment and time beyond the school building, especially for students who are academically at risk, homebound, or in need of more flexibility in their schedules. Other countries such as Belgium, Portugal, Japan, Norway, and Singapore also reported efforts to improve Internet connections in schools. Finally, four countries (Australia, Canada, Finland, and New Zealand) have invested in nationwide efforts to provide universal Internet access, benefiting the education system directly by expanding the availability of the Internet while also increasing Internet-based opportunities for learning outside school. Australia, Canada, and New Zealand instituted programs with the goal of bringing broadband Internet to their entire populations. Finland passed recent legislation that provides access to high-speed Internet and sufficient data storage as a right of citizenship.

Countries continue to focus on improving access to computers for teachers and students. About half the respondents (11 of 21) reported that increasing the computer-to-student ratio was a top national priority with six countries (Australia, Austria, Canada, Israel, Japan, and South Korea) reporting a goal of a one-to-one ratio for students. Five countries (Estonia, Israel, Japan, New Zealand, and Portugal) reported a goal of reaching a one-to-one ratio for teachers.

The integration of mobile technologies into the instructional environment is an emerging priority for many countries. Mobile communication devices are becoming increasingly prevalent in society, affordable and powerful in regards to their technical capabilities to share, display, analyze, and process information. Eight governments (Canada, Austria, Estonia, Israel, Japan, New Zealand, Portugal, and South Korea) reported having in place programs to investigate the use of mobile devices for teaching and learning. For example, South Korea reported piloting digital textbooks that students access on tablet computers.

Several countries are adopting Internet-based computing or cloud computing to address server costs, cyber security, and shared access to updated software resources. Countries that reported a move to cloud computing include Austria, Denmark, Japan, and South Korea. Austria's centralized learning management system was developed primarily to eliminate barriers to school-based integration of ICT in the classroom by reducing local investments in servers, maintenance, and training.

ICTs to Enhance Instruction and Student Learning

A majority of countries have established ICT standards for ICT competencies for students. Fifteen of 21 countries reported ICT standards for students that were either embedded in other academic content standards or in separately articulated documents. Austria and France reported mandatory assessments of student ICT skills linked to the national ICT standards. In four countries, either no standards are in place or standards are determined at the local rather than national level (Chile, England, the Netherlands, and Portugal).

In some countries, the nationwide adoption of learning management systems offers new possibilities for managing courses and delivering instruction. Learning management systems (LMSs), also known as curriculum or course management systems, are platforms that offer discrete digital spaces for courses in which teachers and students can upload or download material, create content, and respond to one another's materials in blogs, wikis, and discussion forums. Teachers have access to additional functions, such as the ability to post assignments or announcements and to maintain an e-grade book. Belgium, Estonia, Hong Kong, Iceland, Singapore, and Sweden reported having LMSs in either most (over 70 percent) or nearly all schools. Denmark, Finland, and South Korea reported having LMSs in place in all schools.

Seven countries reported national initiatives to deliver online instruction for students (Belgium, Canada, Denmark, Finland, Israel, the Netherlands, and South Korea). The Alberta Distance Learning Centre (Canada) serves 30,000 elementary and secondary students with distance learning services, including fully online courses, and manages the province's virtual school. In the Netherlands, an online platform offers flexible and accelerated learning for gifted students. In Finland, online language courses are helping recently arrived immigrants adapt to their new cultural surroundings. Israel, South Korea, and Denmark are using online tutoring courseware to provide struggling students with individual supplementary help by using the courseware to help focus the instruction on areas of greatest individual need. In Belgium, the ICT Without Boundaries Bednet program allows chronically ill students to follow and participate in classes remotely.

Fewer than half of the participating countries reported the online delivery of national assessments. Eight of the participating countries reported the implementation of programs for using ICT for summative assessments (Australia, Canada, Denmark, England, Israel, New Zealand, Norway, and Sweden). Denmark has made the strongest commitment among participating countries to implementing an online system for the delivery of national assessments. National grade-level testing is administered wholly online, and a pilot program is underway to allow students to have unrestricted access to the Internet while taking national exams. Fewer countries are investing in online assessment initiatives with a specific goal of providing real-time feedback on student academic progress to both teachers and students.

Building Teachers' Capacity with ICTs

Most countries consider the development of standards for teachers' ICT skills a national priority, but only a handful of countries have instituted national assessments designed to measure teacher ICT skills. In this study, ICT standards for teachers were defined as a framework or set of guidelines that describes desired teacher outcomes or competencies relative to ICT, whether or not those competencies are assessed and whether or not they are mandatory or recommended. By this definition, 17 of 21 countries reported teacher technology standards in place in 2010. Of those countries with standards, ten conduct some form of assessment of teacher ICT skill (Austria, Canada, Chile, England, Estonia, France, Israel, Japan, the Netherlands, and Norway). Four governments (Canada, England, France, and Israel) tie ICT skills to teacher licensing requirements. In France and Israel, only new teachers need to meet this requirement. In Chile, there is an optional assessment, but it is not a licensing requirement.

The provision of digital resources for teachers is the most prevalent national ICT initiative to build teacher capacity. The most frequently reported governmental activity addressing ICT-supported efforts to build teacher capacity focused on the provision of digital learning resources, including home-grown and commercial materials and software tools, through online portals. Seventeen of 21 countries reported the availability of a national website or online portal that houses digital resources.

Some countries are using ICT to support interactive, collaborative models of material development and to share instructional materials and strategies. Six governments participating in the IETE study reported using ICTs to support communities of practice among teachers. Belgium, Canada, New Zealand, Singapore, South Korea, and Sweden all are using Web-based tools (blogs, chat rooms, wikis) to support nationwide communication, collaboration, and sharing among teachers.

Online professional development for pre- and in-service teachers is available in almost half of participating countries. Nine countries (Austria, Chile, Denmark, France, Iceland, Israel, New Zealand, South Korea, and Sweden) reported providing formal online or blended courses to either build teachers' capacity to integrate ICT or for more general pedagogical training.

National ICT-Supported Continuous Improvement Efforts

More than half of the participating countries have invested in information systems to support national and local continuous improvement efforts. Countries with national systems covering their primary and secondary level education systems include Austria, Canada, Chile, Estonia, Finland, Hong Kong, Israel, Norway, and South Korea. Two countries, Portugal and Singapore, are currently in the planning phase for a national administrative system to systematically monitor student academic performance across local jurisdictions and schools.

Over the last decade, many countries began to institute their own internal ICT indicator monitoring and collection systems. Eleven of the 21 country representatives reported national-level efforts to regularly collect data on ICT use by educational jurisdictions, schools, teachers, and students inside and outside school (Australia, Austria, Belgium, Canada, Chile, Japan, England, Estonia, the Netherlands, Norway, and Sweden). Data on ICT indicators is typically collected through regular national surveys of school administrators and teachers and, in four countries, through a sample of the student population (Chile, Belgium, Norway, and Estonia). Surveys are administered annually or every two to three years. By far the most common metrics implemented are measures of access to technology (e.g., Internet access per number of students) and infrastructure (e.g., connection speeds and age of computers). Nine countries reported collecting such data (Austria, Canada, Chile, Belgium, Japan, the Netherlands, Norway, Portugal, and Sweden). However, six countries are also focusing on how ICTs are being used in teaching and learning (Belgium, Canada, England, Estonia, Norway, and Sweden). Four countries are also collecting data on local ICT program administration including planning efforts (Ireland, the Netherlands, and Sweden) and management (Chile).

Ongoing evaluations of ICT in education policies and initiatives occur in nearly half the participating countries. Eleven of the 21 countries reported that an evaluation of an ICT policy or initiative was underway (Australia, Austria, Canada, Chile, England, France, Japan, Korea, New Zealand, Portugal, and Singapore). Five of these countries (Australia, Japan, Portugal, Singapore, and South Korea) have established programs to monitor the implementation of their current national ICT in education plans. In almost all cases, ongoing national evaluation efforts are designed to monitor the implementation of policies or programs rather than to estimate their potential impacts on learning. National evaluations tend to focus on collecting data on how ICTs are being used relative to planned use, the intensity of use, teacher and student satisfaction with the technology, and areas of potential improvement.

Future Directions

Even in the midst of a global economic crisis, countries participating in the IETE study continued to invest in ICT strategies to improve their educational systems, although a few reported scaling back efforts. Continued investments in ICT for teaching and learning are coupled with a growing international interest in the collection of ICT in education data for the purpose of learning from the experience of others who are planning for and investing in ICT to improve education. Currently there are five ongoing or planned international collections related to the use of ICT in education. A recent report published by OECD and the Centre for Research on Lifelong Learning calls for an international consensus on the types of indicators and methodologies that are needed to monitor ICT in education policy and programs.

Results from the IETE study suggest several opportunities for nations to support ongoing international initiatives in providing meaningful and insightful cross-country comparisons that can inform and improve policies and practices. These opportunities include participating in upcoming data collections and international collaborative learning spaces for government officials and supporting efforts to leverage national collections.

International Collaborative Learning Spaces. Given the current interest in the international community for benchmarking and for opportunities to collaborate and share information regarding best practices and lessons learned about the use of ICT in education, the need for an international effort to collect, archive, and disseminate information on country-specific policies and investments in ICT seems evident. The IETE data collection suggests that many governments are grappling with similar issues and concerns and that the experiences of other governments are relevant to each others' policies. There is also a growing reservoir of information on ICT indicators and programs that currently resides within individual countries. Over the last decade, many countries have begun to institute their own internal ICT indicator monitoring and collection systems and have conducted numerous evaluations of their ICT in education initiatives. Governments have an opportunity to create an online space for sharing this knowledge, along with tools and other resources. An ongoing initiative by the European Schoolnet (http://www.eun.org), the development of its Insight portal (http://insight.eun.org), is one example of such an international effort to facilitate the sharing of information on national experiences with ICT in education. The Insight portal is being used to document country-specific information on ICT in education policies and programs with a goal of disseminating this information to the broader community. Currently fifteen European Union member countries are participating.

Despite the level of investments, no country participating in this study seemed entirely satisfied with the degree to which ICTs in education are deployed at a national-level. And the linking of investments in ICT to improvements in student outcomes is the next big research challenge for all countries investing heavily in the use of ICT for education. Thus it may be an opportune time for the international community to collaborate on collection methods, measures, and instruments and collectively participate in data collections in order to maximize resources supporting ICT use in education. Many countries are working on similar issues. A common goal of the international community could be to improve the collective understanding of how best to implement ICT in education and of how best to support teachers and students in acquiring the skills necessary to teach and learn with technology.

Introduction

In a 2009 speech to education researchers, U.S. Secretary of Education Arne Duncan stated, "Just simply investing in the status quo isn't going to get us where we need to go…We're competing with children from around the globe for jobs of the future. It's no longer the next state or the next region." He challenged education leaders to focus on four areas of education reform:

- Adopting rigorous standards that prepare students for success in college and the workforce;
- Recruiting and retaining effective teachers, especially in classrooms where they're needed most;
- Turning around low-performing schools; and
- Building data systems to track student achievement and teacher effectiveness.

To help meet these challenges, the U.S. Department of Education issued the *National Education Technology Plan 2010*, which includes technology-related recommendations for states, districts, the federal government, and other stakeholders to use in helping to achieve these reforms. In an effort to learn from the experiences of other countries, particularly counties with high performing education systems, the Department of Education funded this study, *International Experiences with Technology in Education* (IETE).

Although information about U.S. policies and practices is included in specific sections of the report, the United States is not a primary focus. Instead, the report looks beyond U.S. borders to expand awareness of ICT activities in 21 countries.

The report addresses the following questions:

- What international educational technology data are being collected by international and national organizations? What are the limitations of these data?
- How are technologies being used to improve student access to high-quality instruction?
- How are technologies being used to increase teacher quality?
- To the extent that governments maintain national education data systems for continuous improvement, evaluation and accountability purposes, what indicators are being used to track student progress and inform policy and program decisions?

To address these questions, the project team collected and analyzed data from two main sources: (1) a Web-based search to identify recent international data collections related to the use of ICT in education and (2) a survey and interview with selected government officials in 21 countries. International data collections identified through June 2009 were included in the review. Survey and interview data were collected primarily in the spring and summer of 2010, although country respondents may have been contacted after the primary collection for points of clarification. As noted elsewhere in this report, national policies and programs appeared to be in flux during data collection. Information in the report is intended to be accurate as of July 1, 2010. Please see Appendix A for details on the study methodology and Appendix B for a list of selected indicators from prior international collections related to ICT in education and the research questions stated above. Unless otherwise stated, data regarding country practices are drawn from survey and interview responses from country respondents identified in Appendix C.

The country selection process began with the identification of industrialized countries with significant technology infrastructure to support the widespread implementation of ICT in education. Rankings on both the Networked Readiness Index (NRI)[2] and the labor productivity index (LPI, 2008 GDP per person employed)[3] were also used. Geographical representation was not considered. Exhibit 1 is the final list of countries included in this review.

Exhibit 1. Countries Included in This Report

Australia	Estonia	Netherlands
Austria	Finland	New Zealand
Belgium (Flemish Community)	France	Norway
Canada (Alberta)	Hong Kong (SAR, China)	Portugal
Chile	Iceland	Singapore
Denmark	Israel	South Korea
England	Japan	Sweden

Eighteen of these governments are countries and three are governmental bodies that are responsible for setting educational policy within a defined region of a country. Canada and Belgium do not have national education ministries. The province of Alberta and the Flemish Community, respectively, were selected in these cases. Similarly, Hong Kong is a Special Administrative Region of the People's Republic of China. The selection of these three governments was based on the recommendations of the study's Technical Working Group and supported by the precedence of their prior inclusion alongside national governments in international ICT collections. For example, SITES 2006 featured Alberta as one of its

[2] The NRI, developed by the International Technologies Group at Harvard University (http://cyber.law.harvard.edu/itg/) and currently administered by the World Economic Forum, is a composite of three components: the environment for ICT offered by a given country or community, the readiness of the community's key stakeholders (individuals, businesses, and governments) to use ICT, and the use of ICT among these stakeholders. Data are derived from publicly available sources and an executive opinion survey conducted by leading research institutes and business organizations within the countries included in the analysis. In total, data on 27 indicators, including utility patents, mobile phone use, and bandwidth available, are combined with 41 survey indicators to give the overall NRI score.

[3] The LPI used is based on a country's 2008 GDP per person employed in 2008 U.S. dollars. The international data reported were taken from the Total Economy Database on Output and Labor Productivity maintained by The Conference Board (http://www.conference-board.org/economics/database.cfm#6).

participating education systems. And ICT indicators such as the Network Readiness Index typically include Hong Kong as a separate entity. For the sake of convenience all 21 governments are referred to as “countries” or “participating countries” in the text that follows.[4]

Review of Existing International Collections

Research analysts identified a set of online sources to review that provided information on ICT in education indicators, attending specifically to the availability of information that would be both relevant to current U.S. goals and feasible to collect from a broad set of countries. As a result, the review of online sources focused primarily on reports from existing multinational collections, including such efforts as the Second Information Technology in Education Studies (SITES), The Programme for International Student Assessment (PISA), Progress in International Reading Literacy Study (PIRLS), Trends in International Mathematics and Science Study (TIMSS), two surveys of European Union countries—Eurydice and eLearning Policy Indicators 2006: Head Teacher and Classroom Teacher Surveys (ECEP)—and two surveys of Asian countries by the Organisation for Economic Co-operation and Development (OECD) and the Asia-Pacific Economic Cooperation (APEC). The review included both survey instruments used in these collections as well as the associated dissemination reports. In addition, the project also examined a set of country-specific reports from the United States, United Kingdom, South Korea and Australia to supplement the information on existing ICT in education indicators from the multinational data collections. The reviews of 11 reports associated with eight major multinational data collections resulted in the identification of over 230 unique indicators for possible consideration relevant to U.S. policy goals (see Exhibit A-1 and Appendix B for additional information about the collections reviewed and indicators found, respectively).

Indicators and data available had three major limitations: 1) data were incomplete across policy priorities of interest, 2) participation among selected countries in multinational collections was limited, and 3) current major international collections are not conducted on an annual basis which currently limits their ability to contribute up-to-date information on international investments in ICT for education. Few indicators are currently available from international collections to inform how technology is being used across various countries to deliver professional development to teachers. And no indicators were identified that provide data on countries’ investments in technology to monitor and manage educational performance for continuous school improvement. Also limited is international data on emerging ICT uses to aid instruction including investments in online learning, use of mobile and social networking technologies and the use of tablet devices. Thus far international collections have not been updated to reflect these emerging trends in ICT in education investments. In addition, country participation in international collections is limited. For example, SITES 2006 had limited participation that included only 22 education systems. The United States did not participate in this study, and only 14 of the 25 countries initially identified for participation in the IETE study

[4] Twenty-five countries were selected for inclusion in the study. In addition to the countries listed in Exhibit 1, researchers tried to include Germany, Ireland, Taiwan and Switzerland in the study. However, multiple factors precluded the participation of these four countries, including staffing resources and state- or province-level (rather than national-level) policymaking and planning. Sufficient information was collected on Ireland to include a country profile in Part II of this report.

participated in SITES. The Eurydice and ECEP studies were limited to European Union participation; the APEC study was limited to the participation of Asian Pacific countries. Only IEA (TIMSS, PIRLS) and OECD (PISA) assessment studies have a broad base of country participation that address the policy needs of the United States. But these studies are not focused on ICT indicators, and consequently in the past they have supplied limited information that is relevant to U.S. ICT in education priorities.

Finally, of the major international collections reviewed, none of the collections were conducted on a regular basis nor are there plans for future administrations, thus limiting their role in any future international efforts to benchmark ICT in education trends. Of the studies reviewed for this report that focus on ICT indicators, the ECEP, ISUSS, APEC and Eurydice studies were one-shot studies. And while SITES represents a series of five studies (CompEd: 1989, 1992; SITES M1: 1998-1999; SITES M2: 2000-2001; SITES 2006), the focus of each study varied as did the data collection methodology. An additional SITES study has not yet been scheduled by the IEA. Only for the IEA and OECD assessment studies – PISA (every 3 years), TIMSS (every 4 years) and PIRLS (every 5 years) - was there a regular cycle of offerings. But as described above, these studies historically have focused primarily on student achievement, although there is an increase in consideration for technology-related survey items in future collections.

Scheduled Future Studies

In the near future, four international studies with implications for research on ICT in education will be initiated as follows: a United Nations-sponsored effort to update the ICT Core Indicators; an updating of OECD's TALIS survey; OECD's online administration of PISA 2012; and IEA's administration of the International Computer and Information Literacy Study (ICILS.

ICT Core Indicators. The United Nations Conference on Trade and Development (UNCTD) brought together partners, including UNESCO, the World Bank, International Telecommunications Union (ITU), OECD, EuroStat and other organizations, to update the ICT Core Indicators. The previous Core Indicators, last updated in 2005, were limited to national infrastructure, access to and use of ICT by households and individuals, use of ICT by businesses and commerce in the ICT sector. In 2010, the indicators were expanded to include educational ICT for the first time. At this point, there are only eight educational ICT indicators. They are:

1. Proportion of schools with radio used for educational purposes
2. Proportion of schools with television used for educational purposes
3. Proportion of schools with a telephone communication facility
4. Learner-to-computer ratio in schools with computer-assisted instruction
5. Proportion of schools with Internet access by type of access
6. Proportion of students who have access to the Internet at school
7. Proportion of learners enrolled at post-secondary level in ICT-related fields
8. Proportion of ICT-qualified teachers in schools

While these new core indicators have not yet been used to report data, the intent is that they will be reported by the ITU for participating countries on an annual basis.

Teaching and Learning International Survey (TALIS). The next cycle for OECD's TALIS, described above, is 2012-2013, when efforts will be made to coordinate samples with PISA. The design process for this survey is in its initial stages.

PISA 2012. PISA 2012 will continue to move toward ICT-delivered assessment, offering digital assessments of mathematics and reading. In addition, PISA will be totally revised by the 2015 administration (www.pisa.oecd.org). Science will be the featured discipline, the entire assessment will be delivered electronically, and the assessment items will be redesigned to take advantage of capabilities of ICT, using interactivity and simulations to engage students' higher-level skills.

International Computer and Information Literacy Study (ICILS). IEA is currently in the planning phase of International Computer and Information Literacy Study (ICILS), scheduled for administration in 2013 (www.iea.nl). The ICILS plans to address an individual's ability to use computers to investigate, create, and communicate in order to participate effectively at home, at school, in the workplace, and in the community. The ICILS assessment will be authentic and computer-based, incorporating multiple-choice and constructed response items based on realistic stimulus material and software simulations of generic applications. Students will be required to complete an action in response to an instruction and authentic tasks will require students to modify and create information products using "live" computer software applications. Consequently, as ICT becomes integrated into mainstream studies, the data on student outcomes will have greater implications for ICT policy.

Survey of National Collections

In order to develop a more complete understanding of ICT in education policy and practices among participating countries, the IETE project collected survey and interview data from 21 country representatives. The project team used the surveys and interviews of country respondents to update existing information and include more qualitative information on international programs and priorities for ICT in education. The focus of these efforts was to develop a picture of national activities in these 21 countries. Data about individual provinces or local activities were not a priority for collection. Country respondents were asked to report on data already available; no respondents were asked to conduct new data collections within their countries. Appendix C provides the final list of country respondents to the study's survey and interview protocol.

The data collection for this study (2009–2010) took place during a time of global uncertainty. Over these months, several countries were grappling with the global economic downturn. Iceland, Ireland and Sweden were all suffering from the repercussions of the recession. In addition, at least two countries, England and Japan, experienced changes in government administrations. This underscores the instability of data collected in dynamic global contexts, in which programs and priorities can change dramatically and suddenly. It also suggests the need for regular review and updating of data collected, particularly because the use of technology in education is rapidly changing in its own right.

Organization of this Report

This report has two main parts. Part I provides an overview of international programs and priorities by synthesizing the individual country reports that are in the second part of the report. Unless otherwise noted, information about countries and their policies and programs in Part I is derived from the country-specific narratives or "profiles" included in Part II. In the first part of the report, summaries of international practices and priorities related to five themes are presented: (1) the international context at the time data were collected and national governance for education among the countries included in the study, (2) infrastructure, (3) the use of ICT for instruction, (4) the use of ICT to prepare teachers and (5) ICT-supported continuous improvement efforts. Part I concludes with a summary of report findings, their implications, and future directions. Future directions focus on potential efforts to collect systematic and comparable data describing the type and impact of ICT policies and programs in education across a range of countries.

Part II includes narrative descriptions of ICT in education activities for each country included in the study. Each of the individual country profiles begins with a one-page graphical snapshot of key country indicator data available from secondary sources. This data is followed by an overview of the country's educational system and then priorities and programs related to infrastructure, the use of ICT for instruction, the use of ICT to build teacher capacity, and ICT-supported continuous improvement efforts.

Part I:
International Overview of ICT in Education Activities

International Overview of Educational Planning and Governance

This section describes the national political and economic context in which the policies and programs that support ICT in education operate. It also provides an overview of the use of national education technology plans in many of the 21 countries reviewed.

Educational Authorities' Roles and Responsibilities

The role of the national government in education ranges from comprehensive in places with strong central powers regarding education (e.g., Chile, England, Estonia, Hong Kong, the Netherlands, New Zealand, Norway, Singapore and South Korea) to more narrow in places with strong local control of education (e.g., Austria, Canada, Israel and Sweden). The remaining countries, however, do not fall neatly into simple conceptions of national versus local control. For example, although educational responsibilities appear to rest at the national level in Belgium, educational governance is in fact shared among distinct linguistic groups (Flemish, French and German). Similarly, age of students can affect which level of government takes the lead such as in Austria, where local agencies have authority over the education system for children ages 6–15, while the national government shares responsibility for students ages 16–18.

Indeed, across many of the 21 participating countries, the relationships between national and provincial governments are evolving toward shared responsibility. Ten countries (Austria, Denmark, England, Finland, France, Iceland, Japan, the Netherlands, Portugal and Sweden) reported that educational governance is shared across the national and local levels. Typically, the national government is responsible for setting goals, including curriculum and competency standards for schools, teachers and students. France, for example, has a national curriculum but the Ministry of Education takes a results-oriented approach, leaving the specifics of implementation and financing to local authorities. In Denmark, England and Portugal, the national governments have a relationship with local authorities comparable to that in France. National governance often also entails the maintenance of accountability systems across provinces or states and, as in the Netherlands and New Zealand, the provision of substantial funding to the local level.

Responsibilities specifically for ICT in education span a similar range of governance structures—structures that are either centrally controlled, locally controlled or a shared responsibility between central and local control. Countries including Chile, Denmark, Estonia, the Netherlands, Singapore and South Korea—and, until recently, England— manage policy and planning for ICT centrally in either a ministerial unit or quasi-governmental organization. Others leave decisions regarding technology largely to local governments (e.g., Canada and Sweden).

National Policy and Planning for ICT in Education

The development of a strategy for ICT use in education is a common undertaking that national or provincial governments use to engage and coordinate multiple stakeholders. These strategies provide a vision for how and why ICTs should be used by educational systems, an analysis of gaps between the current state and the vision and a set of goals consistent with the vision put forward. In many places, these are called national education technology plans or “master plans.” Many countries indicated having had such a plan in the last 10 years. All 21 countries identified at least one document in which national guidelines regarding ICT in education are presented. Of these countries, nine governments (Australia, Austria, Belgium, Canada, Chile, Finland, Hong Kong, Portugal and Singapore) had a comprehensive, national plan guiding policy and programs in place during 2009–10. For another six governments (Canada, France, Israel, Japan, New Zealand and South Korea), national education technology plans were actively in development in 2010. [5, 6] England had a new plan as of 2009, but a change in administration raised uncertainty about the execution of that plan.

In most countries with decentralized education systems, the plans themselves are typically referred to as “guidelines” rather than “mandates” and can take on several different forms. They may be stand-alone documents focused exclusively on ICT in education, integrated into broader curriculum frameworks (as in Denmark and Norway), or integrated into cross-sector governmental strategies for ICT (as in Finland and Iceland). Finland’s Ubiquitous Information Society plan, for instance, was developed under the aegis of the Ministry of Transport and Communications with input from other ministries (Education, Employment and the Economy, Social Affairs and Health, Justice, Finance, Defense and the Interior), research organizations, and private companies.

Although stand-alone plans are still the norm, countries such as Estonia and the Netherlands are moving away from high-level vision documents. In Estonia, for example, the broad strategy plan is reviewed annually and specific, year-long action plans are developed as a result. These guide the activities of Estonia’s ICT in education agency, Tiger Leap, a nonprofit organization that also benefits from significant ministerial support. The Netherlands has taken a similar approach, with national ICT in education plans guided by an annual planning activity conducted by the Kennisnet Foundation.

National goals for ICT in education, in whatever form they are expressed, share many common elements. These goals include: updating infrastructure; ensuring equity of access to digital technologies; improving ICT proficiency among students, teachers and administrators; increasing the availability of digital learning resources; and increasing the integration of ICT into instruction to support students’ creativity and problem-solving and collaborative skills.

[5] In Alberta, the existing education technology policy guides programs until the new policy is approved by the Minister.
[6] The U.S. released its National Education Technology Plan in November 2010.

The Role of the Private Sector

The role of the private sector in national, public educational efforts varied considerably across countries. Seven countries (Canada, England, Iceland, Japan, Norway, Singapore and Sweden) reported little or no significant engagements between the educational ministry and the private sector. Japan seems to limit private sector involvement in education in order to avoid potential conflicts of interest, although even in Japan teacher training occurs frequently through private sector providers and there are research and development collaborations. The representative from Norway reported a more collegial relationship with the private sector in which experts from industry frequently consult and advise educational administrators, often on an informal basis. Canada, England and Iceland reported fee-for-service types of contractual relationships with content and service providers. New Zealand and Portugal also reported contracting for content and services with the private sector in addition to their other activities reported below.[7] Hong Kong, Singapore and South Korea also accept private sector donations in the forms of hardware, software and funding for program development.

In some cases local, private industry is viewed as a source of both expertise and funding. Estonia and Israel reported receiving funds for operating expenses of a national foundation and third-party funded instructional projects, respectively. A reported 15 percent of operating funds for Estonia's Tiger Leap Foundation come from the private sector. Israel reported that 50 percent of key infrastructure programs are funded by third parties. In Portugal, the private sector is actively engaged in educational programs as a stakeholder that depends on an educated workforce. Portugal's private sector is expected to contribute to workforce readiness by providing internships and training opportunities.

Countries identified strategies for supporting software publishers and encouraging a local market for educational technologies by investing start-up funds or seed grants, stimulating demand among teachers and schools, and creating policies that enable private sector activity, such as licensing arrangements and continuity of funding. Seven countries (Chile, Denmark, Finland, France, Hong Kong, the Netherlands and New Zealand) reported a relationship with the private sector related to content for student instruction or teacher training, including a reported focus on the support of the development and distribution of digital learning resources by the private sector. Hong Kong's ICT in education policies, for example, are designed to support the market as a sustainability strategy. In fact, Hong Kong has a memorandum of understanding in place with IT companies to limit competition between public and private content providers. Hong Kong, Denmark and the Netherlands have websites that showcase commercial products. Chile and Denmark also provide start-up investments and seed grants for the development of content that can be sold to schools, often at a volume discount. Finland recently partnered with software publishers to distribute digital materials, and in France the ministry partnered with publishers to pilot digital textbooks. In New Zealand the private sector participates in communities of practice for teachers.

[7] Feedback from respondents provided evidence that this practice is probably more prevalent than a review of study data suggests. Countries may have underreported activities that were not considered noteworthy or simply commonplace.

Summary

Although the role of national governments in ICT in education varied among the study’s 21 participating countries, governments generally appear to be trending toward shared responsibility for educational systems at the national and provincial levels. Whether in stand-alone documents or integrated into cross-sector ICT strategies, national education technology plans are widely used to convene stakeholders and coordinate activities across levels of government. The private sector often plays a role such as either a provider of ICT hardware, software and services or an educational stakeholder that is viewed at the national and local level as a key contributor to the education system. Cultural norms and smaller markets that are less desirable to the private sector seem to limit the role of the private sector in some countries.

Infrastructure

Access to the Internet and a robust ICT infrastructure form the foundation for any subsequent ICT investments intended to yield long-term benefits. The Internet has transformed how people interact with information and each other through such capabilities as digital online portals, videoconferencing and data streaming. Globally, the number of Internet users has risen steadily in the last decade, from approximately 400 million (roughly 7 users per 100 inhabitants) in 2000 to 1.8 billion (about 27 users per 100 inhabitants) in 2009 (Exhibit 2).

Exhibit 2. Global number of Internet users, 2000–09

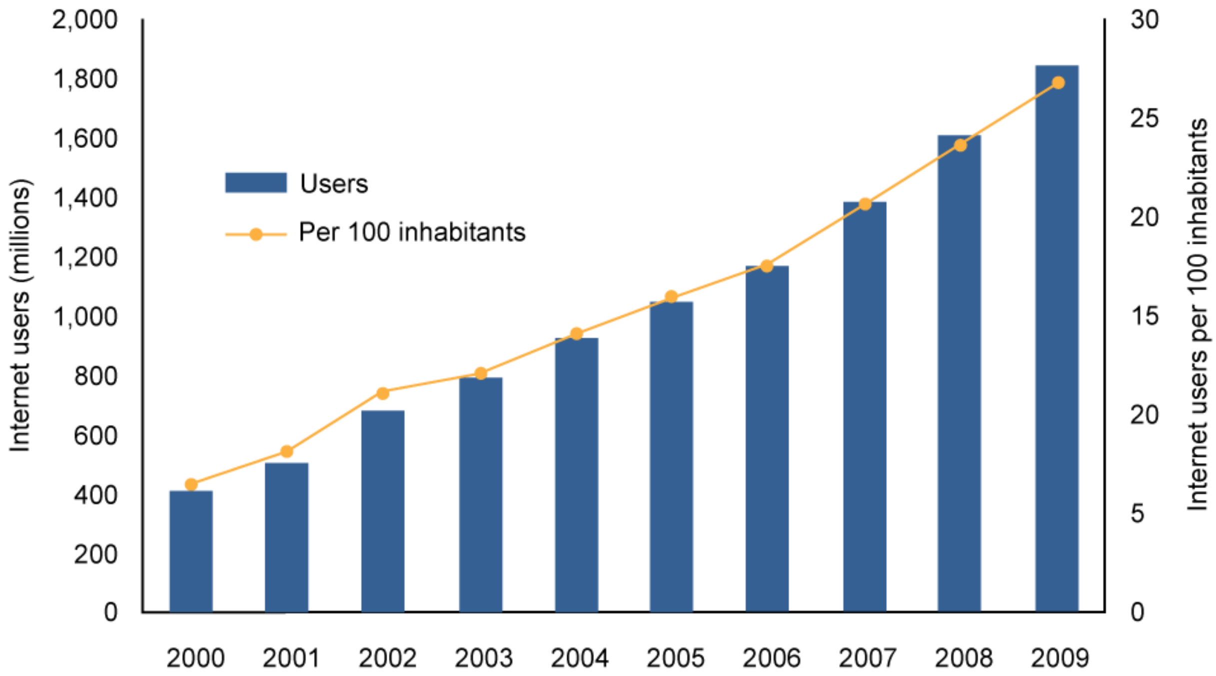

Exhibit reads: In 2000, approximately 400 million people, or 7 in 100 people globally, were using the Internet. In 2009, 1.8 billion people, or about 27 users in 100 people globally, were using the Internet.

Source: International Telecommunication Union 2009.

Given that broad and equitable ICT access figures prominently in numerous participating countries' national plans for ICT in education, it is not surprising that 19 of 21 respondents consider ICT infrastructure a high priority. Even countries that have achieved earlier infrastructure targets continue to invest in improvements, such as newer and more advanced technology, faster Internet connections and expanded access to populations and areas not previously served.

This section focuses on three important components of ICT infrastructure that are affecting education: Internet connectivity, hardware and technical support. It also addresses two notable trends to support ICT adoption―the use of cloud computing and the development of interoperability standards.

Internet Connectivity

Although the number of Internet subscriptions per 100 people ranges from 32.47 to 90.56 across participating countries, access to faster connections is far more rare. As of 2009, no country in the sample had more than 50 broadband subscriptions per 100 inhabitants (International Telecommunication Union 2009). The number of broadband subscriptions is likely to continue to grow in the near future. Nearly all (20 of 21) countries consider improving Internet connectivity a high priority, and more than half (12 of 21) explicitly stated an aim to improve connection speeds in schools.

Some national broadband access programs are part of cross-sector, national level initiatives that benefit the general population. The Digital Education Revolution fund in Australia, for example, allocates USD 80 million to support a program that targets delivery of broadband connections of up to100 Mbps in 93 percent of Australian schools, homes and workplaces. The program includes provisions for remote locations of wireless and satellite connections, which function at speeds at least 12 Mbps. Its objective is to deploy high-speed connections consistently in order to facilitate more seamless, anytime-anywhere connectivity for students. The stimulus-funded program, Building the Education Revolution, also includes modernization of school facilities, primarily for those serving students ages 6–12 (primary school), as one of its broader targets. Similarly, the SuperNet High Speed Network project in Alberta, Canada, provides broadband connections to the Internet for all public institutions, including schools. The province provides funding for a basic level of service, upon which local authorities can expand. Schools can opt for increased bandwidth at subsidized rates.

Extending learning opportunities beyond traditional classroom boundaries and meeting the needs of underserved populations were both cited by study respondents as goals for improving connection speeds in schools. Six countries (Australia, Canada, Chile, France, Iceland and New Zealand) explicitly target improving service to rural populations, some through broader efforts that rural students also benefit from and others through specific education initiatives. As an example of a broader approach, the government of Iceland provides network infrastructure in rural areas not already served by commercial providers, which hesitate to extend their own infrastructure due to the limited market potential. A pilot program in New Zealand involved implementing videoconferencing ICT among 200 schools to share teaching expertise.

Three countries (Belgium, Canada and the Netherlands) address the specific needs of certain populations by extending learning beyond traditional school spaces and schedules. Belgium's ICT Without Boundaries program provides access for students with disabilities and chronically ill students. The program has created an email client for mentally disabled children and a special interface that allows ill children to follow and participate in class remotely. Ill children use a laptop to view their classrooms via webcam. They can ask questions through voice or chat, print handouts and submit assignments using the interface. Canada is exploring ways to better serve students at risk of not completing high school and English- or French-language learners, and the Netherlands is experimenting with an online platform to offer accelerated learning for gifted students.

Interpreting published connection and transmission speeds of networks can be a misleading indicator of true Internet connectivity without considering the end user's connection. A user may never experience a network's advertised speeds, depending on the quality of the "last mile" of the wired network, the quality of a wireless connection and the age of the user's computer. Further, demand for access can vary by grade level.

ICT Hardware

Providing access to hardware is another priority shared by nearly all (19 of 21) participating countries, even though nine countries reported that current levels of hardware access were sufficient. Although computers are the primary focus of policies and programs concerning hardware, eight countries also reported efforts to increase access to other technologies, such as interactive whiteboards and liquid crystal display projectors.

Target Ratios

Participating countries generally track and establish targets for the number of teachers and students who share a given computer or other Internet-enabled device. Target ratios are often used to help governments identify inequalities among schools or regions. And representatives of four countries (Chile, France, Japan and the Netherlands) reported that they regularly survey schools to keep an updated inventory of equipment.

Eight countries reported large scale investments to improve current ratios (Australia, Canada, Estonia, Israel, Japan, Korea, New Zealand and Portugal). Of these, the sheer scale of Portugal's laptop rollout—1.2 million since 2007—makes it worthy of mention. National programs provide discounted laptops for students of different ages, with low-income families receiving subsidies (Portugal Ministry of Education website). The target ratio for older students is one computer for every two students.

However, the utility of technology ratios as an important indicator of technology integration and the ability to compare published ratios across countries is questionable. As recent reports from France and French Belgium have observed, calculating a meaningful ratio requires more than merely counting machines. Other factors worth considering include the age of the computers, whether they are in working order, the presence and quality of Internet connections, the presence of appropriate software, the presence of appropriate peripherals (such as printers, scanners, or projectors), and location in the school (Fourgous 2010; AWT 2010). Because there is no standardized approach for computing existing and targeted student- and teacher-technology ratios, comparing published ratios from individual countries is not always possible.

One-to-One Computing

Nine of the 21 participating countries are pursuing one-to-one computer ratios for either teachers or students or both (Australia, Austria, Canada, Estonia, Israel, Japan, South Korea, New Zealand and Portugal). Five countries have a goal of one-to-one computing for teachers (Estonia, Israel, Japan, New Zealand and Portugal). And of the eleven respondents who reported national plans to decrease computer-to-student ratios, six of these are aiming for one-to-one for a subset of students (Australia, Austria, Canada, Israel and Japan) while South Korea is aiming for one-to-one computing for all students ages 6-18 by 2013. One-to-one initiatives focus on laptops or less expensive netbooks, and can include tablet computers or mobile smartphones as well. For example, the Australian government is investing USD 1.8 billion, or about 95 percent of the total funding for its national ICT plan, to achieve one-to-one computing for all students in grades 9 through 12 (ages 14 to 17) under its National Secondary School Computer Fund.

Mobile Devices

Affordability and the existing widespread penetration of mobile devices, including student-owned devices, are fueling countries' interest in netbooks, tablets and smartphones as tools for teaching and learning. Exhibit 3 illustrates the prevalence of mobile phone subscriptions in participating countries, although without distinguishing subscriptions for Internet-enabled phones. Eight of 21 country representatives reported that their countries were currently implementing pilot programs involving mobile devices (Austria, Canada, Chile, Israel, Japan, New Zealand, Singapore and South Korea). For example, South Korea reported piloting digital textbooks which students access on tablet computers. In addition, the national education technology plans of both Austria and Singapore contain language describing the positive potential of mobile devices. However, student-owned Internet-enabled devices can also be perceived as a distraction rather than a resource. In Finland, home of GSM pioneer Nokia Corporation, mobile phones are currently banned from classrooms, although small pilot projects are underway to exploit the devices for teaching and learning in the longer term.[8]

[8] GSM, or Groupe Spéciale Mobile, was the first and is today the most widespread internationally accepted standard for mobile telephony.

Exhibit 3. Mobile phone subscriptions in sample countries, 2006

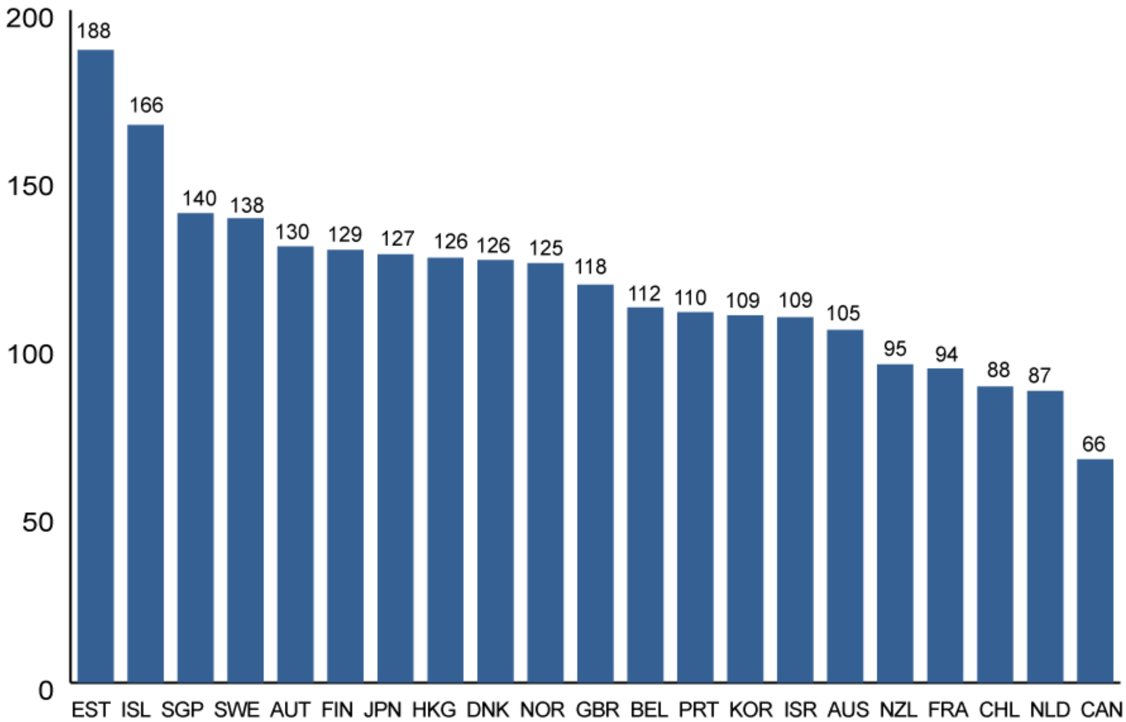

Exhibit reads: Estonia has 188.2 mobile phone subscriptions per 100 people. (A list of country abbreviations can be found in Exhibit 15.)

Source: SITES 2006.

ICT Technical Training and Support

Although almost all participating countries (18 of 21) consider providing improved technical support a priority, not all support this need with programs. England, for example, provided national funding for hardware purchases but relied on schools to fund their own technical support services. Schools bearing responsibility for their own support was the most common technical support model according to SITES 2006 (Exhibit 4).

Exhibit 4. Technical support providers

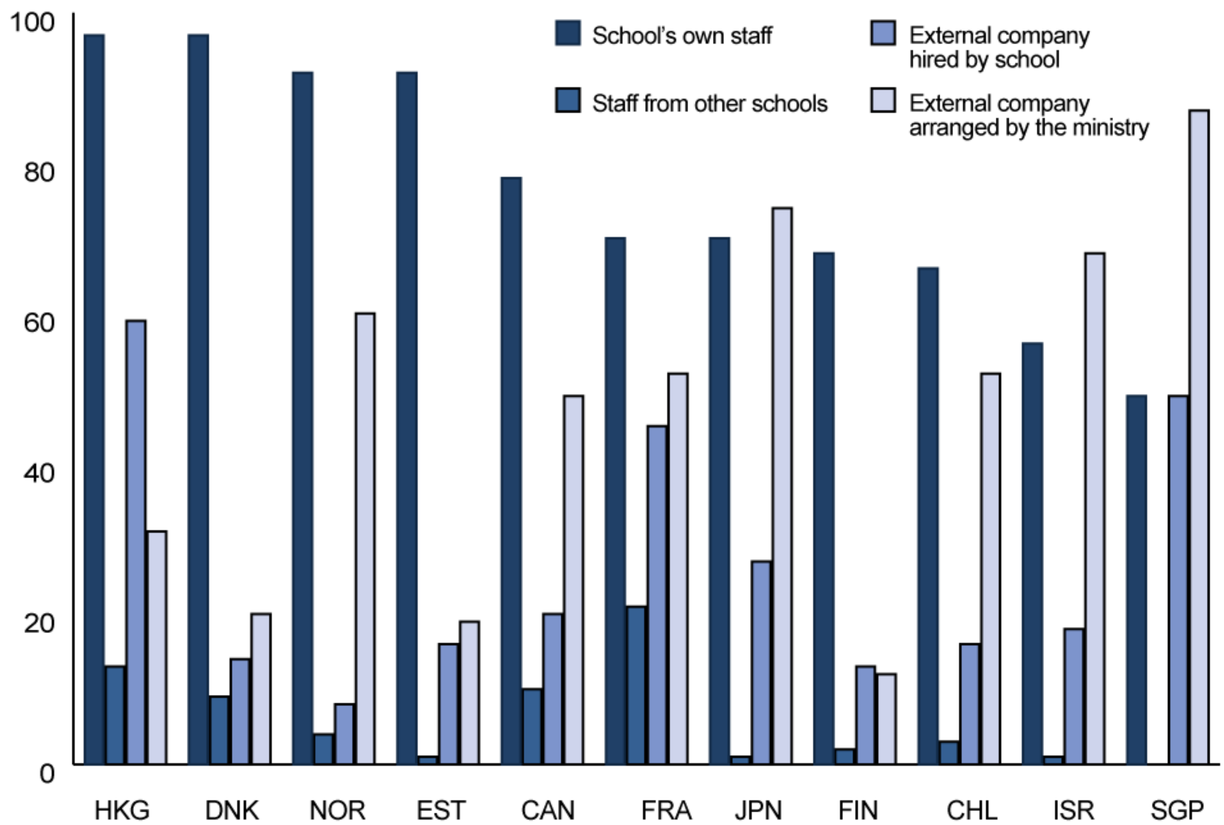

Exhibit reads: In Hong Kong, 97 percent of schools have some technical maintenance provided by their own staff and 12 percent of schools have some technical maintenance provided by the staff of other schools. Almost 60 percent of schools have some technical maintenance provided by external companies hired by schools and approximately 30 percent of schools have some technical maintenance provided by companies hired by the Ministry.

Source: SITES 2006

In contrast to local models of technical support, some governments are providing training and support services as part of hardware improvement initiatives. Portugal, for example, conducted a needs-based analysis and studied existing support programs in other countries in order to develop a support program to accompany its massive current infrastructure rollout. The program, that takes a centralized, comprehensive approach, includes face-to-face support as well as phone-based and Web-based resources. Along the same lines, New Zealand established a National ICT Helpdesk for hardware and software support. Austria embedded training and technical support in a Ministry-developed, centrally run learning management system, with the view that reducing the costs and logistical burden for schools would promote schools' adoption of the system. In Israel, the Smart Classrooms initiative couples hardware grants with 120 hours of teacher professional development (Exhibit 5).

Exhibit 5: Integrated Approaches to National Technology Rollouts

Infrastructure improvement and investment are important aspects of ICT use in education, but without coordinated, integrated plans to support implementation, equipment may remain underused by teachers, students and administrators. Several countries have developed integrated approaches to rolling out ICTs in education, linking infrastructure investments to explicit requirements around training and professional development, maintenance and support and technology management, in order to help ensure that the technology works as planned and that teachers and students know how to use it. Portugal, Israel and Chile offer three examples of how training and other requirements are linked to ICT investments.

Portugal's Ministry of Education links large-scale ICT infrastructure investments with teacher training and technical support. The Ministry of Education conducted a study on barriers to increasing ICT use in schools and found that limited ICT-focused teacher training and a lack of ICT competency certification were major factors. In order to reduce these barriers, the Ministry mandated certification in basic ICT skills and in competencies for integrating ICTs into teaching and learning, with the goal of having 90 percent of teachers certified by the end of 2010. The resulting *ICT Competencies Training and Certification* program was developed as part of the national Technological Plan for Education (Plano Technólogico Educação). The Portuguese government created a law establishing the System of Training and Certification of Competences in ICT, with three levels of certification, (1) certificate of competence, certifying basic skills; (2) certificate of teaching skills, certifying the ability of teachers to use ICT in teaching and learning; and (3) certificate of advanced skills, certifying the ability of teachers to use ICT as a resource from the perspective of innovation and education research (Diario de Republica website). Portugal's Center for Technological Support for Schools project (CATE) provides technical support for teachers, as well as other users. CATE integrates the support services (a helpdesk) of several technology suppliers for the Ministry to one point of contact, that creates a simplified process for schools to receive assistance (Plano Technólogico Educação 2008).

Similarly, Israel requires teacher training and provides technical support for new infrastructure investments. The "Laptop for Every Teacher" program (www.athenafund.org) and the "Smart Classrooms" program (www.kadimamada.org) both provide new infrastructure for classrooms, and the Ministry of Education supplements the technology with instruction and preparation for its use. Both programs provide teachers with 120 hours of training to ensure their success and the "Laptop for Every Teacher" program has targeted courses focusing on general computer skills and how to access useful information on the Internet, to help facilitate student learning as well. In addition to providing teacher training, Israel's Ministry of Education also provides technical support.

In Chile, the Ministry of Education requires that schools commit to teacher training before new infrastructure is delivered to a school. In addition to training, schools must sign two other agreements, an "ICT Management Plan," committing to maintenance and support, and an "ICT Use Plan," defining clear strategies and goals for use. Enlaces, the Chilean ICT in education agency, finds that the agreements help lay important groundwork for new infrastructure provisions by urging school staff to work together to develop a unified vision (www.enlaces.cl).

A variety of models are being used to provide on-site technical support as is demonstrated by the models in place in France, Belgium, Ireland, and Chile. In France, for example, each region (academy) has its own ICT advisor who works with school staff while also contributing to nationally available guidance materials aimed at supporting teachers. Belgium has adopted a school-based approach, whereby the ministry designates a half-time in-school ICT coordinator for every 100 full-time school staff members. The majority of ICT coordinators there spend their time on technical issues such as cabling, maintenance and security, although their mandate does specify pedagogical support. In Ireland, the National Centre for Technology in Education has been creative in its attempts to meet teachers' needs for support without hiring additional dedicated ICT staff: Primary-school principals were trained to provide technical support to supplement overextended in-school ICT coordinators.

As Chile's approach to support demonstrates, the responsibility for maintenance and support does not have to lie entirely with the ministry or entirely with schools. When Chilean schools receive government-funded ICT infrastructure improvements, they must commit in writing to defining usage goals for the new infrastructure, including goals for teaching and learning, before receiving funds. Schools must also develop and sign a technical support and maintenance plan and ensure teacher training and the proper management of the use of the technology for teaching and learning. For the ministry, these use agreements are a means of both gauging a school's interest in new infrastructure and encouraging school staff to develop a unified vision for how it will be used and supported.

Other ICT Trends

Cloud Computing

Cloud computing is an Internet-based computing architecture for centralized processing, storage and services for a large number of networked computers (Urquhart 2010). Cloud computing is being implemented to reduce local hardware and maintenance costs, improve cyber security and facilitate access to software resources. South Korea, for example, is developing supercomputing facilities to be shared by all the nation's research entities as a means of promoting collaboration across sectors and providing secure storage. In Austria, a standardized learning management system supported by centralized servers and services is being deployed to reduce the cost of local investments in server hardware and maintenance.

Interoperability Standards

Interoperability standards can help existing digital resources be more seamlessly integrated and allow new digital resources to be designed with compatibility in mind. Although this study's survey did not address interoperability standards specifically, representatives of several participating countries discussed them in the follow-up interviews. Study data do not support an exact count of how many countries already have interoperability standards in place and where they are being developed. However, the experiences of two participants – Australia and Singapore – demonstrate the interest in this area. In a partnership between Australia and New Zealand, interoperability standards for digital resources are in the planning phases. The objective of this partnership is to improve the sharing of digital resources between countries. In Singapore, the ministry has outlined interoperability standards for the learning management systems used by schools. Schools must comply to ensure compatibility with existing and future software applications.

Summary

The countries included in this study already had relatively advanced ICT infrastructure in place, given that a high score on the Network Readiness Index was a criterion for selection. Even so, nearly all participating countries are still prioritizing improvements to existing ICT infrastructure. National broadband initiatives, in which ministries of education may play little or no direct role in their funding or implementation, can improve ICT-related opportunities within schools while also helping extend learning opportunities beyond the school day. Several countries are taking advantage of better broadband infrastructure to deliver resources to rural populations or specific groups, such as homebound students or high-level athletes. Many countries seem to agree that hardware investments are a prerequisite to taking advantage of improved connections. Most hardware investments focus on computers, especially laptops, although some countries indicated that investing in interactive whiteboards and projectors constitutes an additional priority. Several countries are examining the potential of mobile devices—not only laptops, but also netbooks, tablet computers and even smartphones—and some are including student-owned devices in their approaches to achieve goals for computer-to-student ratios.

Numerous countries are linking investments in hardware and connectivity with strategies to promote adoption. Some countries are using small-scale pilots to inform the planning for national-scale initiatives. And several ministries are playing a role in providing technical support and teacher professional development, in addition to funding infrastructure development.

Improving Student Learning Through Technology-Enhanced Instruction

The IETE analysts' review of six prior international data collections that compiled information on ICT in education (all of which took place between 2001 and 2006) yielded 106 indicators relating to improving student learning through the use of ICTs—far more indicators than were found in any of this study's other focal areas. (A complete list of these indicators is in Appendix B.) The large number of indicators associated with ICT use for instruction underscores the complexity of this topic. This section is organized around three broad categories: ICT standards for students, including expectations for students' skills, attitudes and achievements; ICT-supported teaching and learning, from digital textbooks and learning management systems to resources tailored to special needs students; and ICT-supported assessment, including electronically administering assessments and the use of e-portfolios.

ICT Standards for Students

In this report, ICT standards for students are defined as a framework or set of guidelines that describes desired student outcomes or competencies with regard to ICT, whether or not those competencies are assessed and whether or not they are mandatory or recommended. Seventeen of 21 countries have ICT standards for students either embedded in other academic content standards or in separately articulated documents.[9] In both cases, the goal is to integrate ICTs throughout the curriculum. In four countries, either no standards are in place or standards are determined at the local rather than national level.

The most prevalent model of student standards outlines a combination of technical, analytic and social ICT skills. That is, students should learn to efficiently operate common applications—word processing programs, spreadsheets, presentation software and Internet browsers—while also being able to use these tools to support problem-solving, critical thinking and decision-making. Social ICT skills include communication and collaboration. Respondents used such terms as "media literacy" and "digital literacy" to encompass technical, analytic and social ICT skills. Another term frequently invoked in standards, "21st century skills," generally includes the analytic and social sides of ICT use and can also refer to personal qualities such as creativity. Norway offers an example of detailed standards, associating specific skills with specific subject courses: the standards state that 10-year-olds, for instance, will use 3-D imaging software to design simple houses in art class. New Zealand's standards for digital literacy stand out from the other countries because they require the demonstration of higher-level technical skills, describing outcomes for programming and the manipulation of image and audio files as part of digital literacy.

Six countries' standards (those of Belgium; Canada; Hong Kong, Japan, Norway and Singapore) further suggest that students develop an understanding of what constitutes ethical, responsible

[9] These figures are from interview data. In the IETE survey, only 10 countries reported having standards. This disparity arises from different countries' approaches to the notion of standards. Many believed standards could not be thought of as such unless they were tied to a formal assessment.

ICT use. Lessons on ethical, responsible use are generally aimed at middle school students to make them aware that the Internet is a means by which they present themselves and their views of others potentially to the whole world. ICT standards in Canada and Japan feature language about ethical use, and both countries currently have anti-cyber bullying campaigns. Responsible use can also mean legal use: Hong Kong, Norway and Singapore include respect for copyright in their student standards.

Approaches to Developing Students' ICT Skills

Despite the prevalence among participating countries of ICT standards embedded across the curriculum, some countries did report teaching computer science as a separate subject. In England, for instance, students ages 5–15 take ICT courses as part of their regular studies. ICT is also a separate subject for vocational high school students in several places. Respondents for Estonia and Finland, where students have long been assumed to be proficient and ICT has not been taught as a separate subject, spoke of wanting to reestablish ICT courses. These respondents found that although students are indeed already proficient in certain applications and online tasks, their skills do not entirely overlap with those desired for school and employment.

Most countries do not assess students relative to national ICT standards. Instead, guidelines for desired competencies are available to teachers, who might use them to embed opportunities to practice a given ICT skill into subject lessons. Two countries, Austria and France, have mandatory assessments tied to their standards. In Austria, ICT assessment takes place with national grade-level testing for 10- and 14-year-olds (fourth and eighth grades). In France, subject teachers assess all middle school students in an ongoing way and award a supplemental certificate with the middle school diploma to students who have proven they possess the required competencies in ICT; a similar system will soon be in place for high school students. In Norway, a locally developed assessment was piloted nationally in 2009, but the utility of a national test is being debated. Chile, Denmark and Japan provide optional assessments. Denmark offers optional certification through the Pupils' ICT License program, and Japan provides a commercially developed assessment.

ICT-Supported Instruction

More countries are using ICTs to improve access to and disseminate instructional materials to teachers and students than for supporting the development of 21st century skills. Nearly all participating countries count among their priorities using ICTs to increase students' access to content and to disseminate content (20 of 21 in both cases), and nearly all support these efforts with programs (18 and 19 of 21, respectively). Just under three-fourths of countries reported interest in using ICT to promote collaboration among teachers (15 of 21 consider this a priority, and 15 have programs). Slightly fewer reported the use of ICTs to support collaboration among students (14 consider this a priority, and 13 have programs) and to facilitate student inquiry (13 consider this a priority, and 10 have programs).

The following is an overview of the data collected, focusing on trends and innovative uses, including types and uses of digital learning resources, copyright and licensing issues, and the use of ICTs for individualized learning and for special needs. Exhibit 6 presents a laptop program in

Portugal and an interactive whiteboard in Britain as examples of approaches to technology-supported instructional reform.

Digital Learning Resources

Digital learning resources encompass a wide range of teaching and learning tools. This study adopts a definition of digital learning resources that includes: collections of materials stored in online repositories or catalogs; digital textbooks; online tutoring and other supports for individualized anytime-anywhere learning; and videoconferencing applications that are often used for foreign-language learning or collaboration with students in other schools. Digital learning resources can be distributed or accessed online or locally, in formats such as DVDs or CD-ROMs. (For a comprehensive definition of digital learning resources, see OECD (2009a).) More than half of participating countries have collections of electronic resources stored online. Because teachers are often the primary users of such online portals, they are discussed in the teacher capacity chapter. Students' use of online portals is addressed below, along with other digital tools for individualized learning.

The discussion of digital learning resources here focuses on three areas of emerging, innovative content and practice: digital textbooks; the online delivery of courses, serious games and videoconferencing; and learning management systems (LMSs).

Digital Textbooks

Three of the participating countries - France, Hong Kong, and South Korea – are actively planning for and piloting the use digital textbooks to either replace or complement traditional paper-based textbooks. Hong Kong intends for digital textbooks to complement their traditional materials, as a tool that can offer a more individualized, interactive experience with course content, while allowing anytime-anyplace access to tutorials and other supports. South Korea, in contrast, plans for digital textbooks to replace paper textbooks in all grade levels by 2013. A pilot is now underway at the primary level. The digital textbooks are all loaded onto a tablet-style device, such as an iPad. The textbooks, which are open resources, are offered through a Linux-based platform (LMSs in South Korea are also open and Linux based.)

As described above, partnerships between Ministries and publishers make possible the development of high-quality digital learning resources in many places; this is true for digital textbooks in France, where a small pilot program is also underway at the middle school level. The Ministry of Education has purchased a 4-year license to the digital textbooks' contents, an investment it views as parallel to its usual investments in paper textbooks. In France, the digital textbooks are stored in schools' LMSs.

Online Learning, Videoconferencing, and Serious Games

Online learning, videoconference applications and online educational games (also called serious games) are three modes of delivering instruction via the Internet. Online courses function as substitutes for face-to-face courses in remote or underserved areas that may not have a large enough school population or sufficient funds to provide the same range of language instruction or advanced courses available to students in more populated or privileged areas. Seven of the participating countries reported having national programs for offering online courses instruction to all students or to special populations (Canada, Belgium, Denmark, Finland, Israel, the Netherlands and South Korea). The Alberta Distance Learning Centre (Canada) serves 30,000 elementary and secondary students in a range of distance formats including blended and fully online. The Centre also manages the province's virtual school.

In the Netherlands, an online platform offers accelerated instruction for gifted students. In Belgium, the Bednet project, part of the ICT Without Boundaries program, allows chronically ill students to follow and participate in classes from home or the hospital. The student uses a laptop to view the classroom via webcam. The student can participate through voice or chat features, print handouts remotely and submit assignments using the interface. Teachers can also monitor students during assessments. In Finland, online learning is being used to support language instruction for recently arrived immigrants. Finland's online education program, VIRTA (an abbreviated name for the Finnish phrase for Virtual Regional Resources), was launched in 2008 as a means for integrating the country's new immigrants who come from a wide range of countries and settle throughout Finland. VIRTA now offers anytime-anyplace access to language and orthodox religion courses. The government would like to expand the program to offer courses in immigrants' own languages and religions as well.

Three countries reported having online tutoring programs. In Denmark, the recently launched program known as "The Trainer" features interactive content aimed at all academic levels, from struggling to gifted students. Israel and South Korea are using online tutoring courseware to provide struggling students with individual supplementary help by using the courseware to help focus the instruction on areas of greatest individual need. In Israel, students have access to the cyber-tutor programs after having been identified by their teachers whereas in South Korea, the system is available to all in order to provide more equitable access to quality academic tutoring services.

Another valuable tool for learning foreign languages, several countries reported, is videoconferencing. Of the participating countries, the United Kingdom has one of the most mature videoconference-supported language instruction programs. The education organizations BECTA and Future Lab have promoted the use of ICTs including videoconferencing for foreign language learning since 2004 (Facer and Owen 2004; BECTA 2004b). Coupled with e-mail and presentation software through which students can represent their worlds to one another through photographs, text and audio, videoconferencing can enhance interest in and understanding of other cultures, while exposing students to spontaneous, unscripted interactions with native-speaker peers. Videoconferencing, e-mail and presentation software are being used for instruction outside language courses, too. For instance, students whose schools participate in the European Commission's eTwinning program may use these tools to collaborate with students in other European countries on interdisciplinary themed projects or subject-specific assignments (http://www.etwinning.net).

Whereas participating countries' interest in online courses and videoconferencing applications is focused on delivering specific content or interactions to a remote area or a targeted group, interest in serious games in Austria and Estonia is primarily motivated by building 21st century skills across subject areas, with increasing student engagement cited as a secondary factor. In Austria and Estonia, ministry representatives view serious games as an engaging way of presenting students with scenarios that require them to solve problems or work collaboratively. Serious games are also viewed as a way to familiarize students with the tools and techniques of various professions. In both countries, the hands-on, student-directed experiences that videogames provide are considered a valuable means of workforce development.

Exhibit 6. Technology-supported Instructional Reform

21st century skills—defined in a 2008 OECD survey as creativity, critical thinking, collaboration, communication, productivity, innovation and leadership—are considered critical for future professional success in the ICT-driven knowledge economy (Ananiadou 2009). Participants in the present study generally agreed that technology-supported instructional reform enables the acquisition of 21st century skills but takes different approaches to implementing reforms. Two ICT-supported instructional reform programs—one in England and the other in Portugal—represent two different approaches, one focused on equipping classrooms, the other on mobile devices.

The recently closed British ICT-in-education agency, BECTA, implemented an interactive whiteboard initiative in primary and secondary classrooms. A study found that the new tools increased the depth and pace of learning, encouraged active engagement and improved interactions between teachers and students (Becta 2004a). Other studies have also found that interactive whiteboards can increase student engagement (Smith et al 2004), but evidence is mixed regarding their potential to improve student outcomes. As Glover et al. (2007) and Shuck and Kearny (2007, 2008) have shown, whiteboards can be linked with improved student achievement but not all teachers use the boards effectively. Further, whiteboards promote student-centered learning only if teachers take advantage of student-response features that provide ongoing feedback on comprehension or provide students opportunities to use the boards themselves (Glover et al. 2007; Shuck and Kearny 2007, 2008).

In Portugal, the Magellan Initiative, launched in 2008, aimed to distribute half a million Intel-developed netbooks to students in grades 1-4. The netbooks, called Classmate PCs, are specifically designed for young children: they are lightweight, shock-resistant, and feature a rotating touch-screen and a handle for easy carrying (Intel Learning Series website). The machines are relatively affordable and Portugal provides them to underprivileged children free of charge. The netbooks come pre-loaded with software that facilitates collaboration among students. The software allows student group leaders to monitor activities in other students' computers and provide guidance as necessary, while allowing teachers to do the same in all students' computers (Microsoft Magellan Initiative Fact Sheet 2009).

In addition to Portugal, eight countries had either recently completed one-to-one pilots or have current programs to support the adoption of one-to-one computing (Australia, Austria, Canada, Estonia, Israel, Japan, Singapore and South Korea). Advocates suggest that when students each own an Internet-enabled device, they will gain self-confidence with ICTs and take responsibility for their own learning (Stansbury 2010). Students may also conduct their own research, gather their own data, devise solutions to open-ended problems and collaborate with other students (Baumgartner et al 2010, Trucano 2010, Stansbury 2010). Research indicates that one-to-one computing can lead to improved student engagement and "modest increases in student achievement among classes using [devices] effectively" (Stansbury 2010). Whether countries invest in hardware for classrooms or mobile devices, research suggests that thoughtful planning, relevant teacher training, and buy-in from school leadership, teachers, students and parents are all factors in improving student outcomes through ICTs (Stansbury 2010).

Learning Management Systems

A Learning Management System (LMS) is an online environment used to organize and manage courses, both in terms of administrative tasks and content. LMSs are being used to track student attendance and progress, post and share content, and communicate through features such as wikis, blogs and discussion forums (Trotter 2008). Individual teachers typically organize materials into course-specific sites within the system. Students and teachers log in for restricted access to relevant materials. Teachers have access to additional functions, such as the ability to post assignments or announcements and to maintain an e-grade book. Depending on how the platform is configured, students may have individual pages or storage space and collaboration across courses may be possible. Depending on the functionalities of the system and the goals of stakeholders, access can also be granted to administrators or parents. Blackboard, a commercial product and Moodle, an open-source platform, are commonly used LMSs. School Information Systems (SISs), which typically house a range of data on students, teachers and other school staff members and infrastructure and resources available at a given school, are not generally linked to LMSs, although some LMSs have some SIS-like features built in.

Six participating countries have LMSs in all or nearly all schools. Regardless of levels of penetration, how ministries of education, local education authorities, and schools conceive of and use LMSs varies greatly by country. In most places, local or regional authorities are responsible for selecting and installing LMSs, as well as for providing related training. In this scenario, the ministry may provide some funding or other support and possibly technical specifications but does not impose a selection. The French Ministry of Education, for example, supported the development of LMSs by a few different companies, and regional educational authorities (known as academies) choose from among the resulting systems. French LMSs can thus be networked at the regional level. Similarly, in Denmark local education authorities initially invested in different platforms, so that several were in use throughout the country. Over time, however, schools all switched to a single, preferred platform, although that choice was not imposed by the ministry.

In other countries, the ministry or the ministry-affiliated ICT in education agency develops an LMS platform that schools are strongly encouraged to adopt. This approach can support networking the systems nationally, which can facilitate certain types of data collection. LMSs are nationally networked in South Korea, for example. A cloud-computing approach to LMSs—with national or regional educational authorities hosting the platform, along with providing online training and support—spares schools or municipalities the expense of investing in servers and training and thereby reduces barriers to adoption. In Austria, the LMS for upper secondary schools (16- to 18-year-olds) was developed in this manner. In Sweden, by contrast, early enthusiasm for LMSs led to their installation in nearly all schools, and recently, questions about the value of the investment have been raised. The ministry reported having fielded complaints about accessibility features. Several countries are clearly taking the lead in using LMSs to improve educational practice (Exhibit 7).

Exhibit 7. Understanding National Uses Of Learning Management Systems

Learning Management Systems (LMSs), also known as curriculum or course management systems, are platforms that offer discrete digital spaces for courses in which teachers and students can upload or download instructional materials, create content and respond to one another's materials in blogs, wikis and discussion forums.

In both Austria and Estonia, the Ministry of Education has contributed to the development of open-source LMS systems offered through centralized servers. In Estonia, the Ministry provided guidance but no funding for the development of eKool (eSchool) by the Look@World Foundation. In Austria, EduMoodle was developed through a Ministry program. EduMoodle is available free to schools, and as a result, schools do not have to invest in dedicated servers or training—those things are managed centrally (BMUKK e-content and sustainability plan; Hummer 2007). EKool charges schools small monthly subscription fees that, its website states, covers initial training, development and support (eKool website). In addition to lowering costs for schools, centralized services facilitate tracking individual students as they move from one school to another. A student's eKool log-in grants access to all of that student's course records, regardless of his or her point of log-in or current school.

EKool integrates social networking capabilities with student information and course management features. First piloted in 2002, it has become the most common LMS platform in Estonia. The platform won a European Public Sector Award in 2007 (Snellen and Todorovski 2010; eKool website). The system allows parents to log in and follow their children's progress, and sends text-message alerts to parents when a child is absent. EKool also generates data reports for use by school heads and local educational authorities (Anton 2010; Snellen and Todorovski 2010). Developers are now working on improving the interoperability of eKool with the national education information database, so that teachers do not have to log-in and enter overlapping information (such as grades and attendance) into both systems (Microsoft). Three other open-source LMS systems are also in use in a small portion of Estonian schools: Moodle, Viko and Interactive Virtual Academy (IVA). Both Viko and IVA were developed in Estonia at Tallinn University—Viko with financial support from the Estonian ICT in education agency, and IVA with support from the Tiger Leap Foundation (Viko website; Tallinn University IVA website).

This study found that while teachers in participating countries use LMSs for administrative purposes, pedagogical uses remain less common. Watson and Watson (2007) and Carlson (2009) have shown that LMSs can support constructivist, student-centered learning. Students can contribute to generating course content and respond to one another's work, allowing teachers to assume the role of facilitator. For example, as a preliminary step in a collaborative research project, students could work in groups to compile multi-media bibliographies on a wiki page and annotate the group's entries. The websites of both Moodle (http://moodle.org) and IVA (http://imke.tlu.ee/learning-management-system-iva/) state that the systems were designed with constructivist approaches in mind.

Open Resources and Approaches to Copyright

ICT is often a frontier area of intellectual property law, with devices and techniques invented faster than the legal system can adapt to account for them, and ICT in education is no exception. Ministries of education are taking different steps to make resources widely available. Eleven of the 21 countries (Belgium, Canada, Chile, Denmark, France, Great Britain, Hong Kong, Israel, the Netherlands, Portugal and South Korea) reported having some type of formal incentive in place for the development of ICT-related materials for instruction; of these some are intended solely for the private sector while others include university researchers and semi-governmental agencies. This number (11 of 21) does not accurately represent the whole landscape of ministries' relationships with developers and publishers, however, because several countries pursue similar partnerships without formal arrangements.

Types of agreements with the private sector include discounted prices for devices or software; contracts, subsidies, or seed grant funds for commercial publishers for the development of content; and licensing arrangements. Ministries may also hire university-affiliated or independent experts as consultants on the development of in-house materials (as in Hong Kong). At the same time, countries (e.g. Australia and Belgium) may pursue specific copyright agreements or copyright reform in order to make existing materials—digitized archival materials or reference resources, for example—available for free use. South Korea has taken an exceptionally pro-open resource position. There, the governmental ICT in education agency, KERIS, produces materials in house. The nationally implemented LMS and the new digital textbook program both run on open Linux platforms.

A number of factors play into countries' attitudes and strategies regarding copyright and open resources. For example, ministries may be more likely to support private developers and publishers where it is considered important to have materials created at home and in the language of instruction or where unions and lobbyists have clout. (In Denmark, for instance, the launch of an online tutorial system developed by the ministry has been delayed by pushback from the publishing industry.) A secondary reason cited for supporting private developers is that competition among several producers may result in a higher quality product for a more affordable price. Last, a number of ministries reported pursuing relationships with private (or university or nonprofit) entities while at the same time pursuing exceptions to or the reform of copyright laws; the two approaches are not mutually exclusive.

Uses of ICT for Individualized Learning and Special Needs

Eighteen of 21 countries expressed interest in using ICTs to provide learning opportunities tailored to students' individual needs and styles; however, only 13 countries have such programs, suggesting that this is an emerging area in several countries. Data from interviews with country representatives suggest that online tutoring is one common way to individualize instruction.

Online tutoring can provide struggling students supplementary help in an individualized way by tracking their responses and focusing on the areas where they need the most support. Israel and South Korea both have cyber-tutor programs. In Israel, students must be identified by teachers as needing the service in order to gain access. In South Korea, the Cyber Home Learning System is open to all students; its purpose is to reduce the advantage of the private tutoring wealthier South Koreans traditionally invest in for their children. Online resources can not only help students catch up, but also provide them with experiences they would not encounter in the regular school day and regular curriculum. In the Netherlands, for instance, the ICT agency, Kennisnet, and the national curriculum development organization (SLO) together developed an online portal called Acadin to provide challenging, creative opportunities for gifted students. The site contains resources for teachers—ranging from background information to specific activities targeted to a range of talents—and parents (Acadin website).

ICT also has great potential for students with disabilities, providing tailored supports for students with mental disabilities and new opportunities to participate in class for physically disabled students (e.g., text-to-voice programs or a digital bell to signify raising one's hand to give an answer). The IETE study did not identify many uses of ICT to support special-needs students. Possibly efforts are already underway but not at the national level or not by the national government. One notable exception is Belgium, which launched its ICT Without Boundaries program in 2007 as a means of improving opportunities for children in special-needs schools. The program focuses on developing learning materials for special-needs students, including learning objects for the deaf, those with mental disabilities, and those with autism spectrum disabilities. The program also has an e-mail client for mentally disabled children and a remote-access project for homebound students. ICT Without Boundaries includes in-service training and project support for teachers and other staff members.

ICT-Supported Student Assessment

Approximately half of participating countries reported using ICT to support some form of student assessment at the national level (Exhibit 8). ICT is most commonly used to support summative assessment (11 of 21 countries prioritize this; eight of those 11 countries support that priority with a program). The use of ICT to support formative assessment for feedback on student progress to teachers is a priority for 10 countries, six of which have programs. This is more common than using ICT for formative assessment for feedback to students, which nine countries consider a priority, of which four countries have programs.

Exhibit 8. ICT-supported Student Assessment

Type of ICT-supported student assessment	Countries prioritizing this	Countries with programs in this
Summative	11	8
Formative, for feedback to teachers	10	6
Nontraditional assessments (e.g., e-portfolios)	10	6
Formative, for feedback to students	9	4
Diagnostic, to identify student learning difficulties	5	4

n = 21

Exhibit reads: Eleven of 21 countries consider summative ICT-supported student assessment a priority.
Source: IETE Survey Data.

The disparities between countries now prioritizing ICT-supported student assessment and countries reporting related programs, apparent across four of five categories of ICT-supported student assessment provided in Exhibit 8, may suggest that this is an emerging area, at least at the national level. Of the countries reporting the most activity in this area, one is actually a province (Alberta, Canada) and the other, Australia, has a distinctly decentralized educational system.

In terms of ICT-supported diagnostic assessment, the apparent lack of disparity between the number of countries that consider it a priority and those with a related program (five and four, respectively) hides the fact that only one IETE participant (Alberta, Canada) reported both. Otherwise, no overlap exists between countries considering ICT-supported diagnostic assessment a priority and those with programs in that area. This unevenness could indicate that this, too, is a relatively new concern at the national level.

Ten governments (Australia, Austria, Canada, Denmark, Estonia, Hong Kong, Iceland, Israel, Norway and Portugal) reported innovative practices in nontraditional assessment, although many of them are still in planning stages or only fledgling efforts. For example, several countries reported interest in e-portfolios, but use is not yet widespread. In Austria, e-portfolios are created by upper secondary students (ages 16–18) and stored in the centralized LMS system. At that age, 80 percent of Austrian students are in specialized schools,[10] so the e-portfolios are seen as a means for students to present themselves not only to the school community, but also to potential employers. The Austrian Ministry of Education reported that the range of work in an e-portfolio can demonstrate far more detail regarding a student's qualifications than a traditional résumé—writing skills, along with critical-thinking and problem-solving skills.

[10] These specialized schools are called vocational schools, which encompass not only trade schools, but also schools focusing on business, arts and culture and tourism, for example.

In Portugal, the Magellan PCs used in the national laptop program for students age 6–12 provide an innovative means for teachers to carry out ongoing assessment. The machines come preloaded with Mythware's e-Learning Class software, which enables a designated computer to monitor and even intervene in activities taking place in other computers. This way, teachers can record the activity of students' computers and use the records for assessment. Teachers can also authorize a similar operation in certain students' computers, selecting group leaders who can coach their peers in a given activity. Denmark's use of ICT for both summative and nontraditional assessments is noteworthy. National tests have been administered online, and a pilot program is underway to allow students to have unrestricted access to the Internet while taking national exams. National implementation is expected within 3 years.

Summary

All participating countries are invested in developing students' 21st century skills and view ICTs as a promising means of accomplishing that objective. Language describing the competencies and qualities associated with 21st century skills—problem-solving, critical thinking, creativity, initiative, the ability to communicate and work collaboratively—is incorporated into the ICT standards for students in numerous countries. Digital resources and online environments, such as digital textbooks, online tutoring, learning management platforms, and serious games, offer students a chance to develop these skills while gaining proficiency and self-confidence with ICTs. Despite consensus on the importance of 21st century skills, ways to assess them are only just emerging. The use of e-portfolios seems promising in this regard. Finally, although ICT holds great promise for students with disabilities, the fact that this study did not identify many initiatives in this area by participating countries suggests that if efforts are underway, they are not taking place at the national level.

ICT-Supported Efforts to Build Teacher Capacity

Technology skills per se (e.g., basic hands-on computer tasks and how to operate basic office software) have long been a focus of ICT-related teacher professional development in many places around the world. Definitions of and standards for teacher technology competency have expanded over time to include use of ICTs to support innovative teaching and learning practices, especially to support student-centered pedagogy and a renewed focus on students' skills in critical thinking, communication and collaboration. This is particularly evident in the UNESCO ICT Competency Standards for Teachers (UNESCO 2008a, 2008b). In the review of international data collections related to ICTs in education, staff found only one indicator directly related to the use of ICTs to build teacher capacity; it asks about the use of the Internet to both provide opportunities for teacher training and allow access to educational materials (Eurydice 2001). This section explores the prevalence of teacher technology standards in the 21 participating countries, methods being used for assessing teacher skills and government activities designed to build teachers' capacity through the use of ICT, including the use of websites and portals and provisions of online training.

Teacher Technology Skill Standards and Assessments

As was the case with student ICT standards, the use of the term "standards" was problematic for some countries that may not have identified licensing requirements or recommended guidelines related to ICT as "standards." In this report, ICT standards for teachers are defined as a framework or set of guidelines that describes desired teacher outcomes or competencies with regard to ICT, whether or not those competencies are assessed and whether or not they are mandatory or recommended. Using this definition, 17 of 21 countries had teacher technology standards in place in 2010 (Exhibit 9). ICT standards may be in a stand-alone document that addresses the types of knowledge and skills that nations believe a teacher should possess, or they may be embedded in the context of broader teaching skills.

Of those countries with standards, nine conduct some form of assessment of teacher ICT skill. In Austria, the assessment is optional for teachers pursuing a credential documenting ICT ability. Japan uses teachers' self-reported data to determine programmatic and professional development needs. The Netherlands also uses self-report data to develop policies and programs that meet teacher needs, and it also considers teachers' ICT skills during teacher evaluations. Likewise, Estonia ties decisions about teachers' promotions to their ICT skills among nine other skill categories. Four governments (Canada, England, France and Israel) tie ICT skills to teacher licensing requirements. In France and Israel, only new teachers need to meet this requirement. Norway tests teacher skills every two years as part of a national data collection, but results are not tied to licensing or promotions. Chile makes available a test that is not required for licensing.

Exhibit 9. Overview of National Teacher Technology Competency Policies

Countries	National Standards for Teachers Present	National Standards for Teachers Assess nationally?	Remarks
Australia	Yes	No	
Austria	Yes	Yes	Optional certification
Belgium (Flemish)	No	No	
Canada (Alberta)	Yes	Yes	Demonstration of skills required for certification
Chile	Yes	No	Includes preservice and inservice requirements
Hong Kong SAR, China	Yes	Yes	
Denmark	Yes	No	Standards integrated with other subject domains ICT licensure program optional
England	Yes	Yes	Basic ICT skills required for licensing
Estonia	Yes	Yes	Integrated with academic curriculum standards, promotion tied to ICT and other skills
Finland	Yes	No	Integrated in other academic curriculum standards
France	Yes	Yes	New teachers only, since 2006
Iceland	No	No	
Israel	Yes	Yes	New requirement for ICT skills for licensing
Japan	Yes	Yes	Assessments based on teacher self-report
Netherlands	Yes	Yes	ICT skills part of teacher evaluation, country collects teacher self-report data for policy-making
New Zealand	No	No	
Norway	Yes	No	Teacher test data collected biannually at national level for policy-making
Portugal	Yes	No	
Singapore	Yes	No	National teacher standards in development
South Korea	Yes	No	Guidelines suggested to teachers
Sweden	No	No	
Total	17	9	

Source: IETE Survey and Interview Data.

Nationally Sponsored Websites with ICT-Related Resources for Teachers

By far the most frequent government-reported activities to address ICT-supported efforts to build teacher capacity were in the provision of digital learning resources for use by teachers in their classrooms, including home-grown and commercial materials and software tools, through websites and portals. Seventeen of the 21 countries reported that support for websites or portals that provide digital resources to improve teacher capacity as a national priority.[11]

Developing Communities of Practice for Teachers

An emerging trend among participating countries is a move to interactive, collaborative models of material development and sharing including communities of practice. The concept of communities of practice permeates the field of education. Any group of people who share an interest or profession can either evolve a community of practice informally or institutionally establish one with the goal of encouraging collaborative solving of complex problems and to encourage continuity of practice. Through the process of sharing information and experiences with the group, members learn from each other (Lave & Wenger 1991). Communities of practice can exist online through interactive discussion forums or in real life during group planning periods in schools, during lunch or other designated times. Communities of practice can also use blended techniques, leveraging both face-to-face interactions and online tools and discussions. The value of online community of practice components includes ease of asynchronous communication, the inclusion of participants from wide or diverse geographic boundaries, and digital archival features for easy access to materials and discussions that may have begun or occurred in the past. Exhibit 10 provides detail on the way the governments of Canada and Belgium are encouraging teacher participation in nationally sponsored communities of practice.

In at least three countries—Sweden, the Netherlands and New Zealand—the communities of practice were developed or strongly influenced by teachers. Sweden's Lektion.se (www.lektion.se) is one of the most active Websites for facilitating a community of practice within the European Union. The site, developed by former teachers, features shared lesson plans, activities and other instructional resources. New Zealand's, Te Kete Ipurangi (TKI; www.tki.org.nz), is an online educational Web portal that provides access to online communities and educational materials for teachers and other educators.

Three countries (New Zealand, Singapore and South Korea) also specifically referred to the use of Web 2.0 features for teachers. In New Zealand, The portal was updated recently to include interactive Web 2.0 features for teachers, including blog pages and discussion forums, driven by input from teachers. The site includes a "software for learning" community page, where teachers discuss how they use various software applications to improve their teaching; the assessment community, which provides resources and tools for assessing student knowledge, searchable by subject; and the professional learning community, which allows teachers to participate in

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[11] Finland, Japan, South Korea and Sweden did report that the provision of digital resources to improve teacher capacity was a national priority. Finland and South Korea did have some resources available, but reported that developing them was not a current priority, nor were there current programs or data collections around developing or providing access to online resources for teachers, at the time of the survey.

discussion forums, chats and online conferences on their teaching practices. South Korea's edu-café website supports chat functions, allowing teachers, parents and students to participate in online discussions.

Exhibit 10. Encouraging Participation in Educational Communities of Practice

Technological advances have expanded the potential scope and depth of collaboration and information sharing among teachers, administrators and educational researchers. As discussed in the main text, the reviewed countries display a trend towards facilitating and encouraging the development of online communities of practice among educators. Added-value elements of online communities of practice include the ease of asynchronous communication, the inclusion of participants from a large geographic area, the ease of access, the digital archiving tools, and the materials and discussions that were posted or took place in the past. Online communities of practice take a variety of forms from country to country; programs range from local to national in scope, and while some programs are exclusively for teachers, others include a larger group of stakeholders or are available to the general public. In this case study we explore the experiences of Belgium and Alberta, Canada, with online communities of practice. Belgium is notable for pioneering an incentives program that encourages teachers to contribute resources and feedback to the community. Organizations and institutions in Alberta, Canada, have taken a diverse set of approaches to utilizing online communities of practice in education, many of which include not just teachers but also administrators, researchers and parents.

The Flemish Belgian Ministry has consistently favored open-source solutions, and in 2002 it created its own open-source portal, *KlasCement,* as a central access point for teachers to share learning materials. Since its creation, the portal has expanded to include over 60,000 members and 13,000 contributions. Learning resources available via the portal include articles, documents, websites and software. Because nearly all of these are freely available and non-commercial in nature, the quality of the service depends upon user-generated contributions and feedback. The government has thus developed an incentive system to encourage teacher participation.

The incentive is a points system for users, who must register in order to begin downloading resources. Users lose points for downloading materials and gain points for contributing content and for posting ratings of materials they have used. The privilege of downloading materials is revoked when a user's balance falls to zero points (De Craemer 2010a). This portal also offers "Classy," a free weblog service (i.e., blog space and hosting) for teachers and their classes (De Craemer 2010b).

The government of Alberta's Ministry of Education promotes communities of practice both through teacher qualification requirements, applied research initiatives and through regional consortia. The Alberta Teaching Quality Standards include a requirement that teachers communicate with others electronically and use electronic media for their own enrichment. The Alberta Teacher's Association maintains a virtual online environment, known as the Teachers' Network (TNET), which hosts websites and collaboration sites as well as individual teacher profiles and contact information. Individual research initiatives have created subject-based online communities, such as Alberta's Emerge One-to-One Laptop Learning initiative's Community of Practice. Alberta Education also sponsors seven regional consortia, as well as the Alberta Regional Consortia Career and Technology Studies Training and Support Website, a resource base and forum for the teaching community.

The Alberta government operates in a supportive climate for community engagement in communities of practice. Many Alberta K-12 teachers, school-based leaders, mentors, teachers-in-training, and university faculty are members of a national-scale, non-profit online community of practice called *Intelligence Online*. The program uses a basic project structure, aligned with regional curriculum requirements, under which teachers can copy, adapt and share projects with the online community. Teachers are able to collaborate and communicate online through private or open forum discussions, and can share select information with parents and students (Galileo website).

Online Teacher Professional Development

Many countries reported that using ICTs to deliver teacher professional development (through formal or informal instructional activities) is a priority. The two most commonly reported specific priorities were (1) supporting teachers' integration of ICTs into instruction (all 21 countries reported this as a priority, and 17 reported having national programs in this area) and (2) improving teachers' pedagogical skills (20 countries reported this as a priority, and 18 reported having national programs to address it). Seventeen countries indicated that using ICTs to improve teachers' subject matter knowledge was a priority, and 15 reported having national programs to address this need.

Nine countries (Austria, Chile, Denmark, France, Iceland, Israel, New Zealand, South Korea and Sweden) also reported providing formal online or blended courses to either build teachers' capacity to integrate ICT or focus more generally on pedagogical training. In places that have centralized LMSs, training and support are available online. In fact, online learning was reported to be a popular option for both pre- and in-service teacher professional development, with a reported 50 percent of teacher professional development occurring online or through related distance learning options. Similarly, the licensing program in Denmark is almost entirely online. The online courses model instruction, including group projects and collaborative learning. The Enlaces program in Chile has both online and blended courses. Israel offers online modules or other courses with online elements for both pre- and in-service teachers. Online teacher professional development provided by the French Ministry of Education is adapted from Intel's teacher professional development program, Intel Teach.[12] Courses available through the Swedish Web portal focus on practical IT and media knowledge, with about half the districts in the country using the courses for in-service training.

Summary

As countries continue efforts to integrate technology into elementary and secondary instruction, they are developing supports and training tools for teachers. Most countries have standards or related guidelines that suggest what teachers should know and be able to do with technology. However, only about 40 percent of countries assess teachers' ICT skills for licensing or evaluation. Countries frequently reported efforts to build teachers' capacity through the use of websites and portals that contain digital learning resources tied to the curriculum. These websites and portals are provided to give teachers easy access to high-quality, digital curricular materials and thereby increase the likelihood that technology is integrated into instruction by teachers. The use of these websites typically relies on teachers to seek out digital learning resources or to voluntarily participate in communities of practice. Formal online professional development was reported to be offered less frequently at the national level than the provision of digital content through websites and portals.

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[12] For more information about Intel Teach Worldwide, see http://www.intel.com/about/corporateresponsibility/education/programs/intelteach_ww/index.htm (accessed October 20, 2010).

ICT-Supported Continuous Improvement Efforts

In this section, national policies and programs related to the use of technology to support administrative systems for accountability, evaluation and continuous improvement are described. Information is presented on how national education systems are using technology to monitor and track school, teacher and student performance to help policy makers and administrators identify where new policies and programs may be needed and where current policies and programs are on track or in need of improvement.

Also discussed is the extent to which countries are collecting national data on ICT in education indicators, including measures of access, use and impacts of ICT within their own educational systems. Information on the specific indicators collected and data collection procedures is presented in the individual country profiles included in Part II.

Finally, countries' efforts to evaluate their own internal ICT in education policies and initiatives are described. Information was collected on the designs and methodologies being used, including data collection instrumentation (e.g., administrative records, surveys of administrators and teachers).

National Efforts to Deploy Information Systems to Support Continuous Improvement Efforts

More than half the countries surveyed (12 of 21) reported using or planning to use information systems to support national and local continuous improvement efforts. Countries with national systems covering their primary- and secondary-level education systems include Austria, Canada, Chile, Estonia, Finland, Hong Kong, the Netherlands, Israel, Norway and South Korea. Austria also has a separate continuous improvement system dedicated to monitoring performance within its vocational school system. Two countries, Portugal and Singapore, are in the planning phase for future deployments of a national administrative system to systematically collect and monitor student academic performance across local jurisdictions and schools.

In some countries, responsibility for the use of academic performance data in decision-making rests with the local education authorities and schools. Although in most cases national agencies in those countries are responsible for data collection, analysis and dissemination, it is the local educational authorities and schools that are ultimately responsible for how the data are used and interpreted for local policy and programming decision-making. Austria, Canada, the Netherlands and Norway all have agencies that provide academic performance data to local jurisdictions and schools to support local continuous improvement efforts.

Descriptions of a set of six representative national programs are in Exhibit 11. Additional details on these programs along with the details of the programs for the other six countries listed above are in the individual country profiles.

Exhibit 11.
Description of National ICT-supported Continuous Improvement Programs

Country	Program description
Canada	Alberta's Accountability Pillar system is responsible for assessing local jurisdiction and school performance on a common set of measures. The data collected include student test scores on Provincial Achievement Tests and Diploma Exams and non-achievement measures including the extent to which school environments are safe and caring and the extent to which parents are involved and satisfied with their children's educational experience. Data are collected annually via the Web from all publicly funded schools. To assist local jurisdictions and schools in identifying areas needing improvement, the ministry provides them with their current and past results (last 5 years). Jurisdictions and schools analyze these data to develop their 3-year education plans. Schools also report annual results to the community.
Austria	The use of educational data to support continuous improvement became common and widespread only recently in Austria. Three years ago, the ministry founded the Federal Institute for Educational Research, Innovation and the Development of the Austrian School System (BIFIE) to undertake national data collections. BIFIE established a school monitoring system, and published a comprehensive national education report for the first time in 2009. In addition, BIFIE facilitates schools' systematic use of student outcome data to inform teacher improvement strategies. Principals receive annual reports of student performance, broken down by subject area, enabling them to track subject-area performance over time.
Estonia	A national data system tracks approximately 45 indicators on students, including grades, transcripts, diplomas and personal information; and 50 indicators for teachers, including their specializations, training and course loads. Each school is responsible for entering data into the national system. Electronic transcripts and diplomas are archived in the system from students' first year in school (age 7) through the doctorate level.
Finland	Data relating to the educational system is collected on an ongoing basis by Statistics Finland, the national organization responsible for official statistics in every area of society. Educational data collected include the numbers of students enrolled in various levels of the educational systems as well as in special education, the students' academic progression (e.g., course taking, graduation or completion rates, student placement after schooling), the school characteristics (e.g., size, staffing, courses offered, infrastructure) and the fiscal picture of educational institutions. Schools' learning management systems are networked to Statistics Finland, enabling school personnel to enter data directly.
Norway	The ministry's Directorate for Education and Training is responsible for the national quality assessment system, supervising and supporting schools in the use of data for decision-making. The directorate analyzes the data, makes the data and findings publicly available for regional and local education authorities through an online portal and provides guidance, support and supervision in the use of the data.
South Korea	All public schools are networked to the National Education Information System operated and maintained by a separate division within the ministry. The system facilitates the ministry's annual collection of student-level data, including academic performance by school and jurisdiction. The ministry uses this information to guide policy and to target jurisdiction and school support initiatives. Schools can also use the system to communicate with parents.

Norway and Korea offer contrasting approaches to technology-supported continuous improvement (Exhibit 12). Both countries have made significant investments in national systems to collect regular data from schools, teachers and students to help monitor and improve education policies, programs, curriculum and instruction. While Korea's current focus is the use of data to improve national education policy, Norway is implementing a national continuous improvement system that supports decision making at the local-level

Exhibit 12. Technology-Supported Continuous Improvement

The use of technology is critical not only as a means for disseminating information, but also as a tool for creating and maintaining administrative systems for accountability, evaluation and continuous improvement. As described in the body of this report, technology is used by national education systems to monitor and track school, teacher and student performance for the purpose of helping policy makers and administrators identify where new policies and programs are on track, in need of improvement or may be in need of improvements.

While the data collection that supports continuous improvement is typically gathered through national or regional programs, it can be utilized to support decision-making at various levels. In this case study we highlight the experience of two countries with technology-supported continuous improvement systems: one with primarily centralized decision-making, South Korea; and another with a more locally centered education system, Norway. In South Korea, the national Ministry of Education, Science and Technology (MEST) uses information collected through the country's informational network to guide national policy in education. In contrast, Norway has recently undergone a shift of decision-making power to the regional and local levels, which is reflected in the country's continuous improvement strategy.

Each of South Korea's public schools is networked to the National Education Information System (NEIS) that is operated and maintained by a separate division within the Ministry. Both teachers and parents can enter data into this system. MEST also conducts annual, national collections of school-level data and samples of student-level performance data through the system. NEIS central headquarters and regional offices both analyze data and disseminate information. Results of the analysis are used to guide policy and to develop strategies for designing and deploying support (Kim 2010).

The South Korea Information and Research Information Service (KERIS), the national agency responsible for South Korea's educational Information & Communication Technology (ICT) development, collects a separate set of ICT use data. KERIS tracks the number of log-ins, time spent, and how resources are used for Edunet, an educational information service, and the Cyber Home Learning System, a student e-Learning system for students. KERIS is then able to map where active users are located as means of determining where students who are not yet benefiting from the services may still be isolated. Analysis of the data collected is used to inform policy and budgeting decisions related to ICT.

The education system in Norway has traditionally been unitary and centralized, but is undergoing a shift of decision-making power to the regional and local levels due, in part, to recent educational reforms such as the Knowledge Promotion reform (described in the next section) as well as to Norway's geographic size and regional disparities (OECD 2009c). One practical implication of this decentralization effort is that local school authorities can adapt the national curricula to local conditions and develop their own strategies for ICT implementation (OECD 2009c). Thus, while the Ministry's Directorate for Education and Training is responsible for the national quality assessment system, its responsibilities also include supervising and supporting schools in the use of data for decision-making. The Directorate analyzes the data, makes the data and findings publicly available for regional and local education authorities through an online portal, and provides guidance, support and supervision in the use of the data (Johannessen and Strømsheim 2010; Soby and Egeberg 2010).

Exhibit 12. Technology-Supported Continuous Improvement, (Continued)

Norway has invested in a national quality assessment system focused on improving the quality of basic education. Established as part of the Knowledge Promotion curriculum reform (Soby and Egeberg 2010), this national data system relies largely on two types of data: student achievement data from annual national exams and learning environment data from surveys with students, teachers and parents. Both of these data are collected online annually (Johannessen and Strømsheim 2010). An online annual student survey, the main instrument for collecting data on school environments, covers topics including satisfaction with teachers, academic challenge, student democracy, physical learning environment, bullying at school, motivation and professional guidance (Quality Assessment System).

Both South Korea and Norway have future goals of improving the technology, quality and availability of continuous improvement tools. South Korea is working toward improved data security, broader access and usage and building a stronger role for local decision-making. In the fall of 2010, Norway reported launching Assessment for Learning, their second pilot program aimed at improving continuous assessment for students and teachers.

National Data Collections of ICT in Education Indicators

In addition to the international ICT in education indicator collections supported by OECD, IEA, the European Commission and SchoolNet, over the last decade many countries have begun to institute their own internal ICT indicator monitoring and collection systems. Eleven of the 21 country representatives interviewed reported some form of a national effort to regularly collect data on ICT use by educational jurisdictions, schools, teachers and students inside and outside school (Austria, Canada, Japan, England, Estonia, the Netherlands, Sweden, Chile, Australia, Belgium, Norway). Japan and England were pioneers in this area, initiating data collections on ICT access and use in their education systems in 1989 and 1998, respectively.

Countries are collecting data across a variety of indicators and often expand beyond the documentation of infrastructure and access to technology statistics. The most common metrics implemented based on interviews with country representatives are measures of access to technology (e.g., Internet access per number of students) and infrastructure (e.g., bandwidth, age of computers). Nine countries reported collecting such data (Austria, Belgium, Canada, Chile, Japan, the Netherlands, Norway, Portugal, and Sweden). However six countries are also focusing on how the ICTs are used for teaching and learning (Belgium, Canada, England, Estonia, Norway, and Sweden). In addition to collecting data on the types of technologies and how they are used, some countries also collect data on local ICT planning efforts (Ireland, the Netherlands, Sweden) and management (Chile). England, Ireland and Japan also collect data on the number of teachers and administrators attending ICT professional development and completing certifications. Given the ubiquity of student use of ICT technologies outside school, Chile has begun to add relevant items to their student survey to capture the prevalence of different types of ICT use in the home and elsewhere.

Four countries reported implementing assessments of both teachers' and students' ICT competencies (Australia, Belgium, Japan, Sweden). Australia conducts a national assessment of

ICT literacy skills every 3 years (since 2005) on a national sample of students ages 11 and 15. Students are administered a computer-based performance assessment to assess their “confidence, creativity and skills” in the use of ICTs. The Australian assessment also measures students’ knowledge and skills in dealing with ethical and legal issues associated with ICT use. In addition to Australia, Belgium, Japan and Sweden have also implemented assessments of student ICT literacy, with Belgium and Japan including an assessment of teachers’ ICT competency as well.

Data on ICT indicators are typically collected through regular national surveys of school administrators, teachers, and in some countries a sample of the student population. Based on information collected through interviews with country representatives, collections are typically conducted every one to three years. Some countries, like South Korea, are beginning to leverage the availability of continuous use records from online resource systems, such as Edunet, to facilitate data collection and monitoring. In most countries, data collections are administered by the ministry, but in some cases data are collected by other national agencies responsible for telecommunications policy and programs or the collection of national statistics.

Four examples of national programs for the collection of ICT indicators are described in Exhibit 13. Details on these programs as well as program descriptions for the other 76 countries that are implementing national ICT indicator data collections are in the individual country profiles in Part II.

Exhibit 13. Examples of National ICT Data Collections

Country	Program description
Belgium (Flemish)	The ministry’s Monitoring ICT in Schools program, using survey instruments developed by researchers at the universities of Ghent and Leuven, was initially implemented during the 2007–08 school year. The next collection is scheduled for 2012 and will be administered online, with plans to continue the collection every 2 years hence. For each collection, 20 percent of schools are sampled for the administration of the survey. Separate surveys were developed for school administrators, teachers and students. Through the program, the ministry collects information on four types of ICT in education indicators: ICT competencies, infrastructure, usage and stakeholder perceptions of the educational value of ICT-supported instruction. ICT competencies are assessed for both students and teachers. Relative to infrastructure, the instrument gathers data on such elements as the number of computers per student, the ratio of Internet access to students, the type and age of available computers and the quality and scope of computer facilities. Monitoring ICT in Schools also collects information on the use and integration of ICT in the learning environment, which includes the level and type of ICT use, the use of electronic learning environments and ICT-related educational practices.

Exhibit 13. Examples of National ICT Data Collections, (Continued)

Country	Program description
Chile	In 2009, Enlaces, a department of the ministry founded to improve education through the use of ICT, developed a national system for monitoring of ICT developments in the school system. The goal for the collection is for the ministry to be able to classify schools on their ICT capacity and improve training and capacity where needed. The program is a census consisting of a set of surveys administered to all school administrators, ICT coordinators, and a sample of teachers and students. All government-funded schools and a sample of unsubsidized private schools participate in the collection. Information is collected on the capacity of the available ICT infrastructure, the management and use of ICTs in schools, and additional resources in the schools. The student survey also captures information about how students use ICTs outside of school. For international comparability purposes, many of the survey questions are similar to items in IEA's SITES 2006 and SITES M1. Some of Enlaces' continuous improvement efforts are supported by the cross-sector indicator collections of the interministerial Digital Strategy 2007–2012 group's ICT Observatory. The ICT Observatory collects 90 indicators in four areas: education (including hardware delivered to schools through programs attached to the current national plan), Internet access (including the presence, type and speed of connections in schools), and ICT industries and e-government.
Netherlands	The Kennisnet Foundation, a publicly funded organization responsible for assisting schools in integrating ICT into teaching and learning, conducts a regular data collection of ICT in education indicators known as the Four in Balance Monitor. Since 2001, this monitor has collected data on key factors that influence the use of ICT in education: ICT infrastructure, professional development, availability and use of digital learning materials and the schools' vision for ICT integration. The Four in Balance Monitor collects data from a representative sample of school boards, administrators, teachers and students. Data are collected by several research institutes as well as the Dutch inspectorate for education. In addition to data on ICT infrastructure, the program collects data on ICT-supported instructional methods, teacher professional development, and schools' plans for instructional use and their implementation. These data are used to report developments of ICT in education to the ministry and to guide Kennisnet's annual planning activities and programs. In addition, schools can access their results and compare their standing on the ICT measures with that of other schools in their area and with national indicators. The final Four in Balance Monitor collection is scheduled for 2012.
Norway	The ministry has collected ICT in education indicators biennially since 2003 through the ITU Monitor program. The program's primary objective is to identify the extent to which ICT is integrated with pedagogy and broadly assess the frequency and nature of its use in Norwegian schools. Primary indicators reported in the ITU Monitor 2009 include: student access to computers in school; frequency of student computer use in school and at home for homework; frequency of student computer use across different subject areas; and teacher use of computers in instruction. In addition, in 2009 the ITU Monitor program also piloted a digital literacy test for teachers and students. However, there are currently no plans for a national administration of the test.

National Efforts to Evaluate ICT Policies and Programs

Almost half the countries that participated in the survey (11 of 21) are funding or have recently funded evaluations of ICT in education policies and initiatives (Australia, Austria, Canada, Chile, England, France, Japan, South Korea, New Zealand, Portugal and Singapore). Five of them—Australia, Japan, South Korea, Portugal and Singapore—have established programs to monitor the implementation of their current national ICT in education plan. In Singapore, the ministry recently initiated a school-level longitudinal study to track the implementation of the current ICT master plan. Results of the study are being used to understand progress toward full implementation and to identify areas where the plan can be improved and where schools can use more support. School leaders, teachers and students were surveyed and classroom observations were conducted along with teacher and student focus groups. Details on specific evaluation initiatives are in the individual country profiles in Part II.

Many of these evaluations rely on self-reported data from administrators, teachers and students, but several evaluations are using automated use records archived by the technologies to facilitate the monitoring of particular initiatives. Chile is an example of country that is using automated use records from an online professional development delivery system to support an evaluation of the system. Chile's Enlaces program is collecting data on teachers' use of online professional development including automated records of teacher-to-teacher interactions within the training courses and teacher interactions with the course materials and delivery platform.

In almost all cases, ongoing national evaluation efforts are designed to monitor the implementation of policies or programs rather than estimate their potential impacts on learning. The national evaluation tends to focus on collecting data on how ICTs are being used relative to planned use, the intensity of use, teacher and student satisfaction with the technology and areas of potential improvement. One exception is a recent study of interactive blackboards in Japan that used a quasi-experimental design to estimate the impact of the use of the technology on student learning and interest in the subject area (Shimizu 2010).

Summary

Using information systems to facilitate national and local continuous improvement efforts is an emerging area of ICT application within education. Twelve of the 21 countries surveyed reported having a system and active program in place to use student school performance data to guide and improve policies and programs. In many cases, the installation of information systems by local education authorities and schools is the key factor making these practices more cost-effective, responsive, and sophisticated in terms of the type of student data available for analysis. For example, the prevalence of networked school-based learning management systems is enabling ministries to systematically and efficiently collect a variety of local school outcome data (e.g., grades, attendance, graduation rates) to supplement national test data.

However, the drive toward the use of student performance in decision-making, accountability, and continuous improvement is not universal across countries. Nine of the 21 countries surveyed have no national system in place. Although uncovering the specific reasons behind a country's decision to implement or not implement a national system was not a focus of this research, only one possible factor was suggested in the information collected through follow-up interviews with ministry representatives: societal opposition to national monitoring of school and teacher performance using student test scores.

Societal views on national student testing and the potential to use test results to monitor school and teacher performance for accountability purposes may undermine some country’s efforts to adopt a national continuous improvement system. Interviews with ministry representatives revealed that in some countries public resistance against these practices is strong, making discussions about the adoption of national monitoring systems that include the aggregation and analysis of student test scores politically untenable. Public opposition to the use of student testing results within accountability systems was mentioned in interviews with representatives from Austria, England, France and Norway. However, although this resistance may curtail ministry-directed continuous improvement efforts in these countries, ministries may still be investing in systems to support local efforts. For example, countries such as Austria and Norway continue to invest in national information systems for the collection and analysis of student performance data but as a resource to support local continuous improvement efforts rather than as a component of a national school and teacher accountability system.

Conclusions

Even in the midst of global economic crisis, countries participating in the IETE study reported that they are continuing to invest in ICT strategies to improve their educational systems. They indicated investments in ICT infrastructure to improve equity of access to high-speed Internet connections and to increase opportunities for all schools to leverage the capabilities of high-bandwidth instructional tools in the classroom involving both video and audio and unlimited users. Countries also reported investing in computer hardware, increasingly portable and mobile, to improve access to the Internet and instructional software for teachers and students. Further, jurisdictions' and schools' adoption of technology-supported learning management systems is changing the way coursework is organized, accessed and delivered and the way student performance is communicated to parents. Learning management systems are also facilitating national and local monitoring of student performance and the targeting of policies and programs to areas of greatest need. While the combination of increasing access to high-bandwidth Internet and learning management systems can also expand the capacity for instruction accessed from home and elsewhere outside school, unbounded by time and location, few countries are currently leveraging this capability. Emerging efforts to drive down the costs of local ICT adoption and maintenance include investments in cloud computing and the development of interoperability standards.

In addition to investments in ICT infrastructure, computers and learning management systems, countries also reported investing in one of their most important resources—teachers. Almost half of the countries reported providing online professional development for improving teacher skills and providing interactive collaborative tools to foster the development and sharing of instructional materials and strategies among teachers. Almost all of these countries also reported providing digital instructional resources for teachers through websites, online portals and learning management systems, often partnering with commercial publishers for their development.

These continued investments in ICT have sparked international interest in the collection of indicators of ICT in education for the purpose of policy and program monitoring and national benchmarking. Existing international collections administered by OECD, IEA, APEC and the EU, are a primary source of information on the extent of ICT use in education across a variety of countries. However, the information collected to date has been mostly limited to indicators related to access to ICT and types of use. There has been little or no effort to try to link ICT investments to better student outcomes. The number of countries represented in these collections is limited.

The limitations of existing international ICT data collections suggests there may be a need for a cycle of ICT-related studies that periodically collects data not currently addressed by these other collections. Or existing international ICT collections may want to include additional data not collected, as yet. Examples of the types of data that are currently lacking from international collections include: teacher surveys of professional development needs related to ICT, the use of ICT to deliver teacher professional development, the availability and use of digital instructional resources in classroom instruction, the use of information systems to support data-based decision-making and continuous improvement efforts and participation of teachers in interactive collaborative environments with other teachers.

Initiating regular international benchmarks of policy relevant indicators from a large number of comparable countries will require full participation and collaboration among the international community. Over the last decade, many countries began to institute their own internal ICT indicator monitoring and collection systems and conducted numerous evaluations of their ICT in education initiatives. Ten of the 21 participating countries reported some form of national effort to collect regular data on ICT use by educational jurisdictions, schools, teachers, and students inside and outside school. The same number of countries reported that an evaluation of a major national ICT policy or initiative was currently underway. Given the current interest in the international community for benchmarking and for opportunities to collaborate and share information regarding best practices and lessons learned about the use of ICT in education, the need for an international effort to collect, archive and disseminate information on country specific policies and investments in ICT seems more apparent.

One possible model for this international collaborative learning space might be European Schoolnet and its Insight portal. European Schoolnet is a nonprofit consortium of 31 European ministries of education dedicated to supporting ministries, schools, and teachers in the use of e-learning strategies. One of the main features of the Insight portal is a searchable archive of country reports describing national ICT in education policies and initiatives. The country reports, developed by the individual ministries, follow a framework developed by the European Schoolnet. Main topic areas covered in each report include trends in education and ICT, ICT policy, ICT practice, content and services, teacher education for ICT and infrastructure. Ministries are responsible for updating information in their country reports on a regular schedule. A possible expansion of the Insight country report framework might include updated information on national ICT indicator monitoring efforts and ICT policy and program evaluations. In addition, it would be beneficial to the community to include links to any data collection instrumentation used including surveys. Similar information could be archived for major policy and program evaluation activities including a description of the policy and program, evaluation design, and a link to any published interim and final reports.

Investments in ICT to improve education are a global priority. Given the current level of national investments, there is a critical need and opportunity for the international community to leverage local knowledge that is being accumulated on effective ICT policies, programs and practices to support teaching and learning. Thus it is a particularly opportune time for the international community to collaborate on collection methods, instruments and tools, and participate in international data collections in order to maximize the collective resources of the international community. The common goal should be to improve understanding of how best to implement ICT in education and of how best to support teachers and students in acquiring the skills necessary to teach and learn with technology.

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Part II:
Country Profiles

Introduction to Country ICT in Education Profiles

In the country reports that follow, the sources for indicators included under the header "Country Statistics at a Glance" at the start of each country's data are as follows:

National Technology Indicators

Total country population, 2007: http://stats.uis.unesco.org/unesco/TableViewer/document.aspx?ReportId=143&IF_Language=eng

Labor productivity index (rank), 2009: The Conference Board and Groningen Growth and Development Centre, Total Economy Database. http://www.conferenceboard.org/economics/

Network readiness index, 2009-10: World Economic Forum The Global Information Technology Report. http://www.weforum.org/en/initiatives/gcp/Global%20Information%20Technology%20Report/index.htm

Mobile telephone subscriptions per 100 population, 2008: International Telecommunication Union, World Telecommunication/ICT Indicators Database 2009.

Internet users per 100 population, 2008: International Telecommunication Union, World Telecommunication/ICT Indicators Database 2009.

Broadband subscribers per 100 population, 2008: International Telecommunication Union, World Telecommunication/ICT Indicators Database 2009

Education and Technology Indicators

Public expenditure on education as a percentage of GDP, 2006: UNESCO Institute for Statistics available at http://data.un.org/Data.aspx?d=UNESCO&f=series%3AXGDP_FSGOV . Exceptions from 2006 as focal year are noted in individual profiles as appropriate.

Total elementary school enrollments (public only), 2007: UNESCO Institute for Statistics.

Total secondary school enrollments (public only), 2007: UNESCO Institute for Statistics.

Total number of Internet computers per 100 pupils, 2006: EC eLearning Policy: Head teacher and classroom teacher survey (ECEP), 2006 (Total – Primary and Secondary combined) as reported in

Korte, Werner B., and Tobias Hüsig. 2006. *Benchmarking Access and Use of ICT in European Schools 2006*. Empirica Association for Communications and Technology Research. www.empirica.com/publikationen/documents/No08-2006_learnInd.pdf.

Percentage of schools with a broadband connection, 2006: EC eLearning Policy: Head teacher and classroom teacher survey (ECEP), 2006 (Total – Primary and Secondary combined) as reported in Korte, Werner B., and Tobias Hüsig (2006).

The "Country Statistics at a Glance" at the start of each country's profile use the following abbreviations for countries (Exhibit 14).

Exhibit 14. Country Abbreviations Used in Country Statistics at a Glance

Australia	AUS
Austria	AUT
Belgium	BEL
Canada	CAN
Chile	CHL
Denmark	DNK
Estonia	EST
Finland	FIN
France	FRA
Hong Kong	HKG
Iceland	ISL
Ireland	IRL
Israel	ISR
Japan	JPN
Netherlands	NLD
New Zealand	NZL
Norway	NOR
Portugal	PRT
Singapore	SGP
South Korea	KOR
Sweden	SWE
United Kingdom*	GBR

*Although England participated in the IETE study, data from the United Kingdon was more consistently available in the collections reported in the "Country Statistics at a Glance" data that follow.

Currency throughout the report is provided in U.S. dollars. This was based on the average conversation rate for 2009 as published by the U.S. Treasury.

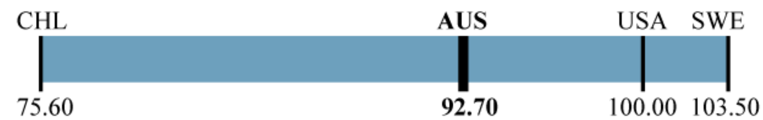
Country Statistics at a Glance

National Indicators

Total country population (2007)

Labor productivity index (% US, 2009)

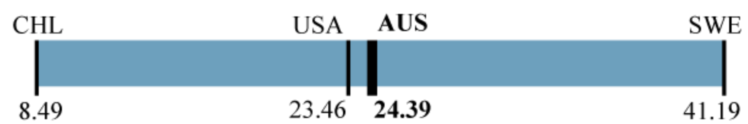
Network readiness index (% of US, 2009-10)



Mobile telephone subscriptions (per 100 population, 2008)

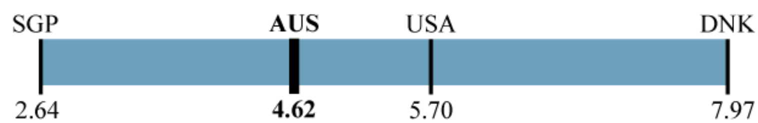
Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

Public expenditure on education (% of GDP, 2006)



Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)

Data not available.

Percentage of schools with a broadband connection (2006)

Data not available.

ICT in Education Highlights

Australia's Digital Education Revolution aims to contribute sustainable and meaningful change to teaching and learning in Australian schools that will prepare students for further education, training and to live and work in a digital world.

States and territories are collaborating on the planning and implementation of the Digital Education Revolution in order to coordinate actions at the national level and leverage resources and capabilities among states and territories. In addition to infrastructure investments, the budget provides funding for supporting the provision of online resources and supporting teacher and school leaders.

Australia began its assessment of ICT literacy in 2005 with a national sample of students in grades 6 and 10 and continues to administer this in three-year cycles. The assessment makes use of authentic, performance-based tasks that include using online search engines, working with word documents or adding graphics to presentations.

Structure and Nature of the Education System

Authorities Primarily Responsible

As a federal system, Australian states and territories bear primary responsibility for educational administration, including staffing, teacher qualifications, infrastructure and equipment and funding (Arthur 2010). Authorities at the state and territory levels provide standards frameworks that require schools' compliance when making decisions about textbooks, instruction and curriculum. The national government plays a leadership and budgetary role, collaborating with state and territory governments to provide guidance and financial investments to support a range of reforms (Arthur and Stuparich 2010b).

Efforts to coordinate policies and activities at the national level have increased through the leadership of the Council of Australian Governments, the top intergovernmental group which includes the Prime Minister and the heads of all states and territories. Coordinated efforts are underway to create a national curriculum (known as the Australian Curriculum) and to develop a collaborative and cross-sectoral approach to enhancing priority areas of Australian education and training in order to develop more productive citizens.

The Department of Education, Employment and Workplace Relations (the Ministry), is the lead agency at the national level responsible for education and labor, i.e., workplace training, the transition to work and industrial relations (Ainley 2009; Arthur and Stuparich 2010b). The Australian Information and Communications Technology in Education Committee is the lead national committee charged with providing advice to Australian Ministers for education and training on the use of ICT in education and training and on the implementation of the Digital Education Revolution. With funding from the Ministry, this committee includes representation across all sectors: public and private, all education levels, the states, territories and the Australian government (AICTEC website).

Australia ICT in Education Profile

Political and Economic Context

The current Australian government came to power in 2007 on its platform to revolutionize the education system, promoting reforms in curriculum, assessment, reporting, teaching quality and leadership, and working towards greater equity and rewards for performance and infrastructure (Arthur and Stuparich 2010; Paul 2010). Under the education-focused portion of the national stimulus plan, called Building the Education Revolution, billions of dollars are earmarked for infrastructure improvements; the program overview does not detail the role of ICT specifically in the building projects. Specific reforms and strategies are defined under the Digital Education Revolution.

National Plan for ICT in Education

Australia does not have a national plan per se: the Ministry does not consider the comprehensive Digital Education Revolution program, aimed at developing system-wide reforms in education focused on the integration of digital technologies into schools to support teaching and learning, a national ICT in education plan. However, the Digital Education Revolution merits discussion here, since it is comparable to the national ICT in education plans of other countries included in this report. Developed by the Ministry, the Council of Australian Governments and the Ministerial Council for Education, Early Childhood Development and Youth Affairs (MCEECDYA), the Digital Education Revolution was a cornerstone of the electoral platform of the current government. It represents an agreement between the national government and Australian states and territories. A total of USD 1.9 billion has been allocated for the period 2008–14 in order to meet the following objectives (DEEWR website):

1. Provide for new ICT equipment for all secondary schools with students in years 9–12 through the National Secondary School Computer Fund in order to achieve a computer to student ratio of one-to-one by the end of 2011.
2. Support the deployment of high-speed broadband connections at a minimum speed of 100 Mbps to Australian schools.
3. Support systemic change to increase the level of ICT proficiency for teachers and school leaders across Australia to use ICTs in teaching and learning and support the development of innovative projects and research that enable professional learning in the use of ICT. This includes the development of national training system and accreditation standards for training courses, which were previously defined at the state and territory levels.
4. Provide for digital learning tools, resources and infrastructure, aligned with the Australian Curriculum.
5. Enable parents to participate in their child’s education through online learning and access.
6. Support mechanisms to provide vital assistance for schools in the deployment of ICT.

Details of National Plan

Title: Digital Education Revolution

Year of Publication: 2008

URL: www.digitaleducationrevolution.gov.au

Private Sector Involvement

Historically, the private sector has contributed to education at the state and territory levels given Australia's federal system of government. The Ministry has had limited partnerships with the private sector, although representatives from the private sector are invited to give commentary on policies and programs as well as participate in government-led working groups. To build and operate the National Broadband Network, the government formed a wholly government-owned company, NBN Co. Ltd., to design, which aims to deliver high-speed fiber connectivity to all households, schools and workplaces, including those in remote locations. The government plans to sell down its interest in the company within five years after the network is completed (Arthur and Stuparich 2010b). The Australian government also supports non-government schools, providing around 40 per cent of the total funding for non-government schools. The funding for non-government schools is typically designed to provide targeted assistance.

Increasing ICT Structure and Support

Priorities and Programs in This Area

Although Australian students enjoy extensive ICT access, among the highest in the world according to participants in the Program for International Student Assessment (PISA) 2003 and the Trends in International Mathematics and Science Study (TIMSS) 2008 (OECD 2005; Thomson and Fleming 2004), the government continues to invest heavily to increase student access to connectivity and computers in schools. The National Secondary School Computer Fund, a flagship program under the Digital Education Revolution, provides new ICT equipment for all secondary schools to achieve one-to-one computing for student ages 14–17 (grades 9–12). An estimated USD 1.8 billion, which is equivalent to about 95 percent of the total funding for the Digital Education Revolution, is earmarked for the purchase of computers in order to meet this goal by December 2011 (NSSCF Website). This funding is separate from the expectation that schools expend their own funds on ICT to encourage subsequent investments in interactive whiteboards, data projectors, digital cameras and other technologies (Arthur and Stuparich 2010). In addition, the government allocated USD 80 million to support the deployment of high-speed broadband connections to all Australian schools as part of the Digital Education Revolution, which will be coordinated with the country's broader telecommunications program, the National Broadband Network, run out of the Department of Broadband, Communications and the Digital Economy. This program targets the delivery of up to 100 Mbps to over 90 percent of homes, schools and workplaces with provisions for wireless and satellite connections of at least 12 Mbps to remote locations. Its objective is to deploy high-speed connections consistently in order to facilitate more seamless, anytime-anywhere connectivity for students. The stimulus-funded program, Building the Education Revolution, also includes modernization of school facilities, primarily for those serving students ages 6–12 (primary school), as one of its broader targets. The program allows schools to consider ICT items only if they are necessary for the building to be used as intended (Arthur and Stuparich 2010).

Such investments in infrastructure reflect the government's commitment to the importance of ICT as a tool for increasing productivity; however, specifications about the specific uses of ICT have yet to be developed, as many efforts are still in the planning phase (Arthur and Stuparich 2010). Examples of these include the development of interoperability standards and intellectual-property protections to promote the sharing of resources across jurisdictions.

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

ICT literacy was initially defined as "the ability of individuals to use ICT appropriately to access, manage, integrate and evaluate information, develop new understandings and communicate with others in order to participate effectively in society" (MCEECDYA Performance Measurement and Reporting Taskforce). More recently, "ICT literacy has become increasingly regarded as a broad set of generalizable and transferable capabilities that are used to manage and communicate cross-disciplinary information using computer technology. The integration of information and technology is seen to transcend the application of ICT within any single learning discipline" (MCEECDYA 2010, viii). Results from the National Assessment Program ICT Literacy, which was administered in October 2008, revealed that 57 percent of Year Six students and 66 percent of Year 10 students met or exceeded the proficient standard for their respective years.[13]

In addition, Australia is in the process of finalizing its first national curriculum as a means to develop a more globally competitive population by building consistency across states and territories and leveraging shared resources. The draft curriculum for K–10 focuses initially on English, mathematics, science and history. It was available for public comment in March 2010. Approximately 150 volunteer teachers from the various states and territories have been piloting sample activities in classrooms since June 2010 in order to meet the target release date of 2011 (ACARA website). The Ministry expects that the Australian Curriculum for K-10 English, mathematics, science and history, will go to Australian education ministers for approval in December 2011. With the goal of fostering cross-disciplinary learning and attention to 21st century skills, this curriculum will explicitly attend to ten general capabilities as embedded

[13] Proficiency at Year Six requires that a student demonstrate the ability to "generate simple general search questions and select the best information source to meet a specific purpose, retrieve information from given electronic sources to answer specific, concrete questions, assemble information in a provided simple linear order to create information products, use conventionally recognized software commands to edit and reformat information products." Proficiency at Year 10 requires that a student demonstrate the ability to "generate well targeted searches for electronic information sources and select relevant information from within sources to meet a specific purpose, create information products with simple linear structures and use software commands to edit and reformat information products in ways that demonstrate some consideration of audience and communicative purpose" (MCEECDYA 2010).

across all learning areas: literacy, numeracy, ICT, thinking skills, creativity, self management, teamwork, intercultural understanding, ethical behavior and social competence (ACARA website; Paul 2010). The agency responsible for developing the Australian Curriculum will also work to ensure it is aligned with the National Assessment Program – Literacy and Numeracy, an annual national testing program of all Australian students at ages 8, 10, 12 and 14 (grades 3, 5, 7 and 9, respectively) that began in 2008—a shift from prior testing that was independently conducted by states and territories.

Priorities and Programs in This Area

Given that content requirements have varied by state and territory, resources are largely aggregated at this level rather than on a national scale. The National Digital Learning Resources Network provides a national pool of resources that are especially useful to smaller jurisdictions and the Catholic and Independent school sectors. Nevertheless, there is general agreement across all jurisdictions that ICT-facilitated learning management systems and online environments are crucial delivery mechanisms, and work is in progress to develop these (Arthur and Stuparich 2010). The Digital Education Revolution set aside USD 26 million to support the provision of curriculum resources and learning tools that are not only aligned with the Australian Curriculum but also meet interoperability standards in order to facilitate “safe and seamless” sharing across schools and jurisdictions (AICTEC 2009). Explicit uses of ICT in instruction will be embedded in the Australian Curriculum to emphasize the role of digital technologies as an integral part of curriculum delivery. Implementation plans will also encourage friendly copyright arrangements to promote collaboration.

The Use of ICT to Increase Teacher Capacity

National ICT in education standards for teachers

The government continues to invest in teacher and school-leader development as part of its effort to modernize and create more equity in Australian education. Although state authorities found that 90 percent of teachers self-reported that they had acquired basic ICT competency and 50 percent of teachers rated themselves as “intermediate” or “advanced” (Lee Dow 2003), the Digital Education Revolution considers increasing the proficiency of teachers and school leaders as a necessary component of systemic change. Australian governments have agreed to share responsibility for implementing a standards-based national framework for teacher and school leader professional learning. The national professional teaching standards will include specific requirements regarding the use of technology in teaching. Within this professional standards framework, government and nongovernment education authorities in Australian states and territories will have responsibility for setting local priorities and delivering quality professional learning programs” (Arthur and Stuparich 2010). This includes developing a national accreditation system for teacher education courses, national professional standards for teachers and embedding the use of ICT in teacher pre-service education courses (Teachers, School Leaders and ICT website).

Priorities and Programs in This Area

In February 2010, the Australian Government committed USD 31.7 million for implementing its Digital Strategy for Teachers and School Leaders with a target rollout beginning in 2011 (Digital Education Revolution Strategy for Teachers website). Consistent with national efforts to ensure the equitable delivery of education to all Australian students, this strategy focuses on developing supports that will enable teachers and school leaders to make sustainable change in the classrooms. The strategy is a national approach which helps teachers and school leaders to embrace ICT and encourages them to creatively and effectively integrate the use of new technology into the classroom. At the school-leader level, the goal is to build leadership capacity to support the transformation of teachers' practices and student classroom learning by also modeling the required competencies themselves.

The government provides to institutions of higher education, businesses and other organizations under its ICT Innovation Fund, which supports the development of teacher education courses in the use of ICT, the provision of ICT professional learning and the development of online professional learning resources, across three key result areas: improving the capability of pre-service teachers; enhancing the capacity of in-service teachers; and driving innovation through leadership. In addition to the ICT Innovation Fund, the government is exploring options for assisting teachers and school leaders to improve their ICT proficiency.

The National Digital Learning Resources Network (previously known as The Learning Federation) is an online repository of materials aligned with the curriculum and the goals of the Digital Education Revolution (Learning Federation website). Other programs occur at a smaller scale. For example, Centres of Excellence, funded by the Teacher Quality National Partnership and managed at the state or sector level, serve as model schools and centers for the delivery of professional development for geographically clustered schools, where selected centers also have links to local universities (Ainley 2009).

Continuous Improvement Efforts

Investing in Data Systems

Nationally comparable data on all Australian schools are reported through the My School website, including data on student learning outcomes, on the social context of schools, and on school staff resources. The Ministry reports plans to add additional information, such as growth in student performance and school financial data (Arthur and Stuparich 2010).

At the time of data collection, there were no specifications regarding the use of ICT to support the National Assessment Program[14] and how the national testing data might be used. Historically, data collections and reporting efforts were constrained within states and territories (Arthur and Stuparich 2010).

National ICT Program and Policy Evaluation Efforts

The ICT in Schools Task Force, which included representation from all state jurisdictions, began developing a self-assessment framework for schools that enabled them to assess their implementation of ICT activities using a series of rubrics. This was discontinued in 2008 (AICTEC website).

The Australian Government is currently consulting with Australian education authorities on a draft evaluation framework for the Digital Education Revolution. The key components of the framework are indicators, methodology and timeframe for evaluating the overall impact and outcomes achieved through the Digital Education Revolution. The proposed evaluation framework for the Digital Education Revolution reflects the four strands of change for national action as set out in the Digital Education Revolution Strategic Plan. These are:

- Leadership – that ensures schools have a coordinated plan for the provision of infrastructure, learning resources and teacher capability to address the educational challenges of the 21st century.
- Infrastructure – access to digital teaching and learning resources and tools for processing information, building knowledge and for communication and collaboration.
- Learning Resources – which stimulate, challenge and assist students in achieving desired learning outcomes. These include collaborative and interactive activities as well as instructional and reference materials.
- Teacher Capability – providing teachers with the skills and tools to design and deliver programs that meet students' needs and harness the benefits of digital learning.

[14] May 2008 was the first time that all students in Australia ages 8, 10, 12 and 14 (grades 3, 5, 7 and 9, respectively) were assessed on the same tests in reading, writing, language conventions (spelling, punctuation and grammar) and numeracy (working effectively with numbers, space and measurement) as part of Australia's National Assessment Program. Testing continues to be conducted on an annual basis.

National ICT in Education Indicator Collections

Australia began conducting national assessment of students' ICT literacy skills in 2005. Every three years, a national sample of students ages 11 and 15 (grades 6 and 10 respectively)[15] completes computer-based performance assessments designed to mirror real-world contexts to "determine their levels of confidence, creativity and skill development in the use of information and communication technologies" (MCEECDYA 2010). Sample items include using online search engines, editing and creating documents using productivity software like Microsoft Word, and organizing files for easy retrieval and sharing. The assessment also includes items on ethical and legal uses of information.

Plans to Participate in International Data Collections

Australia is a member of the Assessment of 21C Skills Project. It also plans to participate in PISA in 2012, TIMSS 2011 and, for the first time, in the Progress in International Reading Literacy Study (PIRLS) 2011.[16]

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[15] The sample in October 2008 included 10,926 Year Six and Year 10 students in a total of 591 schools.
[16] Due to differences in timing of the school year between northern and southern hemispheres, Australia administered TIMSS and PIRLS in 2010.

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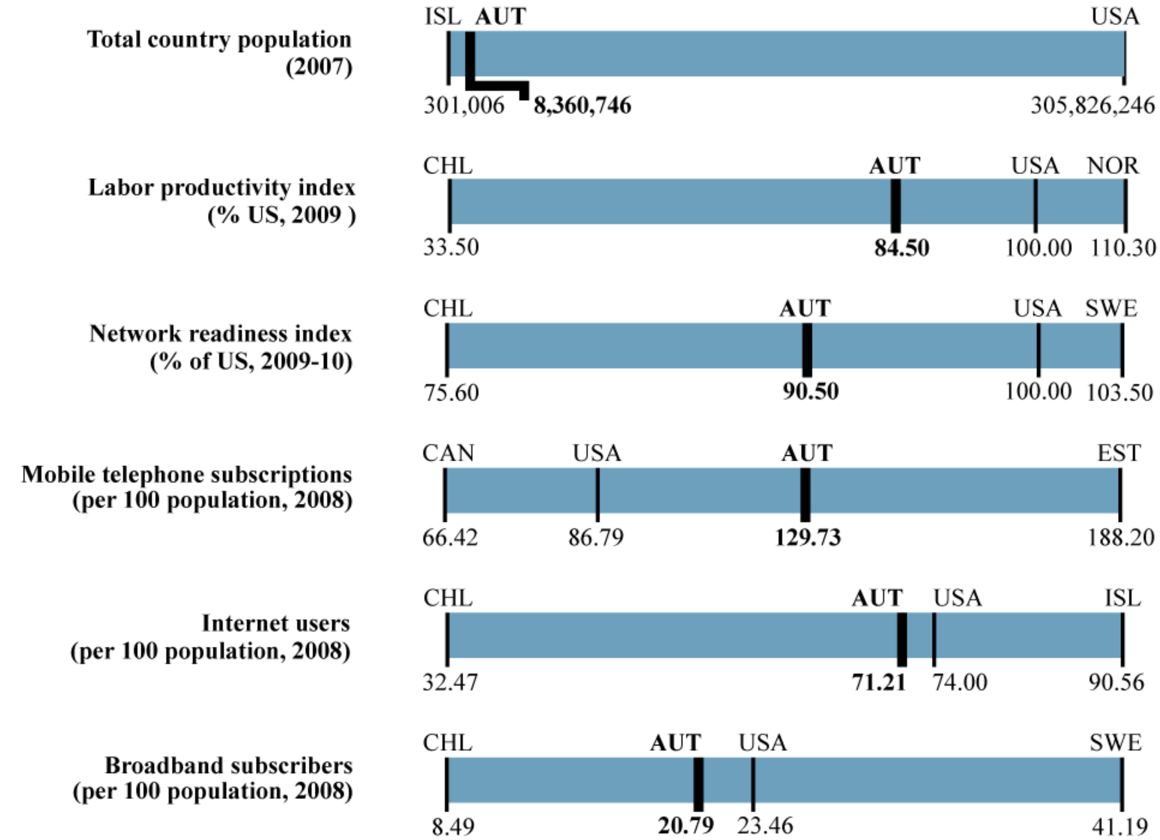
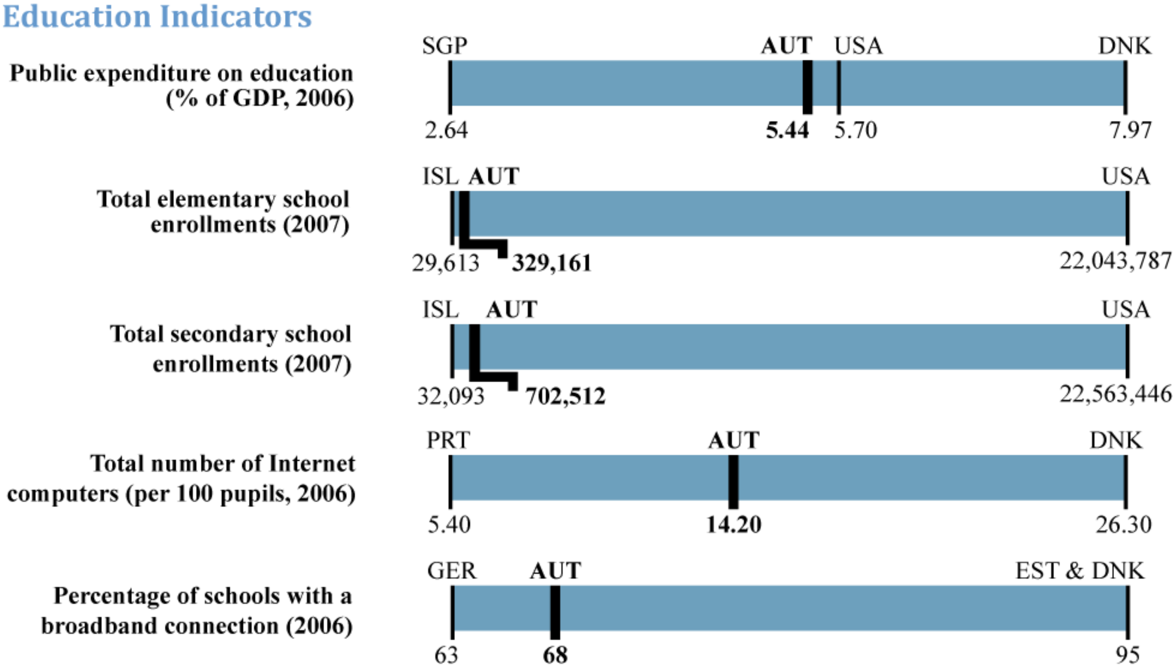
Austria ICT in Education Profile

Country Statistics at a Glance

National Indicators



Education Indicators



Austria ICT in Education Profile

ICT in Education Highlights

Austria is pursuing a one-to-one computer-to-student ratio and sees mobile devices such as smartphones and netbooks as the way to reach that target.

Austria has made it easier for schools to adopt and begin using learning management systems (LMSs) by running the system and offering associated training and technical support, through a central server. One-third of upper-secondary schools already use the system.

The Austrian Federal Ministry of Education, Arts and Culture has significantly expanded its continuous improvement efforts in the last few years. A quality management program is in place in all secondary schools. A new agency was founded in 2008 to conduct monitoring, research and evaluation. Student-outcome data is now being analyzed with the goal of reducing inequality among schools.

Structure and Nature of the Education System

Authorities Primarily Responsible

In Austria, responsibility for primary and secondary school (compulsory school, that is, through age 15) historically rested with provincial governments. Five years ago, the Austrian Federal Ministry of Education, Arts and Culture (Bundesministerium für Unterricht, Kunst und Kultur, BMUKK(Ministry)) began partnering with provincial governments, and shared. General and vocational upper-secondary schools, which serve students age 16–18, are run by the federal government, with responsibility shared among several ministries. Austrian students specialize rather early: from age 16, they train for a specific field. Accordingly, over 200 different types of vocational schools serve 80 percent of upper secondary students, while a small minority attends general schools. Students nearing the end of secondary school select a specialization with guidance from students in vocational schools. Through this mentorship, the younger students have a chance to conduct their own experiments and explore the ICT resources of a given field, while the older students take a leadership role in guiding their successors (Dorninger 2010a).

Federal policy regarding primary and secondary schools serves as a set of guidelines, with the provinces implementing the guidelines as they see fit according to their own contexts and goals. The sharing of authority at all levels can make reform difficult. For a new program to be implemented, it has to be introduced as draft legislation at the national level and then circulated for comment among provincial governments and school boards. Basic laws passed at the federal level have to be followed by laws regarding implementation passed at the provincial level. That said, a “new secondary school” reform was passed in 2008. Focused on students age 10–14, the reform aimed to adapt learning opportunities to students’ different backgrounds and learning styles while imparting key skills, such as responsibility, creativity, communication and teamwork (Hawle and Lehner 2010; Lehner 2008).

Austria has a national curriculum, developed by collaboration among selected groups of subject-area teachers. There are national standards for learning platforms and learning plans, and both the Ministry and local authorities are increasingly interested in sharing digital materials.

However, primary and secondary schools teach the national curriculum and use the Ministry's other materials only on a voluntary basis (Dorninger 2010b; Lehner 2008).

Political and Economic Context

A more systematic approach to continuous improvement has accompanied the expansion of the BMUKK's authority in the last few years. The Federal Institute for Educational Research, Innovation and the Development of the Austrian School System (School System) was founded in 2008 with the mission of conducting research and evaluation activities that will serve to inform policy. The School System developed assessments to go with newly implemented grade-level standards for fourth- and eighth-grade students (ages 10 and 14) and publishes summaries of data it collects throughout the year in annual reports.

Overall, provincial governments fund half of all IT initiatives and some initiatives originate at the provincial level rather than at the federal level. For instance, a province might launch a broadband plan, for which the Ministry will provide some funding (Dorninger 2010a).

National Plan for ICT in Education

In Austria, educational technology plans are developed by the Ministry in conversation with the Ministry of Science and Research, the Ministry of Infrastructure and Technology and provincial governments. The Ministry is solely responsible for approving the plans (Dorninger 2010b). Plans are strategy documents updated every three to five years, with specific targets updated every year. In general, the targets align with European Union resources and goals.

The current plan, Future Learning, went into effect in 2006, building on the former eFit initiative (2001–06). The plan defines a policy of equality and creativity around points such as new learning environments and pedagogical approaches, teacher training and infrastructure goals. For the BMUKK, the ubiquity of ICTs—and especially of user-driven websites such as social networking tools—calls for a new learning environment in which students work collaboratively in groups rather than absorbing material presented by a teacher at the front of the room. At the center of this new environment is a mobile connection for each student and teacher on a personal device of some kind (laptop, mobile telephone, etc.). Improving student-to-computer ratios to the target of one-to-one is a top objective of Future Learning. The BMUKK, which hosted an Organisation for Economic Co-operation and Development (OECD) conference on this issue in Vienna in late February 2010, considers this initiative essential (BMUKK and OECD/CERI 2010). Future Learning also seeks to increase teachers' capacity. To this end, the eContent initiative supports the development of high-quality digital learning resources. The BMUKK would like to increase the usage of new and existing digital materials by better integrating them with schools' LMSs. The BMUKK takes advantage of commercial and open-source software that Europe makes available, as well as European programs, such as a current interdisciplinary program that allows students to learn about all aspects of videography (BMUKK IT Steering Group website; Dorninger 2010a; Future Learning website). Lastly, the education Ministry is focusing on building and maintaining communities of teachers, researchers and IT business leaders, an effort supported by the eLearning Clusters program.

It should be noted that the plan addresses only upper-secondary school students (ages 15–18), those over which the BMUKK has the most direct authority. The fact that the learning experiences of Austrian students in this age bracket are so varied—with 80 percent of students distributed across 200 types of vocational schools—presents a significant policy challenge.

Details of National Plan

Title: Future Learning

Year of Publication: 2006

URL: http://www.bmukk.gv.at/schulen/futurelearning/index.xml

Private Sector Involvement

Over the last 10 years, the Ministry supported networks of schools and universities. The universities provide research and expertise and form partnerships with small companies. The BMUKK negotiates with large companies to build and maintain the ICT infrastructure, in coordination with the Ministries of Science and Research, and Infrastructure and Technology.

Upper-secondary schools (80 percent of which are vocational) partner with leading technology companies for software and workforce-development purposes. The partnerships with companies are not primarily meant for buying software—quality educational open-source software is already available—but rather to improve students' professional qualifications. Upper-secondary students (16–18 years old) can earn certificates from companies including Cisco, Microsoft and Oracle; employers look for these additional qualifications. Graduates of business-focused upper secondary schools can graduate with two certificates. The technology companies also partner with universities in order to carry out or participate in research and share findings at conferences (Dorninger 2010a).

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

The goal of Internet connections in all schools was met under the previous eFit national plan, which ended in 2006. Under the current plan, the BMUKK (along with other Ministries) is improving broadband penetration; promoting the use of LMSs by offering centralized services; and pursuing a one-to-one computer-to-student ratio through a policy of anywhere-anytime access through mobile devices. Approximately 35 percent of classrooms have broadband internet connections, at average speeds of 2 Mbps. At present, there is one computer for every 3.5 students in Austria. Responsibility for ICT infrastructure is shared by the BMUKK and the provincial governments. Broadband initiatives, for instance, usually take place at the provincial level and are co-funded by BMUKK.

The centralized LMS, now in place in one-third of Austrian upper-secondary schools, came about through the EduMoodle program. Based on the Moodle platform, an open-source LMS, EduMoodle relies on a central server. By centralizing the server and related online training and support services, the Ministry sought to make the platform easier and cheaper for schools to begin using. This approach saves schools the expense of having to invest in their own servers and training courses. Further, centralizing services supports data collection efforts and makes it far easier to share materials regionally or nationally. The EduMoodle initiative officially ended in 2007, but the number of schools adopting the platform is still growing—over a third of upper secondary schools are using it at present. BMUKK is seeking to double this number by improving central services.

Although over 20 percent of Austrian schools are equipped with interactive whiteboards and an evaluation of their use is currently underway (Hawle and Lehner 2010), the BMUKK generally favors increasing students' and teachers' access to online resources through mobile devices, rather than prioritizing equipping classrooms with hardware that stays in classrooms. A netbook pilot program is currently underway involving 600 classrooms located throughout Austria (Baumgartner et al. 2010; Dorninger 2010a; Netbooks in Education website).

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

Standards that cover all subject areas and include measures for ICT have been recently developed in Austria for the first time. The standards, now in place for students in grades 4, 8 and 12–13, define levels of competency that students must achieve by the end of the appropriate grade. Students are assessed in terms of the standards via tests developed by BIFIE (Hawle and Lehner 2010). The use of standards represents a new style of work in Austria. The BMUKK expects that in three or four years, they will have enough data from the use of standards to be able to measure achievement at an aggregate level (Dorninger 2010a, 2010b).

Priorities and programs in this area

In order to engage more students in a wider range of ICT-based learning experiences, the BMUKK has focused on developing a centralized LMS that students access through mobile devices. The Ministry continues to develop digital learning resources for use through the platform and via mobile devices, and is now exploring the potential of game-based learning.

Students can access the learning platform and other educational online resources through mobile devices, such as laptops, netbooks or mobile phones. By doing so, they obtain learning materials through various subject matter portals and collaborate on assignments. In striving towards a one-to-one computer-to-student ratio, the BMUKK privileges mobile devices and places far less emphasis on equipping schools with things such as desktop computers and interactive whiteboards. The mobile-device approach used to focus on laptops, but the BMUKK found that their cost proved a deterrent for the families expected to purchase them. Now, students can connect from a wider range of devices, and the point of entry—a mobile phone or netbook computer—has become more affordable.[17] A netbook program is now being piloted in 600 classrooms located in all regions of the country.

Game-based learning is an increasingly important mode of educational ICTs in Austria. Project-based learning is very common at the upper secondary level, partly because most students are enrolled in vocational schools. The Ministry reports that a current BMUKK program in which students design their own computer games in a national contest offers an engaging way for students to take responsibility for their own learning process and achieve concrete outcomes. Twenty upper secondary schools now compete; the Ministry expects the number of participating schools to double each year. A secondary impetus behind this program is to soften the negative connotations around video games in Austria and Germany, where many believe they can incite violence. As the *2010 Horizon Report: K-12 Edition* (New Media Consortium) suggests, serious games have great positive potential as learning tools (Dorninger 2010a, 2010b).

Students are also beginning to create their own e-portfolios, which the BMUKK sees as a means by which they can present their work to everyone—not only school personnel but also potential employers. The portfolios are meant to demonstrate a student's abilities, including writing and problem-solving skills, in a more in-depth fashion than grades and certificates earned alone can provide. Cultural and business vocational schools have been the first adopters.

As ICTs mean that students' learning takes place in an increasingly public (or potentially public) way, and as students use ICTs to take more responsibility for their own learning, the BMUKK sees the need for students to become savvy and ethical users by developing their critical thinking skills and media literacy. Students must recognize what kinds of stresses they encounter in the online environment and determine how to appease those stresses. The new Meaningful Uses of Social Web project provides a forum for young people to discuss the opportunities and risks of social media (Dorninger 2010b).

One study of tourism-focused vocational upper-secondary schools in Vienna found that the e-learning environment has also resulted in changing students' sensibilities, such as attracting female students to disciplines they may not have otherwise chosen. In this study, when more IT options were added to the curriculum, female students enrolled in them, causing enrollments in housekeeping, service, and cooking courses decreased (Dorninger 2010a).

[17] For comparison, a T-Mobile smartphone subscription in Austria including 2,000 minutes, 1,000 text messages and three GB of data currently costs approximately USD 49 per month. A roughly equivalent subscription in the United States costs USD 80–90 per month.

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

Introducing standards for students has meant retraining teachers according to the revised objectives. Sixty percent of new teachers are now "eFIT," or have voluntarily passed assessments in terms of the standards. ICT training is not a required part of the program of study for new teachers but rather one specialization option of 10. There is no required ICT assessment for either pre-service or in-service teachers.

Priorities and Programs in This Area

The BMUKK currently considers increasing the integration of digital materials into pedagogy a high priority. To support teachers in achieving this goal, the BMUKK focuses on the development of additional digital materials, professional development and community-building.

In tandem with increasing students' access to mobile devices and a centralized LMS, the BMUKK continues to increase teacher capacity through the development of digital learning resources.[18] Thus far, students' exposure to digital learning resources varies greatly by subject area. The BMUKK estimates that over half of upper secondary math lessons use ICT resources—perhaps in part because more portals and products are available to Austrian teachers in this area. By contrast, students are less likely to encounter ICTs in their geography, history, or humanities courses (Dorninger 2010a).

In terms of professional development, Austria is a member country of the European Pedagogical ICT License (EPICT) program since the fall 2007. In-service teachers are required to complete 15 hours (2 days) of additional training per year. Teachers choose which courses they pursue, but the choices have to be relevant to their responsibilities. Schools have to meet their training obligations in order to receive a portion of their funding. Teachers at schools with LMSs in place have access to centralized training and support. In general, teacher training became more convenient for teachers over the last few years. Teachers can now fulfill more of their training requirements online. For face-to-face trainings, more experts now come to schools, saving teachers the commute to training sessions at nearby universities.

The community- and partnership-building program, eLearning Clusters, offers additional professional development opportunities for teachers. eLearning Clusters is a grant program that promotes building community partnerships and sharing innovations among teachers, school leaders, education researchers and IT business leaders. Partnerships start among schools; each school that applies has to find a partner school every two years in order to be funded (and refunded). The partner school can be of any type. Participating teachers have to exchange experiences, hold common events and visit one another. Participating schools in a region form a "cluster." Grantees must carry out a community project and a media project (not in connection with university researchers) in order to be refunded. Representatives from participating schools

[18] Smith (2009) addresses how digital learning resources help increase teacher capacity.

attend two conferences per year to discuss progress on their projects with other grantees, as well as with members of government and industry and university researchers. The spring meeting focuses on community building among teachers, while the autumn meeting brings together a range of experts (university teachers, business leaders, school teachers and students, reporting from their project experiences). The meetings are a valuable chance for communication and relationship-building among the BMUKK and participating entities. One informal measure of the program's success is that each year, more principals attend for the first time in order to learn about grant activities. There are now between 500 and 600 schools participating (Austrian eLearning Conference website; Dorninger 2010a, 2010b; eLearning Cluster website).

Continuous Improvement Efforts

Investing in Data Systems

The use of educational data to support continuous improvement became common and widespread only recently in Austria. Three years ago, the BMUKK founded BIFIE to undertake national data collections. A school-monitoring system was established and aligned with international systems, such as the Program for International Student Assessment (PISA). BIFIE published a comprehensive national education report for the first time in 2009 (BMUKK website; Dorninger 2010a).

BIFIE collects and reports outcome data on students of ages 10, 14, and 18 (grades 4, 8, and 12-13) in reading, writing and mathematics (for younger students) and in German, English, and mathematics (for older students). Schools have begun systematically using student outcome data to inform teacher improvement strategies. Principals receive annual reports of student performance, broken down by subject area. That is, the report allows administrators to review the performance of all teachers within a given subject, but not the performance of an individual teacher. The goal of the program is to reduce differences in quality among different schools. Austrian teachers are generally not fond of student-outcome data being used as a measure of teacher performance. Teachers unions are powerful in Austria, where teachers are used to designing assessments themselves. Teachers fear that improved national data collections could result in weaker teachers being singled out and demoted or even dismissed (Dorninger 2010a).

Austria also has a quality management program in place called Quality in Vocational Education (QIBB). This program supports school-level decision making such as revising curricula, improving teaching and learning conditions, and investing in new equipment. QIBB follows on the Quality in Schools program (QIS) and is in place in all upper-secondary schools, general and vocational. QIBB involves an ongoing four-step process through which schools first develop their own quality assurance plans according to guidelines tailored for each sector (e.g., business vocational schools, cultural vocational schools, etc.) and develop their own approaches for evaluation. All teachers and students contribute their impressions through self-report surveys. Two groups of indicators are collected, one on core processes and the other on management and support. Core processes include school and classroom climate, partnerships with industry, career opportunities and outcomes (for students) and the timeliness of training; while management and support covers strategic objectives, resource management and staff development. Surveys are completed and submitted directly on QIBB's website; the system requires a school-specific log-in. The results are not published (Dorninger 2010a, 2010b; QIBB website; QIS website).

National ICT Program and Policy Evaluation Efforts

Evaluations of interactive whiteboard and netbook use are underway in Austria. In addition to the role whiteboards can play in promoting a more student-centered learning style, the BMUKK sees whiteboards as a potentially valuable way to document lessons. The BMUKK is working with university researchers and schools to develop and evaluate lesson materials and lesson sequences for use on the devices. Comparative evaluations are also examining materials and features available from different vendors (Hawle and Lehner 2010).

The netbook pilot study is now in its second year, which focuses on data collection for evaluating a "360-degree learning style." The researchers began by studying other netbook programs underway throughout Europe by observing students as well as analyzing microblogs in which students regularly report on how, where and for what purpose they use their netbooks. The analysis of microblogs allows the researchers to delineate trends from which student interview protocols are being developed (Baumgartner et al. 2010).

National ICT in Education Indicator Collections

Every other year, researchers at the Danube University conduct a study of ICT infrastructure in schools, collecting information on all aspects of equipment and software. The most recent report had not yet been released at the time of writing.

Plans to Participate in International Data Collections

Austria plans to participate in TIMMS and PISA (studies and the European Union [EU] ICT Cluster), as well as all EU-sponsored programs.

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Belgium (Flemish Community) ICT in Education Profile

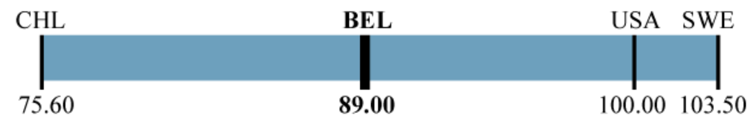
Country Statistics at a Glance

National Indicators

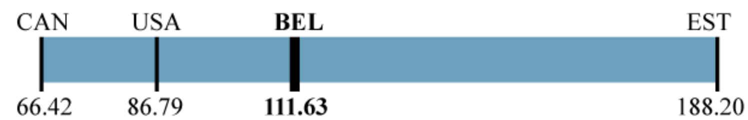
Total country population (2007)

Labor productivity index (% US, 2009)

Network readiness index (% of US, 2009-10)

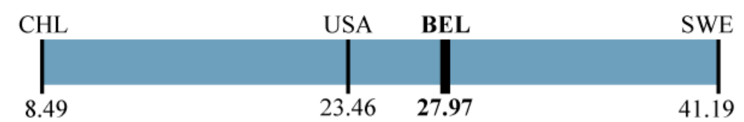


Mobile telephone subscriptions (per 100 population, 2008)



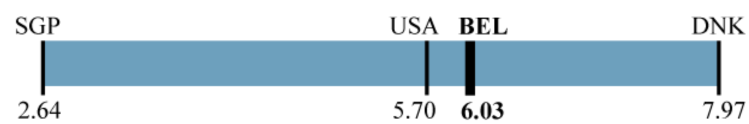
Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

Public expenditure on education (% of GDP, 2006)



Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)

Percentage of schools with a broadband connection (2006)

ICT in Education Highlights

In Belgium, the ICT Without Boundaries program is an awareness-raising campaign to introduce ICT in special-needs schools and increase the usage of ICT by children with special needs.

The Planning for ICT in Schools (pICTos) program is an online software tool to support school teams in the development of a local (school-based) ICT strategy.

The successful educational Web portal, *KlasCement*, is for teachers to share the learning materials that they developed themselves, with their colleagues. It has an incentive/point system to encourage teacher participation and contribution of content.

Structure and Nature of the Education System

Authorities Primarily Responsible

Rather than operating under a single national government, the Belgian government is a federal parliamentary democracy divided into three administrative units, called Communities. Each Community has jurisdiction over a separate geographic region, whose boundaries are determined by the country's three major language groups: Flemish, French and German. The Flemish-speaking Community is the largest, with over 55 percent of the population, and its boundaries correspond to the geographic region of Flanders. French speakers make up 44 percent of the population, and German less than 1 percent (Denis et al. 2009). The French-speaking and German-speaking Communities together make up the geographic region of Wallonia. Each Community has its own education system whose administration and structure are virtually autonomous of the other two Communities. This profile focuses on the Flemish Community (Flanders). Unless otherwise stated, all program, policy and other descriptions in this profile refer to the Flemish Community.

The education system in the Flemish Community of Belgium is relatively decentralized. There is a central organization, the Flemish Ministry of Education and Training, which oversees Community-wide aspects of educational policy. This Ministry is responsible for defining broad educational goals and monitoring the achievement of those goals. It oversees school funding and finances, and also develops policies and projects to meet the needs of Flemish society. For the most part, however, local schools have a great deal of autonomy, and the Ministry does not interfere directly in local school policy. Each school has the authority to define its own curriculum, organization, budget, staff policies (such as hiring and professional development) and students with disabilities. Local schools also take responsibility for developing policy related to ICT. Although exercising a high degree of autonomy with regard to these areas of policy-making, local schools are nevertheless held accountable to the Ministry for attainment of the broad educational objectives established at the Community level (Denis et al. 2009).

Regional Plan for ICT in Education

The current strategic plan for ICT in education in Belgium, *Competences for the Knowledge Society*, was drafted in 2007 and is described below. A new general policy plan for education was put forward after the national elections of 2009; but while the newer plan includes some ICT in education initiatives, it does not contain a coherent ICT in education strategy. Thus, the 2007 plan is still considered the most relevant policy guideline for ICT in education (De Craemer 2010a). The newer general policy plan addresses topics such as open-source software, educational use of games and developing ICT attainment targets for the secondary level (ages 13–15) (De Craemer 2010c).

In the 2007 Plan, ICT is viewed as a core element of the total learning environment. The overarching priority of the Plan is to ensure that ICT attainment targets are integrated across all aspects of the curriculum (Vandenbroucke 2007). This priority is summed up in the Plan's motto, "ICT competencies for everyone." The Plan puts forward one set of ICT attainment targets and related ICT curriculum for primary education (ages 6–12), and another set for the initial grade of secondary education (ages 12). For the second and third grades of secondary education (ages 13 and 14), new attainment targets will be implemented in the coming years.

The 2007 Plan calls for the realization of this new ICT-centered curriculum according to a five-point implementation strategy. This strategy includes:

1. Strengthening the planning and policy-making capacities of educational establishments:
2. Promoting the professionalism of teaching staff (e.g., the Regional Expertise Network offers large-scale in-service teacher training in ICT in education);
3. Providing a high-quality ICT infrastructure;
4. Applying a suitable software and digital teaching aids policy (e.g., framework agreements with software companies to negotiate favorable rates for products); and
5. Research and ICT monitoring (e.g., Monitoring ICT in Schools data collection supports ICT monitoring; also, the Interdisciplinary Institute for Broadband Technology (IBBT in Flemish) supports research on educational broadband applications).

In addition to the above-stated goals, the 2007 Plan also focuses on issues of educational equity and ICT. Given the importance of technology-related skills for success in today's global workforce, it is essential that all students acquire a solid grounding in ICT as a prerequisite for economic and social equity. Educational use of ICT is therefore considered an important means to promote greater social equity in the Community. In keeping with the decentralized nature of Flemish education, local schools are responsible for achieving this goal by providing all students with equal access to acquiring ICT-related knowledge and skills (Denis et al. 2009).

The Ministry was the final authority responsible for writing and approving the 2007 Plan. However, the Ministry developed the Plan after seeking input from stakeholder groups such as teachers, ICT coordinators, educational organizations, academia and the corporate sector (Vandenbroucke 2007).

The Ministry is still working on the implementation of the new curriculum and only recently began rolling out some of its core initiatives, such as a campaign to increase the availability and use of ICT among children with disabilities.

Details of Regional Plan

Title: Competences for the knowledge society: ICT in education initiative, 2007–2009

Year of Publication: March 2007

URL: http://www.ond.vlaanderen.be/ict/english/competencies_knowlegde_society.pdf

Private Sector Involvement

Partnerships between the Ministry and private institutions are somewhat limited. One example of a successful public-private partnership is the negotiation of framework agreements between the Ministry and several leading software companies. Thanks to these agreements, Flemish schools enjoy favorable rates for software and digital teaching aids (Denis et al. 2009; De Craemer 2010b). Through these framework agreements (currently with IBM, Microsoft and Adobe, along with a Belgian telecom company under consideration), the negotiated rate for software is at least 70 percent under market price. The agreements also require, however, that schools prevent the use of illegal software by purchasing only from the participating companies. Microsoft also requires schools to offer products to parents at these discounted rates (De Craemer 2010c).

Another example of private sector involvement in education is the IBBT, an independent research institute for broadband technologies founded by the Flemish government to stimulate ICT innovation. The IBBT supports the research and monitoring of ICT, which are both priorities in the 2007 Plan for ICT in education. The IBBT dedicates its staff and funding to setting high-level priorities and research objectives, while the actual research analysis is carried out by various universities (De Craemer 2010a). Educational technology and e-learning were recently added to the Institute's fields of activity (Vandenbroucke 2007). One IBBT-sponsored project is providing distance learning for children who are homebound or hospitalized due to illness. The IBBT has developed an interface that allows these students to follow classroom instruction online using webcams, interactive whiteboards and other technologies. Another Institute project is the digital archiving of content from the national TV broadcasting company. The Institute is running a pilot to see how this digital content can be provided more effectively to schools and students through the Internet.

Increasing Infrastructure and Support

Priorities and Programs in This Area

Providing a high-quality ICT infrastructure is one of the main priorities cited in the 2007 Plan. The Ministry has supported this priority by developing an ICT infrastructure program that includes a broadband access program and an ICT coordination program. According to the Plan, "[n]early all the European standards [for ICT infrastructure] have been obtained" (Vandenbroucke 2007). Currently, in secondary education (ages 12–18), there are 34 computers for every 100 students, 31 of which are connected to the Internet on average. Sixty-six percent of computers are less than four years old (Clarebout et al. 2010). In ordinary primary education (ages 6–12), there are 16 computers for every 100 students, with 13 of every 16 computers connected to the Internet. In earlier grades, 40 percent of computers are less than four years old (Clarebout et al. 2010). There are no regional targets for such ratios, as schools are free to set their own targets provided their students meet achievement standards. In a similar fashion, European guidelines and Flemish guidelines outline targets for broadband speeds but schools are responsible for determining their own needs.

Access to ICT in schools is supported by a program that provides subsidies to schools to buy software and hardware to ensure a basic ICT infrastructure (De Craemer 2010c). Access to Internet and connectivity is provided through the "I-line" program, which provides inexpensive broadband access to educational institutions at all levels and has an annual budget of USD 5.6 million (De Craemer 2010b). The program began providing Internet connections to schools in 1997 and upgraded to broadband in 2002. As a result of the program, most schools (84.9 percent in primary education and 92.4 percent in secondary education) have broadband connectivity (Clarebout et al. 2010). Schools are requesting greater bandwidth than this program can currently provide, so the Ministry plans to increase the bandwidth available through this program as well as implement a new program that will either complement or replace the current program. The Ministry reports that the available bandwidth appears sufficient for primary schools, which have 38 computers per school on average, but that it is not sufficient for secondary schools, which have 109 computers on average their networks (De Craemer 2010a). The current download capacity is 4.6 Mbps in the Belgacom I-Line system, and 20 Mbps in the Telenet ConnectLine Access system. Upload capacity is 512 Kbps for both the Belgacom I-Line system and the Telenet ConnectLine Access system. The new targets are under negotiation (De Craemer 2010c).

Access to technical support is available through the ICT coordination program. The program provides an ICT coordinator in each school, and the coordinator is in charge of technical and pedagogical support for teachers and the headmaster. However, most of their time is devoted to technical aspects of ICT coordination, such as network safety regulations, spam prevention, firewall configuration, computer theft prevention and maintenance (De Craemer 2010c). "Since 2003–04, this money [to fund ICT coordinators] has been a structural part of the educational budget. The funds allow for a ratio of 0.5 full-time equivalent (FTE) ICT coordinators for every 100 FTE staff members" (Denis et al. 2009).

Improving Student Learning Through Technology-Enhanced Instruction

Regional ICT in Education Standards for Students

The 2007 Plan for ICT in education puts forth two sets of standards, one for primary education (ages 6–12) and another for the first grade of secondary education (age 12). The two sets of standards are similar in scope and address three major objectives: students' usage, safety and attitudes with relation to ICT (De Craemer 2010c).

With regard to usage, the standards require that students be able to use ICT effectively without assistance. Students are also to learn to use ICT for a variety of purposes, including creative expression, responsible communication and effective presentation. Students learn how to use ICT to seek, process and store digital information. In addition, students should know how to choose from various ICT applications in the light of goals to be achieved and to adjust their approach in light of new data (Vandenbroucke 2007).

The second objective is related to ICT and safety. Students are required to learn how to use ICT with proper vigilance, taking precautions with regard to harmful or discriminatory content, protecting personal or confidential information, respecting intellectual property, ergonomics and other safety-related issues (Vandenbroucke 2007). According to the third objective of the 2007 Plan, students are to have a positive attitude towards ICT that will enable them to use ICT as an effective tool in their learning process (Vandenbroucke 2007).

Although all of these objectives are laid out as benchmarks in the Community-wide Plan, they are not tied at the Community level to any formal assessments or measurements of student progress. Schools in Flanders have great autonomy and would likely object if the Ministry tried to implement a centralized exam. For this reason, students are assessed at the school level, but there is no centralized examination or certificate that measures attainment of ICT-related skills. The Ministry does plan to assess all primary-school students in ICT in 2012, as part of its ongoing National Assessment Program (De Craemer 2010b; Vandenbroucke 2007).

Priorities and Programs in This Area

The 2007 Plan also includes a campaign, ICT Without Boundaries, to raise awareness about the role of ICT in providing adequate education for students with disabilities and chronically ill students, and to expand the use of ICT in special needs schools and among children with disabilities generally. When the Ministry introduced the new ICT objectives and curriculum in 2007, they also defined the same objectives and curriculum in relation to special needs education. However, these objectives are not compulsory because it may not be possible for all students with disabilities to reach the objectives. Prior to 2007, special needs schools had little experience with ICT. The ICT Without Boundaries program was developed to remedy that situation by expanding disabled students' opportunities for learning with ICT. The program focuses on developing learning materials for special-needs students, including learning objects for the deaf, those with mental disabilities and those with autism spectrum disabilities, since publishers will not likely create learning objects for such a niche market. (At the primary school level, individual schools are required to provide learning materials to students free of charge while at the secondary level, parents may be asked to purchase learning materials for students.)

The ICT Without Boundaries program also includes three projects worthy of special mention. The Wai-Not Internet project created a learning environment and e-mail client for mentally disabled children. The Bednet project uses ICT to enable chronically ill children to participate in distance learning and maintain contact with their school, teachers and peers. Bednet relies on a desktop in the classroom and a laptop with the home- or hospital-bound student. Students can follow lessons live via webcam and can ask questions through chat or voice. The system also allows students to view handouts and submit assignments. Bednet supported approximately 100 students in 2009 (Close the Gap 2009). Finally, the Letop project raises awareness about students with learning problems such as dyslexia and Attention Deficit Hyperactivity Disorder (ADHD) (De Craemer 2010a). In addition to projects such as these, which are aimed directly at students with disabilities, the ICT Without Boundaries program also provides funding for the development of learning materials and in-service training for teachers and other special needs staff. As the program is relatively new, no evaluation data is available (De Craemer 2010c).

Belgium has also been investing in serious games, co-funding the development of PING (Poverty Is Not a Game) under the 2007 Plan. The Ministry reported plans conduct a survey to study teachers' attitudes towards this game and the pedagogical practice of online games more generally. The survey results will inform the next steps for the uses of serious games in Flemish schools (De Craemer 2010c).

The Use of ICT to Increase Teacher Capacity

Regional ICT in Education Standards for Teachers

There are no ICT education standards for teachers in Belgium per se. Learning outcomes for teacher education are delineated in three categories—responsibilities with respect to the learner, responsibilities towards schools and the community; and responsibilities with respect to society. ICT and media literacy are integrated into the definitions of these categories, but without outlining specific ICT knowledge and skills (De Craemer 2010b).

Priorities and Programs in This Area

Promoting the professionalism of teaching staff is another priority cited in the 2007 Plan for ICT in education. One key program supporting this priority is the Regional Expertise Network, a large-scale in-service training network for ICT in education. Another priority in the strategic plan regarding software and digital teaching aids is supported by an educational Web portal (*KlasCement*) for teachers to share learning materials. Both of these programs are described in more detail below.

In 2000 the Ministry established the Regional Expertise Network, a consortium of teacher training institutes of several universities and teacher training colleges (De Craemer 2010c). The Ministry supports the Network with an annual budget of USD 11 million. The network brings together all partners active in the field of educational ICT use and organizes three main efforts: conference activities, materials development and workshops. It provides approximately 1,100 training sessions each year, reaching about 10,000 teachers (Denis et al. 2009). The program focuses on three areas of training: organizational (targeted at headmasters), technical (targeted at ICT coordinators) and pedagogical (targeted at teachers). The courses vary in length from several hours to several days. The course delivery is face-to-face, not via distance learning. All courses are offered on demand, by which a school or teacher must ask the local program coordinator for a course. If demand is sufficient in a school, an instructor will go to the school to deliver the course. There is one coordinator in each of the five provinces.

A second example of ICT-related teacher professional development is the educational portal *KlasCement*. The Ministry has always strongly favored open-source solutions, and in 2002 it created its own open-source portal as a central access point for teachers to share learning materials. Since its creation, this educational portal has expanded to include over 60,000 members and 13,000 contributions. The learning resources available in the portal include articles, documents, websites and software. Nearly all of these are open-source and noncommercial in nature. Furthermore, the government has developed an incentive system to encourage teacher participation. A user of the portal has to register before she or he can download resources. The user receives a base set of points to begin. Points are deducted for downloading and added for contributing content and ratings for materials used. If the user only downloads content and does not contribute content or reviews to the portal, his or her access will be cut off once the user runs out of points (De Craemer 2010c). This portal also offers “Classy,” a free weblog service (i.e., blog space and hosting) for teachers and their classes (De Craemer 2010a).

In addition to professional development opportunities such as the Regional Expertise Network and the educational portal *KlasCement*, promoting development of teaching staff through ICT also includes online access to instructional communities of practice and to subject matter experts. Although these opportunities are often regarded as an important part of professional development for teachers at public schools, the Ministry has not been involved in providing them. Online access to subject-matter experts is provided through professional associations. Online access to instructional communities of practice is provided within the three educational school networks: the Flemish Community Education Authority (community schools, organized by the government); the Education Secretariat of the Association of Flemish Cities and Municipalities (local community schools organized by the cities/municipalities); and the Flemish Secretariat for Catholic Education (the free school community organized by Catholics; this is the largest school community) (De Craemer 2010c).

Continuous Improvement Efforts

Investing in Data Systems

In keeping with the decentralized nature of Flemish education, the 2007 Plan for ICT in education seeks to strengthen the policy-making capacities of local educational establishments. One example of this decentralizing approach is the pICTos program. This program aims to support local teams of educators in the development of a school-based ICT strategy. During a one-day in-service training, the team uses a Ministry-sponsored software tool to plan its own response to students' ICT needs, guided by the broad objectives of the Ministry's 2007 Plan. This in-service program consists of five phases.

In the first phase all teachers in the school individually have to answer questions online regarding their teaching style. They respond to 28 statements about their educational beliefs. The computer generates an overview of the teaching styles in a particular school. The team discusses the results.

In the second phase each teacher fills in the activities they use to reach each of the ICT curriculum objectives. The computer processes the information and produces individual charts for teachers as well as a schoolwide chart on progress against each final ICT objective.

In the third phase, teachers discuss how they could improve their ICT activity. In the fourth phase, team members develop and add new actions, activities and priorities into the tool. In a recent update, examples of best practices from other schools were added, to help generate ideas for this phase. The examples were selected by university researchers based on a specific procedure that outlined minimum requirements (De Craemer 2010c). The final step for users is drafting an ICT policy plan for their schools.

Approximately 200 schools have used the software. Data from the Planning for ICT in Schools software is collected by the Regional Expertise Network, not the Ministry of Education. A university is currently also using the data for research purposes (De Craemer 2010a).

Regional ICT Program and Policy Evaluation Efforts

Data was not available at the time of collection.

Regional ICT in Education Indicator Collections

The 2007 Plan for ICT in education establishes two priorities with regard to educational data collection: research and ICT monitoring. To help the Ministry meet these priorities, researchers at the Universities of Ghent and Leuven have developed a monitoring instrument called MICTIVO (Monitoring ICT in Schools). This instrument allows the Ministry to collect information on four types of ICT in education indicators: competencies, infrastructure, usage and stakeholder perceptions. With regard to competencies, the instrument is designed to collect data not only from students but also from nonstudent course participants and from teachers. With regard to infrastructure, the instrument gathers data on topics such as the number of computers per student, the ratio of internet access to students, the type and age of available computers, and the quality and scope of computer facilities. With regard to usage, MICTIVO collects information about the use and integration of ICT in the learning environment, which includes the level and type of use of ICT, the use of electronic learning environments and ICT-related educational practices. Finally, this data collection is also designed to record relevant stakeholders' perceptions about the educational use of ICT.

In addition to data collection, researchers at the two universities are developing a Web-based survey for school leaders, teachers and students, with the goal of staying abreast of ICT integration trends (De Craemer 2010b). The student survey will be administered every two to three years during class hours, under the supervision of research assistants (DeCraemer, 2010c).

The Ministry has been collecting educational ICT-related data since 1998. The current data collection program, MICTIVO, began in 2007. Other than ICT infrastructure, three other types of indicators were added to this data collection because the new ICT curriculum requires follow-up competencies. In addition, because ICT integration into instruction appeared to be increasing, the Ministry wanted data on integration indicators (De Craemer 2010a).

The first MICTIVO data collection was for academic year 2007–08 with the next round scheduled for 2012. The budget for each collection was USD 120,000. According to the Ministry representative interviewed, the most interesting finding from the 2007–08 data collection is that Flemish schools have been very slow to take up a broad use of ICT. The representative had previously thought that the general integration of ICT in schools was more advanced, but MICTIVO found that the frequency of ICT use in schools is low, and is mainly limited to looking up information. Schools rarely use ICT for testing, assessments, or other more innovative educational goals (De Craemer 2010a).

To gather data for MICTIVO, researchers at the Universities of Ghent and Leuven take a random sample of a fifth of all schools in Flanders and administer three surveys: one for heads of schools, one for teachers and one for students. The first data collection was administered in both paper/pencil and online formats to test for format bias. The next collection will be conducted entirely online, although students will fill out the questionnaire online under supervision of a researcher at school (De Craemer 2010a).

The use of the MICTIVO data is determined in part by the Flemish election cycle. Before the elections, the Ministry uses this data to contribute to policy agreements. After the elections, when it has been determined who will govern, the Ministry offers the new government the Monitoring ICT in Schools data with relevant recommendations. The data are then used to draft the Ministry's general policy plan for the next five years (De Craemer 2010c).

Plans to Participate in International Data Collections

Belgium participates in the Program for International Student Assessment (PISA), the Trends in International Mathematics and Science Study (TIMSS), the Teaching and Learning International Survey (TALIS), the Program for the International Assessment of Adult Competencies (PIAAC) and the International Conference on Computational Science (ICCS), as well as the European Survey on Language Competencies (ESLC), Eurydice and some European Schoolnet studies (De Craemer 2010b).

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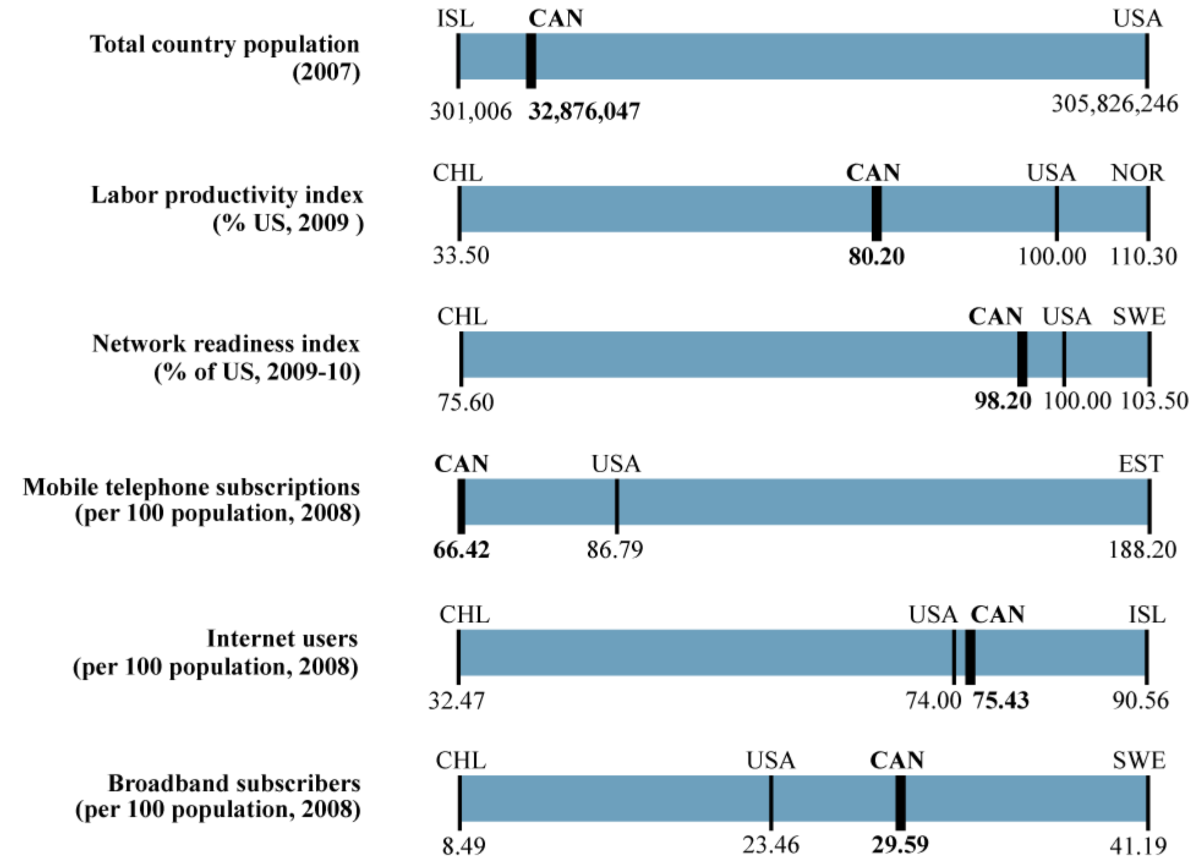
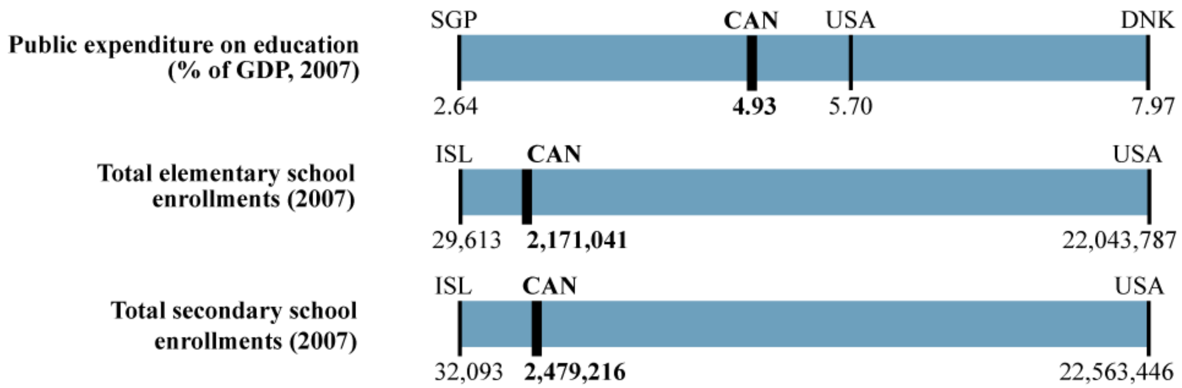
Country Statistics at a Glance

National Indicators



Education Indicators



Total number of Internet computers (per 100 pupils, 2006) Data not available.

Percentage of schools with a broadband connection (2006) Data not available.

ICT In Education Highlights

Alberta is a leader in Canada in two areas of ICT in education: a mandated ICT curriculum, and the Alberta SuperNet High Speed Network, which connects public institutions to a broadband network for high-speed Internet access.

Schools and teachers participate in applied research, development and innovation initiatives through the Technology Sector.

Continuous improvement in schools is supported by the Annual Education Results Report, which includes data annually reported by schools.

Structure and Nature of the Education System

Authorities Primarily Responsible

In Canada, provincial and territorial governments have jurisdiction in education. While there is some collaboration at the national level through the Council of Ministers of Education, Canada (CMEC) there is no official government body responsible for educational policymaking at the national level. The Council convenes provinces to discuss areas of mutual interest such as literacy. There are also regional agreements or protocols among provinces and territories such as the Western and Northern Canadian Protocol which is an agreement among the four western provinces and the three territories to collaborate on curriculum matters (Andrews 2010; Andrews and Burdek 2010). Alberta, one of the Western Canadian provinces, is the subject of this profile. This profile focuses at the provincial level, not national, because of Canada's decentralized education system. Alberta was selected because it is regarded as a leader in ICT in education for its mandated ICT curriculum, as well for the broadband network that links its public institutions. Unless otherwise stated, all programs, policies and other descriptions in this profile refer to the province of Alberta.

Provincial Plan for ICT in Education

As of July 2010, Alberta was in the process of updating its Learning and Technology Policy Framework for education, which has been in effect since 2004. This update is part of a larger province-wide review of the education system in Alberta called Inspiring Education. Teachers, school superintendents and school IT directors are involved in the review, along with a wide range of professional organizations such as the Alberta Teachers Association, the Alberta School Boards Association and professional development institutions. The 2004 framework addressed technology in education goals broadly, from the primary through postsecondary levels. The new framework, whose scope will be limited to K–12 (ages 5–17), will focus more specifically on the transformational power of technology in teaching and learning, and move toward student competencies with technology and 21st Century skills (Alberta Education Inspiring Action website). The new framework was not made public in time for this report, so we summarize the 2004 framework here.

The 2004 framework identifies the role of ICT in education in offering flexible, individualized options for learners as well as in preparing them for a knowledge-based society. It also envisions that learning management systems will effectively and efficiently manage information and data collection. To realize that vision, the document called for the development of a province wide learning network, supported by provincial technology standards. The framework further specifies that funding for technology, supported by accountability measures, is integrated into base funding for publicly-funded schools in Alberta.

Details of Provincial Plan

Title: Learning and Technology Policy Framework

Year of Publication: 2004

URL: http://education.alberta.ca/media/822425/landtpolicyframework.pdf

Private Sector Involvement

The Ministry of Education in Alberta does not receive any funding directly from private institutions. Instead, the Ministry has established several mechanisms that facilitate private sector involvement. For example, the Ministry has established provincial-level licensing agreements, called Education Standing Offers, which enable schools to acquire the most current version of ICT tools, both software and hardware, from a centralized online product catalog at reduced, competitive prices. These agreements are in place with Microsoft and Adobe, as well as with numerous manufacturers of hardware, such as interactive whiteboards, laptops and projectors (Alberta Education ESO website). Secondly, the private sector also offers support and assistance to schools through the Ministry's Technology Sector innovation, research and development initiatives. Companies may offer free software, fund professional learning, or sponsor guest speakers (Andrews 2010).

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

Since 2004, Alberta has been working toward providing access to technology in schools. This has entailed setting a basic standard for equipping classrooms with devices such as instructional laptops, interactive whiteboards and projectors; provisioning both wired and wireless networks; providing access to online tools, such as videoconferencing and resources through the digital content hub LearnAlberta.ca; and implementing technology research and development initiatives in schools (Andrews and Burdek 2010). The provincial-level licensing agreements described in the previous section helped local education authorities enact these improvements (Alberta Education ESO website). ICT infrastructure activity in Alberta also includes the broadband initiative, the Alberta SuperNet High Speed Network, and three support programs.

The broadband initiative to link together public institutions—including schools, hospitals, colleges, universities, libraries and municipal offices—has helped to ensure equitable access to resources for students throughout Alberta. Every school in the province, even in remote areas, is connected to the SuperNet, which has been a great success in terms of making rural students and teachers feel "connected" and providing them with the same educational opportunities available in urban areas through online learning. The government ensures access for every school, provides videoconferencing and, for rural districts in particular, provides additional services for student learning and teacher professional development (Andrews 2010). A 2006 evaluation study of the SuperNet implementation found that all schools benefitted from the connection, although the degree to which schools were leveraging the resource for ICT integration varied a great deal from school to school (Alberta Education 2007). SuperNet service options range from 0.256 Kb/sec to 800 Mb/sec and use Cisco technology (Government of Alberta website). The Alberta government invested 172 million USD to build the SuperNet network and the Ministry of Education provides approx 11 million a year for school connections.

To help classrooms within connected schools capitalize on their high-quality connections, the Ministry is dedicating USD 56 million between 2008 and 2010 to ensure that every classroom has basic standard technology, such as an instructional working computer with a projector or interactive whiteboard (Andrews and Burdek 2010). This program, known as Alberta Innovative Classrooms Funding, can also support other classroom technologies and professional development. The Ministry collects data on the current state of classroom technology as part of an effort to track the impact of this funding on the province's schools. The data is used to help inform provincial programs and standards. For example, evidence suggesting that students and teachers were using Microsoft products led the Ministry to negotiate a provincial licensing agreement with Microsoft, resulting in better rates and services for all publicly funded schools than any single school could have negotiated (Andrews 2010).

The innovation research and development area of the Ministry of Education's Technology Sector funds applied research and innovation initiatives, providing resources and direct support to pioneering schools to pilot, test and evaluate different educational technologies. Large-scale initiatives funded by this Sector include a three-year study of one-to-one wireless learning and a program to boost engagement among high school students through technology, with the goal of improving graduation rates (Andrews 2010; Andrews and Burdek 2010). The total funding for both programs is USD 11 million. The former is the Emerge One-to-One Laptop Learning program and involved 50 schools in 20 jurisdictions (Alberta Education Emerge website). This one-to-one initiative has been deployed at specific grade levels, rather than to the whole schools, with each school focusing on either a specific student population (e.g., English Language Learners (ELL) students) or 21st century skills (e.g., effective communication, digital-age literacy, inventive thinking, high productivity). An evaluation report, *Emerge One-to-One Laptop Learning Initiative: Final Report*, and a video series are available online. The Technology and High School Success program, another initiative funded by this provincial research and development area, explores uses of technology, such as interactive whiteboards, videoconferencing and laptops to improve student engagement and success in high school (Andrews and Burdek 2010). It supports over 70 high schools with more than 22,000 students in grades 7–12 (ages 12–17) and 420 teachers (Alberta Education Tech Success). The program is well aligned with the Ministry's strategic priority to improve high school completion rates

(Alberta Education 2010b). This program was recently evaluated, with the findings reported in the *Technology and High School Success: Year One Report*. A community-of-practice model is used in these and other technology innovation research and development initiatives and the Ministry helps to bring the schools together with researchers, technologists and education experts. Findings from these initiatives provide ongoing guidance for the province's new ICT investments, policies and best practices. For example, the Innovative Classrooms Funding program described above was derived from one of the Ministry-funded research and development projects that had identified a basic level of technology needed in every classroom.

In addition to the ICT-specific programs mentioned above, schools in Alberta can take advantage of general programs for ICT infrastructure and support. The Alberta Initiative for School Improvement program supports school authorities' initiatives to improve student learning and performance by developing and implementing innovative solutions based upon local needs and circumstances. This initiative provides funding (USD 66 million per year) to schools for their school improvement efforts—which can include investments to increase instructional effectiveness through ICT. The initiative's website has a clearinghouse of its projects and promising practices, supporting documents for planning and implementation of its projects and other research and reports related to school improvement (Alberta Education Initiative for School Improvement website).

Improving Student Learning Through Technology-Enhanced Instruction

Provincial ICT in Education Standards for Students

The ICT curriculum is mandatory and is embedded within core courses and programs in Alberta, reflecting the province's view that ICT is "a way of doing things" (Alberta Education ICT Rationale website). According to the ICT Program of Studies—the province's curriculum standards—the ICT graduation competencies are composed of the following:

Communicating, Inquiring, Decision-Making and Problem Solving: This standard refers to the ability to use a variety of processes to critically evaluate information, manage inquiry, solve problems, conduct research and communicate with a variety of audiences. Students are expected to apply their knowledge and skills in real-life situations.

Foundational Operations, Knowledge and Concepts: This standard covers student understanding of the nature and effect of technology, the moral and ethical use of technology, mass media in a digitized context, ergonomic and safety issues and basic computer, telecommunication and multimedia technology operations.

Processes for Productivity: This standard refers to the knowledge and skills required to use a variety of basic productivity tools and techniques; for example, word processing, data organization and graphing, electronic communication, navigation and collaboration (Alberta Education ICT Program of Studies website).

The curriculum standards also articulate a set of general student outcomes for each of these three categories, which are then further specified for particular grade divisions (grades K–3, 4–6, 7–9 and 10–12). An assessment framework for these outcomes is provided as part of the *Classroom Assessment Tool Kits.* Developed in 2003, the tool kits provide guiding principles, rubrics and sample classroom assessment tasks in language arts, mathematics, science and social studies to help teachers design and implement classroom assessments that measure the ICT learning outcomes (Alberta Learning 2003). There is, however, no standardized assessment that differentiates ICT from other subject-area knowledge (Andrews and Burdek 2010).

Priorities and Programs in This Area

Two notable programs support the development of the competencies outlined in the ICT Program of Studies: a media literacy program and a distance learning program. The media-literacy program provides an online tutorial that helps students develop critical thinking for their online experiences. Geared for students in grades 4–8 (ages 9–13), the tutorial covers such areas as online safety, authenticating online information, recognizing online marketing ploys, protecting privacy, managing online relationships and dealing with cyberbullying. The tutorial, called Passport to the Internet, was developed by the Media Awareness Network, a Canadian non-profit organization that develops media and digital literacy programs. A provincial-level licensing agreement allows schools with students at the target ages to use the resource at no cost (Alberta Education Passport website).

The distance learning program is offered by the Alberta Distance Learning Centre. This Center serves 27,000 secondary school students (ages 12–17) and 3,000 elementary school students (ages 6–12). The Center offers courses in a variety of formats including print, online, blended, team-teaching and videoconferencing. From 2004-06 the Ministry of Education provided a minimum of three videoconferencing suites to each school authority in Alberta in order to support distance education programs and professional learning for remote teachers. The Center also manages the province's completely online school, Vista Virtual School (Andrews 2010; Barbour/iNACOL 2009).

The Use of ICT to Increase Teacher Capacity

Provincial ICT in Education Standards for Teachers

Alberta's ICT standards for teachers are a part of the Teaching Quality Standard, which is used as part of the teacher certification process. Alberta's Teaching Quality Standard requires teachers to use technology to help meet student learning needs: teachers should be aware of emerging educational technologies and how to incorporate them in pedagogy; teachers should develop their own and their students' technological/digital literacy; and teachers should communicate with others electronically and use electronic media for their own enrichment (Alberta Education TQS website). All teachers must meet these standards established for interim certification upon graduating from in-service programs (Andrews and Burdek 2010). Teachers are evaluated after two years on their ability to demonstrate the competencies set for permanent certification (Andrews and Burdek 2010). The teacher standards and the principal standards are updated in 2010, along with the ICT policy framework mentioned above (Andrews 2010).

Priorities and Programs in This Area

The Ministry provides several avenues for teachers to increase their capacities in ICT. Some of these are formal professional development programs offered by three distinct organizations. The Alberta Professional Development Consortia facilitates professional learning opportunities at the local, regional and provincial levels.

As of September 2010, the provincial-level online professional development initiatives target two groups of teachers. Training for beginning teachers are supported by Alberta PD, which focuses on differentiated instruction and assessment for diverse learners. Career and technology study teachers are supported by the Consortia's Career and Technology Study Training and Support website. For both target groups, webinars and videoconferencing are commonly used to deliver PD activities (Alberta PD website; Alberta Regional PD Consortia website). Additionally, Regional Consortia deliver professional development to their own teachers, school leaders and district administrators.

Similarly, two nonprofit organizations funded by the Ministry provide professional development in specific areas. The first of these, Galileo.org, focuses on 21st century inquiry-based teaching and leadership and provides ongoing, job-embedded professional development for teachers as well as school leaders mainly through onsite and online mentoring (Galileo Professional Learning website). The other nonprofit organization, the 2Learn.ca Education Society, provides a series of one-hour online sessions designed to promote the use of Passport to the Internet, the online tutorial for students to learn about ethical uses of ICT just discussed. 2Learn.ca also plays a key role in promoting a network of K–12 teachers by using videoconferencing technology in their instruction, providing informal support and facilitating mentoring among teachers (2Learn.ca website).

Other Ministry-supported professional development opportunities are more informal or a blend of both formal and informal. Teachers can participate formally in the applied research initiatives funded by the Ministry. The Ministry reports that many teachers who participated in the research projects through the province's Technology Innovation Research and Development program feel that they received the best professional development experiences because the research was hands-on and participation involved teachers making changes in their practices, receiving coaching, working with experts and other teachers and reporting on their results at several points along the way (Andrews 2010).

Online resources help teachers' informal learning of instructional ICTs. LearnAlberta.ca is a Ministry-developed online portal providing teachers with resources such as learning objects, lessons, video clips and flash simulations. The portal has been so popular that every school has had a content delivery server installed for faster access to the website. All the content on the site has been mapped to the curriculum, so teachers know that the content has been approved by the Ministry and meets the provincial standards. (There was previously debate about whether the portal should be open, in that not all content met the standards.) Some schools have LearnAlberta.ca as their main portal and supplement this with their own digital resource collection area (Andrews 2010).

Continuous Improvement Efforts

Investing in Data Systems

Alberta assesses school jurisdiction performance on a common set of measures using the system called Accountability Pillar (Alberta Education Accountability Pillar website). The data collected through Accountability Pillar include not only student test scores from Alberta's Provincial Achievement Tests and Diploma Exams but other measures that affect student learning—such as safe and caring school environments, parent involvement and satisfaction with the educational experience. These data are collected annually from all publicly funded schools and submitted to the Ministry. Jurisdictions enter their data into an online system that creates local and provincial color-coded progress reports, broken down at the school level. Jurisdictions are required to post their results to a permanent website (Alberta Education Reporting website).

School jurisdiction performance is evaluated by comparing current results against both past performance and provincial standards. To help school jurisdictions and schools identify areas needing improvement, the Ministry provides them with current results as well as five years' worth of historical data, prior three-year averages and evaluations twice a year. School jurisdictions and schools analyze these data to develop their three-year education plan and inform decision-making to improve student learning annually.

School jurisdictions in Alberta also analyze data from standardized Provincial Achievement Tests (administered annually in Grades 3, 6 and 9) in order to identify areas for improvement, such as targeted professional development or student-level interventions. Provincial Achievement Tests are administered digitally in Grades 6 and 9. Results are reported and analyzed through a secure online portal. Alberta Education complements its standardized testing with other validated research tools. The web-based evaluation system, Tell Them From Me: Measuring Student Engagement, provides data on student engagement to inform the ongoing planning needs of teachers, school leaders, and jurisdiction leaders (Andrews 2010).

Provincial ICT Program and Policy Evaluation Efforts

There have been several evaluation efforts for the provincial ICT programs, such as the Alberta Innovative Classrooms Funding, Alberta SuperNet High Speed Network, Emerge One-to-One Laptop Learning, and Technology and High School Success (these programs are described in the Increasing ICT Infrastructure and Support section above). The most commonly used data-collection method in these program evaluations are online surveys with teachers and students, while most evaluations also employed other measures, such as interviews (with administrators, teachers and students), classroom observations and focus groups. Key indicators collected in the evaluations include the state of the school ICT infrastructure, the access and use of technology in the classroom, students and teachers' opinions about instructional use of technology and the school environment that facilitates ICT integration in instruction (e.g., the school leader's vision for ICT, school policies around ICT).

Some evaluations looked into organizational factors that facilitate the teacher and student technology use, while others investigated classroom practices with ICT. The evaluation of

SuperNet, the provincial initiative to provide high-speed Internet access to public institutions, is an example of an evaluation that looked into organizational factors. Its most recent evaluation report stated that when the school administrators had visions for ICT, school resources tended to be allocated in a more focused way, better supporting teachers to integrate technology in their instruction (Alberta Education 2007, 1). In contrast, the Year Two report on Emerge One-to-One Laptop Learning found that, based on surveys of teachers, administrators and project leads, as well as data from site observations, the program's focus shifted from the technological to the pedagogical. The report also indicated that the level of student engagement, which had spiked in the first year of the program due to the novelty of the technology, depended more in the second year on the nature of teaching and learning made possible through technology rather than on the technology itself (Alberta Education 2010a, 2).

National ICT in Education Indicator Collections

The Pan-Canadian Education Indicators Program (PCEIP), a joint venture of Statistics Canada and the Council of Ministries of Education, Canada (CMEC) publishes and online report, *Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program*, in collaboration with the provincial and territorial departments and ministries responsible for education and training. The report, updated online four times per year, is targeted at policy-makers, practitioners and the general public. This data collection includes a set of ICT indicators in elementary-secondary education: students per computer; Internet access; access to computers, at home and school; frequency of computer use; student use of computers to support education; and differences in male-female access and use of computers (CMEC and Statistics Canada 2007). The data in the report are derived from the Organisation for Economic Co-operation and Development and the Program for International Student (OECD PISA) and Canada PISA databases. Each provincial Ministry uses the data to gauge its progress relative to the rest of the country, in order to inform future policy, program and funding decisions (Andrews 2010).

Plans to Participate in International Data Collections

Alberta Education plans to participate in the Trends in International Mathematics and Science Study (TIMMS), PISA, OECD Research; Students' Voices: Listening to Students Views of Learning with Technology; and Project Tomorrow: Speak Out (Andrews and Burdek 2010).

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Chile ICT in Education Profile

Country Statistics at a Glance

National Indicators

Total country population (2007)

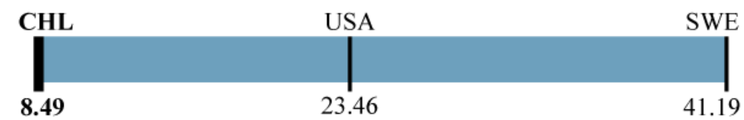
Labor productivity index (% US, 2009)

Network readiness index (% of US, 2009-10)

Mobile telephone subscriptions (per 100 population, 2008)

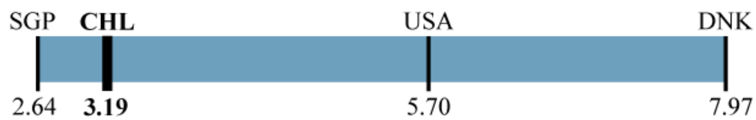
Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

Public expenditure on education (% of GDP, 2006)



Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006) **Data not available.**

Percentage of schools with a broadband connection (2006) **Data not available.**

Chile ICT in Education Profile

ICT in Education Highlights

Chile conducted its first national ICT in education census in 2008. The results were analyzed to inform infrastructure programs and training efforts. Chile plans to repeat the collection every two or three years.

Chile requires that schools receiving infrastructure improvements (hardware, software and broadband connections) agree in exchange to an ICT use plan and a management plan, and to complete certain types of training. Although participation in ICT-related professional development is not required, the use agreements provide strong incentives.

Teacher professional development is delivered through blended and online means. Teachers log in to the system to complete the courses, allowing Enlaces (Chile's ICT in education organization) to collect data on teachers' interactions with one another and with the platform.

Structure and Nature of the Education System

Authorities Primarily Responsible

The school system in Chile has been described by Hinostroza et al. (2009) as a highly centralized state system dating to the 19th century, overlaid by decentralization and privatization—effects of the military junta in power in 1973–1990. Primary responsibility for educational policy-making lies with the Ministry of Education, known as Mineduc (Donoso 2010). ICT in education is managed by Enlaces (meaning "links") in the Ministry's Center for Education and Technology.

Nearly 95 percent of Chilean students attend state-funded schools, either municipal ones or subsidized private ones. The government funds both municipal and subsidized private schools proportionally according to enrollments. A small minority of students attend private schools that receive no public funds (Hinostroza et al. 2009). School is mandatory starting at age seven, although most children start in preschool by age four. High school ends at age 18.

Enlaces was founded in 1992 as part of the aforementioned educational reforms, with the general mission of improving education through an approach that employs ICTs and balances "quality, equity, and relevance" (Enlaces website). Its mission encompasses improving teaching and learning, as well as supporting the use of schools as ICT centers for surrounding communities. The Enlaces website functions as a central hub for everything related to ICT in education in Chile. In 2006, 100,000 teachers were registered with the site, which received 3 million hits per month in that same year (Hinostroza et al. 2009). Furthermore, the Chilean portal is linked to an 18-country Latin American network known as RELPE (La Red Latinoamericana de Portales Educativos).

Political and Economic Context

Significant change took place in Chilean schools between 1990 and 2003: public funding for education tripled during this period and the curriculum was revised from the bottom up. The revised curriculum focuses on competencies rather than content and emphasizes 21st century skills: "experimentation and learning to learn, communication and cooperative work, problem resolution, managing uncertainty, and adapting to change" (Hinostroza et al. 2009). Schools also emerged from this reform period with a greater focus on outcomes.

The focus on results means that schools and teachers are now held more responsible for student outcomes. At the school level, the Ministry collects data to maintain the School Vulnerability Index, which the Ministry uses to direct program efforts where they are most needed. For example, a new program to improve reading and writing skills will start first in the schools that need it most according to the Index. Within each school, an internal monitoring body called a Technical Pedagogical Unit is charged with helping teachers improve their delivery of the curriculum. The focus on results is also clear in a new law called the Special Student Subsidy, now being implemented. This law provides 100 percent more government funding per student for students below a certain socioeconomic level. In order to receive the subsidy, schools must sign a school improvement agreement, committing to meet targets for student achievement over a period of three years (Donoso and Hinostroza 2010).

National Plan for ICT in Education

Enlaces drafts and implements the country's educational technology plans. The current national plan, Technologies for a Quality Education or Plan Tec, was published in 2007. It addresses students from preschool through high school (ages 4–18). Its top objectives are closing the digital divide, increasing teachers' ICT skills and developing new-generation digital resources (Enlaces "Plan Tec").

Plan Tec is aligned with the 2007-2010 Digital Strategy Plan, which was drafted by an inter-Ministry group formed in 2007. The Digital Strategy Plan addresses uses of technology in all aspects of Chilean society. The Digital Strategy group has been measuring its efforts and tailoring action plans to achieve the goals of the general plan. The 2008-2010 action plan defines objectives for improving the penetration of broadband; streamlining e-government through increased interoperability; promoting the use of free open-source software in public institutions; and providing ICT education and training (Ministry of the Economy 2008). Enlaces contributes to the Digital Strategy's lifelong learning goals by offering ICT education classes. The classes, held in schools after the school day, are open to anyone from the local community, regardless of affiliation with the school (Donoso and Hinostroza 2010).

Details of National Plan

Title: Plan TEC (Technologies for a Quality Education)

Year of Publication: 2007

URL: http://www.enlaces.cl/index.php?t=44&i=2&cc=1171&tm=2

Private Sector Involvement

Enlaces has a grant program, in place since 2007, which awards selected universities and private companies with seed money in order to integrate ICT into teaching and learning. Interested entities can apply for funds at one of three levels: to explore a concept, to pilot a program, or to scale an approach that has been successfully piloted (Donoso and Hinostroza 2010). At present, approximately 40 institutions are being funded. Shorter-term awards are approximately USD 30,000, with longer-term awards worth double that amount. Results are posted on the Pedagogical Experiences page of the Enlaces website (Enlaces Pedagogical Experiences website).

ICT and the February 2010 Earthquake

In addition to planned programs and ongoing efforts, the Ministry applied ICT resources to coordinate disaster-relief efforts related to education following the earthquake of February 27, 2010, just at the end of the summer recess. For instance, university students applied online for emergency funds that might help them avoid interrupting or abandoning their studies. And parents of schoolchildren resuming school later than usual in affected areas could also find information and resources on the Ministry's regular information website, "600 Mineduc." Chile also received an influx of donated hardware in the aftermath of the February 2010 earthquake, such as interactive whiteboards from the Canadian company, Smart Technologies. Much of this replaced resources lost in the earthquake, but some went to schools that had not previously had such resources (Mineduc website).

Increasing ICT Infrastructure and Support

Priorities and programs in this area

School-level infrastructure is improving as the ICT census data is available, thanks to a program that began in 2007, when the current educational technology first went into effect. One goal of the plan is to improve the national computer-to-student ratio, from 1:30 to 1:10 (Enlaces "Plan Tec"). Equipment is now being delivered to schools. In order to receive the equipment, schools must sign three different commitments: an infrastructure plan, an ICT management plan and an ICT use plan. In the infrastructure plan, schools state that they have the appropriate infrastructure already in place (in terms of dedicated spaces, security, etc.). In the ICT management plan, schools must commit to reaching and maintaining certain conditions, including proper technical support, administration, procedures for inventories and procedures for maintenance. The management plan also specifies that teachers must be adequately trained to use ICTs. For example, a school may commit to having all its teachers trained in the seven basic areas of a plan. Lastly, the ICT use plan requires that schools use ICTs for a defined range of purposes—not only teaching and learning but also learning management, etc. (Donoso and Hinostroza 2010).

In tandem with the delivery of hardware to schools, the Ministry aims to increase schools' connectivity, in terms of both the number of connected schools and the quality of their connections. To this end, the Ministry launched its Digital Network for Education initiative. This initiative serves not only to connect schools to one another and to the Internet, but also to improve monitoring and reporting capabilities. The program includes a broadband fund, to which schools can apply for help acquiring broadband access. At present, three quarters of government-funded schools in Chile have Internet access, most of it broadband (Donoso and Hinostroza 2010).

According to a 2008 report by the inter-Ministry Digital Strategy group, 48 percent of Chileans have access to the internet (Salas 2008). Enlaces does not currently prioritize anytime-anywhere learning through efforts such as sending students home with mobile devices (although a small pilot program in this area is currently underway). Instead, the community comes into the best-wired places, the schools, for ICT training. Enlaces uses the schools' ICT infrastructure outside the school day to offer ICT training for local residents as part of the current cross-sector Digital Strategy (Donoso and Hinostroza 2010).

As long as Chile's broadband infrastructure is still in a state of growth, the Ministry will continue to use other modes of telecommunications to pursue its overall politics of transparency. Telephone and radio, for example, complement the availability of information online. The Ministry's online announcements page, "600 Mineduc," is still connected with a telephone-based information hotline, and the Ministry is using a national radio campaign to help parents learn of the Ministry's efforts to enroll more of the nation's four-year-olds in the new national preschool program (Mineduc website).

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

There are no stand-alone ICT in education standards. Rather, Enlaces aims for ICTs to support learning across all subjects.

Priorities and Programs in This Area

Enlaces considers ICT-supported instruction a top priority, including the use of ICT to promote inquiry and to individualize learning, and as a means of accessing online content and high-quality instructional resources. Enlaces promotes the development of digital resources through a current grant program, to which universities and private companies can apply for seed money to develop materials. Through partnerships already in place, tools have already been developed to support learning in math, in the sciences (tools for observation, experimentation and analysis; tools for physics modeling; and tools for learning about nature) and in 21st century skills across subject areas (Enlaces Models of Computer Education website).

Two other current initiatives address the hardware side, to support the uptake of digital resources by making ICT devices available in classrooms. One program provides equipment to selected classrooms in the form of a laptop, projector, screen and sound system to support teaching and learning (Enlaces Digital Reading, Writing, Math and Inquiry-Based Science). The other program, Mobile Computer Lab program provides a netbook for each student, a laptop for the teacher and a cart that allows one to easily store and transport all the computers and their chargers. This program also ensures that a wireless network is in place where the Mobile Computer Lab will be used (Enlaces Mobile Computer Lab website).

Chile is not prioritizing the use of ICT for student assessment at this time.

The Use of ICT to Increase Teacher Capacity

National ICT in education standards for teachers

Enlaces has developed ICT in education standards for both pre-service and in-service teachers, but teachers are not yet assessed in terms of the guidelines. However, in-service teachers who participate in the pay-for-performance program discussed above are evaluated in terms of best-practice standards. These standards do not include ICT at present but the certification program for new teachers does include ICT requirements.

Priorities and programs in this area

In order to help teachers integrate ICTs into pedagogy, Enlaces provides professional development programs and makes digital resources available for schools, in addition to the information and resources teachers can find on the Pedagogical Experiences portion of the Enlaces website.

Enlaces revised its approach to ICT training for teachers and administrators in 2007. Between 1993 and 2007, Enlaces ran mandatory, three-year training programs. Schools had to select an ICT coordinator to participate in the courses and could also send up to 20 additional teachers per school. Since 2007, a more flexible, contextual training in ICT use and curricular integration is strongly encouraged rather than mandatory. As discussed above, the use agreements that schools sign when they receive equipment from Enlaces provide a strong motivation to pursue training. All teachers and administrators in a school are responsible for honoring the agreements (Donoso and Hinostroza 2010). The current program, which suggests training pathways for various school personnel, is depicted in a diagram on the Enlaces website (Enlaces Training Grid website). The training program uses both online and blended delivery. The trainings are paid for by Enlaces but offered by the national technical and pedagogical assistance network (Donoso and Hinostroza 2010).

Aside from formal teacher professional development, a number of other resources are available to support teachers in integrating ICTs into their instructional practices. It has already been mentioned that over 100,000 teachers are registered at the Enlaces website. On the Pedagogical Experiences page, they can learn of new approaches that have been developed, piloted and tested through partnerships with Enlaces.

Uploaded items range from subject-specific projects using ICT to descriptions of the implementation of a new school management system in a given municipality. Each item includes reports on results and a form for contacting the information source. The site is searchable by region, by subject and by grade level.

To promote the distribution and uptake of high-quality digital educational resources, Enlaces established an online marketplace in 2008 where schools can review and select resources that will be useful for them. Materials are added on an ongoing basis to this catalog, known as Catalogo RED. The collection includes subject-specific tools for all levels as well as tools for course management. Some featured resources are free; Enlaces helps interested schools purchase those that aren't through its Fund for the Delivery of Digital Educational Resources. In 2009, approximately 20 percent of publically-funded schools were selected to receive funds, having been identified by Enlaces as having sufficient ICT infrastructure and a demonstrated interest in ICT. Among the finalists, Enlaces favored schools in economically depressed areas. RED Enlaces provided between USD 2,000 and 4,000 of software to participating schools. Applications from over 1,500 schools were approved in the program's first year, and the materials are now being distributed to the schools (Catalogo RED website). Enlaces was surprised to find that schools typically selected one license for each of approximately 40 different software products, rather than requesting more licenses for fewer programs. This pattern suggests an eagerness on the part of teachers and administrators to experiment in order to familiarize themselves with a wide range of possibilities (Donoso 2010a).

Current efforts to train and promote community among Chilean teachers grew out of earlier programs that date from Enlaces' inception. In the 1990s, Enlaces used the metaphor of a "plaza" for the virtual space in which teachers could connect as subscribers of pedagogical listservs. One aspect of the Plaza, called "the Museum," was an archive of pedagogical resources. These were the antecedents of today's Pedagogical Experiments and Catalogo RED.

Continuous Improvement Efforts

Investing in Data Systems

Enlaces' commitment to continuous improvement is consistent with the increased focus on outcomes that have characterized the Chilean educational system since 2003. The current broadband program, the Digital Network for Education Initiative, serves infrastructure goals as well as increasing capacity for monitoring and reporting, for example. The Ministry collects general educational data through the School Vulnerability Index, and Enlaces has recently conducted its first national ICT in education census, administered to all schools. At the school level, the Technical Pedagogical Unit monitors the delivery of the curriculum and targets its efforts towards teachers in need of support.

National ICT Program and Policy Evaluation Efforts

Enlaces evaluates its teacher professional development program, which is partly administered online. Participating teachers log in to the system, from which Enlaces gleans data regarding their interactions with one another and with the platform, in addition to tracking overall numbers, such as how many times each course is followed and which teachers take which courses.

National ICT in Education Indicator Collections

In 2008, Enlaces developed a national system for measuring digital development in the school system. The program is a census consisting of a set of surveys for school administrators and ICT coordinators, a sample of teachers and students. Information is collected regarding the available ICT infrastructure, the management and use of that infrastructure and additional resources present in the schools. The student survey also captures information regarding how students use ICTs outside of school. The Enlaces team modeled many of the survey questions after the SITES 2006 and SITES M1[19] for international comparability (Donoso and Hinostroza 2010).

The data-collection process is similar to that already in place for the School Ability Index, except that this one measures ICT needs separately, since a schools' ICT needs can be different from its general needs. Enlaces' goal is to classify schools in order to identify priority areas—such as ICT management plans for rural schools—and improve training and capacity where needed. Enlaces also hopes to track progress over time by conducting the census every two to three years (Donoso and Hinostroza 2010).

The instruments were piloted in early 2009 and the program was implemented nationally midyear. All government-funded schools and a sample of unsubsidized private schools participated. This marked the first time Enlaces had conducted a detailed national collection; previous efforts in this area had used sampling. Enlaces began analyzing the data collected in January 2010 and hopes to publish it by year's end (Donoso and Hinostroza 2010).

[19] SITES stands for the Second Information Technology in Education Study. SITES M1 refers to Module 1 of the Study.

The cross-sector data collected through the inter-ministerial ICT Observatory supports Enlaces' continuous improvement efforts. The ICT Observatory collects 90 indicators in four areas: education (including hardware delivered to schools through programs attached to the current national plan), internet access (including the presence, type and speed of connections in schools), ICT industries and e-government (Digital Strategy 2007–12).

Plans to Participate in International Data Collections

Chile generally participates in everything sponsored by the Organisation for Economic Co-operation and Development (OECD) that relates to ICT in education and currently plans to participate in the Program for International Student Assessment (PISA) 2012 (including the Electronic Reading Assessment, ERA). Chile will also participate in the next editions of the Trends in International Mathematics and Science (TIMSS) and the Institute for Educational Achievement's International Computer and Information Literacy Study (IEA ICILS).

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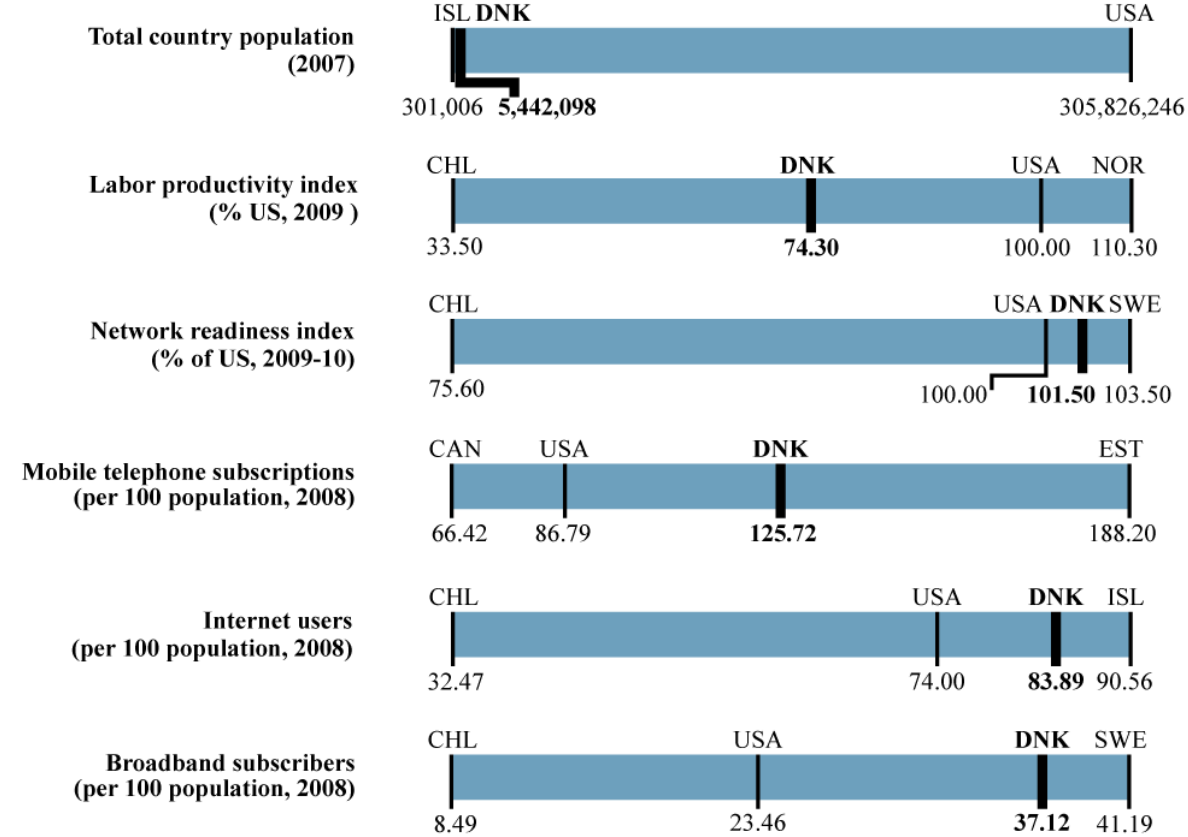
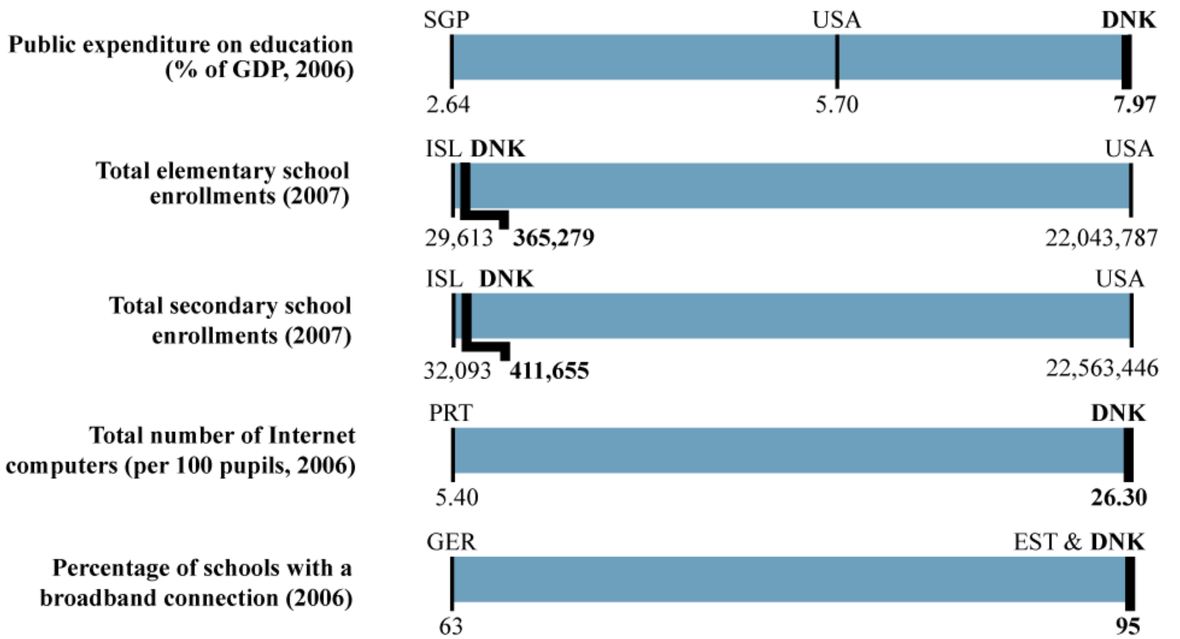
Country Statistics at a Glance

National Indicators



Education Indicators



ICT in Education Highlights

Denmark is conducting an innovative pilot project to provide unrestricted Internet access during examinations at upper-secondary school level (ages 16–19).

The European Pedagogical ICT License program (EPICT) is an in-service teacher training course for ICT in education developed in Denmark. Similarly, students at the compulsory school level (ages 6–16) have the option of pursuing the Pupils' ICT License.

Through the "IT in compulsory schools" program, the Danish Ministry of Education gave seed money to companies to develop digital learning resources to sell to schools.

Structure and Nature of the Education System

Authorities Primarily Responsible

Responsibility and decision-making for primary and compulsory secondary education is divided between the central government (the Parliament and the Ministry of Education) and local government (the municipalities and the schools themselves). The Ministry of Education is responsible for the national curriculum. Although municipalities must meet curricular goals set by the Ministry, they have discretion over the spending of their education budgets, including their investments in ICT. The Ministry provides only an overall frame for budgetary guidance (Højsholt-Poulsen 2010b).

The Ministry is responsible for setting national education policy, including the curriculum and strategy for implementing ICT in education. The Ministry has a specific agency, called UNI-C, which is responsible for implementing the ICT in education strategy. It is the responsibility of the municipalities to implement and finance this ICT strategy at the local level (Larson 2009).

Public education in Denmark is divided into two parts: compulsory and post-compulsory. Compulsory education includes children ages 6–16 (grades K-9). Educational institutions beyond grade 9 are self-governed and subsidized by the state (Højsholt-Poulsen 2010a). Students beyond grade 9 (age 16) may enroll either in upper-secondary education or in vocational schools for grades 10–12. Vocational education (conducted at vocationally oriented education and training schools) has a strong practical training component, which takes place through apprenticeships with private or public companies. Apprentices are paid wages during both the theoretical and practical components. Students who complete upper-secondary school typically go on to enroll in colleges or pre-university, while students who complete a vocational school generally do not. Both general and vocational schools, however, are academically oriented and either can lead to higher education (Larson 2009; Højsholt-Poulsen 2010b).

Political and Economic Context

Relative to other Nordic countries, Denmark is a recognized leader in the innovative use of ICT in education. As noted in a 2009 Organisation for Economic Co-operation and Development (OECD) case study, the Ministry took an active role in ICT under the leadership of former

Education Minister Bertel Haarder. Denmark was one of the first Nordic countries to pioneer a comprehensive policy approach in the area of digital learning resources, and it has maintained that policy consistently for years (Højsholt-Poulsen 2010b; OECD 2009).

National Plan for ICT in Education

Denmark's national plan for ICT in education is not a standalone document but rather is embedded across the various subjects of the entire curriculum (Højsholt-Poulsen 2010b). The plan emphasizes four themes: information search and collection, digital production and dissemination of knowledge, analysis of digital media (such as library databases, statistics, websites, blogs, wikis, etc.), and communication, which includes knowledge sharing and collaboration via Web 2.0 (Højsholt-Poulsen 2010b; Danish Ministry of Education 2010a). National ICT in education objectives are aligned with national cross-sector ICT plans: strengthening ICT use in schools is seen as supporting and stimulating development and innovation in industry, in the public sector, and in the lives of citizens (High Speed Committee Report).

The national plan also addresses leveraging ICT to improve efficiency, in education as well as in other sectors. To support this objective, the government recently launched the Ambitious IT Program. This three-year program, coordinated jointly by the Ministry of Education and the Ministry of Finance, specifies that upper secondary schools are to use ICT to enhance the efficiency of processes such as enrollment, attendance tracking and the scheduling of courses and testing. Schools are to then spend the on producing a more ambitious use of ICT in education. The Ministry of Finance has given guidance to these institutions on how much they are to save, but no guidance yet on specifically how to achieve the savings. Some of the money from the Ambitious IT Program is intended to fund ICT ambassadors, who will serve as teachers' mentors for the development of ICT competencies (Højsholt-Poulsen 2010b). Over the years, Denmark has had a number of professional development programs that were designed for increasing teachers' ICT competence, but these have only impacted about 40 percent of teachers. Drawing on positive experiences from the Netherlands, the Ministry hopes to increase the impact on teachers by placing ambassadors at all schools. The ambassadors are subject-matter experts who also have ICT skills (Højsholt-Poulsen 2010b).

Details of National Plan

Title: Ambitious IT Program

Year of Publication: 2010

URL: http://www.uvm.dk/For%20institutioner/It/AIT.aspx

Title: Common Goals in 2009, Booklet 48, IT and media skills in primary schools ["*Fælles Mål 2009, Faghæfte 48, It- og mediekompetencer i folkeskolen*"]

Year of Publication: 2010

URL: http://www.faghæfte48.dk

Private Sector Involvement

While there are no formal programs to incentivize private-sector investments, the Ministry highly encourages and has partially funded a number of initiatives for private-sector involvement in educational ICT. These include seed funding for the development of digital learning resources under the IT in Compulsory Schools (ITIF) program. UNI-C, the agency that oversees ICT in education, is engaged in many projects that involve the support and cooperation of private industry (Højsholt-Poulsen 2010a, 2010b). For example, private companies are encouraged to promote their digital learning products on UNI-C's national repository of learning resources, "Electronic Meeting Place for the Educational World" (EMU), to increase distribution and uptake of high-quality resources (OECD 2009). Though many of the resources available at the EMU portal are free, students and teachers gain additional access to resources at the EMU portal through a universal login, which has helped increased schools' use of web-based subscriptions to commercially produced digital learning resources (OECD 2009).

UNI-C formerly developed and distributed digital learning resources itself, directly competing in the digital learning resources market. This has not been the case since 2007, when UNI-C's role shifted to that of an "enabler of production and access" (OECD 2009). An OECD (2009) study noted that Denmark has struck a delicate balance between public and private interests in the implementation of national strategies for educational ICT, but this balance occasionally proves difficult to maintain. For example, protests from commercial publishers have delayed the launch of UNI-C's online tutoring program, "The Trainer." Despite the government's intent to use "The Trainer" as a resource to familiarize students with digital resources and thus stimulate the market for commercially-produced digital learning resources, publishers perceive the site's resources as competing with their own products and services.

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

The January 2010 High Speed Committee Report further outlines ICT infrastructure priorities for cloud computing and broadband. The Committee promotes cloud computing as efficient, a solution for security and privacy, and as a platform for new, innovative businesses. The Report recommends that broadband infrastructure should remain market-based and technology-neutral, adding that the promotion of broadband use in the public sector will spur private investment in it (High Speed Committee Report 2010).

There are two key programs for educational ICT infrastructure and support: the renovation and building of educational facilities and the ITIF program, which mainly supports purchasing hardware. Both of these programs are described in more detail below.

The renovation and building of educational facilities such as day care centers and public schools is an important part of developing a broad educational infrastructure of ICT. Beginning in 2010, the Ministry has sponsored a broad support program for municipalities with a funding level of USD 800 million. Although funding from this program is not restricted to ICT investments, ICT is an important part of the overall plan. For this reason, the former Minister of Education has strongly encouraged municipalities to use this program to apply for funding that can be used to renovate their schools' ICT infrastructure (Højsholt-Poulsen 2010a, 2010b).

ITIF is another program that has increased ICT infrastructure in schools. The duration of this program was intended to be from 2004 to 2007, but it was later extended through 2009. Total funding for the program was about USD 93 million (Højsholt-Poulsen 2010a). Overall, 75 percent of the funding went towards purchasing ICT hardware in municipal primary schools (OECD 2009). In an interesting example of Denmark's decentralized approach to education, the program was structured in such a way as to encourage local municipalities to also contribute to their own ICT infrastructure development. According to the program's guidelines, ITIF funding could only be used to purchase ICT hardware for students in grade 3 (age nine). The program chose to emphasize this grade level because it is the earliest point at which students are expected to use ICT. Participating municipalities were then asked to provide matching funds to upgrade their ICT infrastructure for grades 4 and higher. In this way, the program hoped to encourage local municipalities to invest in their own schools' ICT development. All municipalities in the country participated in this matching funds program. Because the responsibility of purchasing equipment lies with the municipalities, state funding acts as a catalyst for encouraging greater ICT investment at the local level. The majority of the funds from this program were used to purchase laptops and interactive whiteboards. This purchase is consistent with an overall trend towards laptop computer usage in Danish schools, as compared to desktop computers. For example, in 2005, 45 percent of computers purchased in compulsory schools were laptops – a significant increase over prior years (Larson 2009). Thanks to investments such as the ITIF program, Denmark has one of the highest computer-to-student ratios in Europe. In 2007, for example, there were about four students for every computer available in grades K–9 (Højsholt-Poulsen 2010b).

Not every aspect of the ITIF program has been such a great success, however. The portion of the program involving dissemination of digital learning resources was met with resistance by teachers, as is noted in a later section of this profile.

In terms of Internet connectivity, 99 percent of schools have access to a wireless network (Danish Ministry of Education 2010b). UNI-C offers schools various wireless networking services, such as a central management system for the monitoring and operation of wireless networks, user validation and wireless security. UNI-C's other services include network security for school local area networks (e.g., firewall and Virtual Private Network (VPN) solutions), universal login (UNI-Login), and data security (e.g., backup, antivirus and antispam tools). UNI-C also provides schools with an electronic mail, conferencing and calendar system.

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

According to the Ministry's national curriculum, ICT skills are embedded in all subjects and must be taught in all subjects (Højsholt-Poulsen 2010b). As mentioned earlier, this holistic approach takes the place of a stand-alone set of ICT standards. As a result, there are no national tests on ICT specifically. Instead, the mastery of ICT skills is built into assessments in all subjects across the curriculum. However, students can pursue an optional ICT certification through the Pupils' ICT License program. The License program was launched by the Ministry in 2004. Through an informal assessment process associated with the License, students may request an evaluation of their skills. Teachers assess students in IT and media skills such as operation, proficiency, knowledge, action and reflection. Students earn the License after successfully passing the assessment. (Danish Ministry of Education 2004). The Ministry hopes that the Licenses will serve students as an additional qualification for employment, and that for participating schools the program signals a commitment to ICT skills (Højsholt-Poulsen 2010b). Lastly, vocational schools are the exception to the embedded approach adopted in other schools: they offer a dedicated course on ICT skills that includes a formal examination of ICT mastery (Højsholt-Poulsen 2010b).

Priorities and Programs in This Area

There are several programs and initiatives to improve student learning through technology-enhanced instruction, including online assessment, a learning management system (LMS), the online homework help service "Trainer," the national educational Web portal "Electronic Meeting Place for the Educational World" and the development of digital learning resources through private partnerships.

All compulsory schools use the same LMS software. The LMS, known as SkoleIntra, was developed by Skolesoft (a private company) and introduced and run nationally by UNI-C. This system has received mixed reviews. On the one hand, the Ministry reported that implementation has been a great success: it has transformed communication with parents in the compulsory schools by streamlining electronic communication and knowledge-sharing with parents

(Højsholt-Poulsen 2010b). On the other hand, a 2009 report from the Danish Evaluation Institute (EVA) suggests that teachers use these systems infrequently to communicate with students and parents as well as other teachers. The report also stated that teachers use the LMS primarily for administrative purposes, not for educational purposes.

Another Ministry-sponsored initiative to improve student learning through technology is the recently launched “Trainer” program. This program will offer students age 6–19 online learning materials that are intended for home use. The free materials are diversified so that they can provide educational support to students at all levels of learning, from the most gifted to those who may be struggling (Højsholt-Poulsen 2010b). The program is best characterized as an online homework help service, and offers many forms of support, such as interactive programs, instructional videos and animations (Danish Ministry of Education The Trainer website). The program’s launch was not without controversy. The publishers’ association reportedly expressed opposition to the Ministry of Education’s project on the grounds that it competed with private-sector efforts (Højsholt-Poulsen 2010b).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

Because Denmark has taken a holistic approach to integrating ICT throughout the educational curriculum, all teachers are expected to have a high degree of ICT competency. In keeping with the country’s decentralized philosophy of government, however, there is no formal standard or assessment of teacher’s ICT skills. Instead, the Ministry promotes an informal set of ICT standards called the Pedagogical ICT License. This national professional development program is widely perceived to be a high official standard for establishing teachers’ mastery of pedagogical ICT use (Højsholt-Poulsen 2010b). It is important to stress, however, that teachers are not assessed against these standards, but merely encouraged to follow them (Højsholt-Poulsen 2010a). The License was launched in 1998 and replaced a prior program that was too focused on IT skills and lacked adequate pedagogy. About half of all Danish teachers have obtained the License.

The Pedagogical ICT License program provides an in-service training course for teacher professional development. It introduces a quality standard for the integration of ICT in education. The program is guided by a fundamental philosophy that teachers’ technological training must always be grounded in sound teaching practice. This philosophy is summed up in the phrase “no technical skills without a pedagogical rationale” (Højsholt-Poulsen 2010b). The program’s classes are offered through universities and regional pedagogical centers. A typical class consists of 20 teachers and is taught almost entirely online. Participants only meet the facilitator once during the course and afterwards participate entirely via electronic communication. Participants must complete eight modules, including four requirements and four electives. Themes encompassed by the four required modules include teaching and learning with ICT, basic computer skills, online communication, online search tools, word processing and innovation through technology. Peer learning is key, and each module involves a team assignment that includes an assessment by the facilitator.

Because the initial licensing program has been so successful at providing basic ICT pedagogical training, the Ministry has also funded the design and delivery of higher-level professional development opportunities, such as subject-specific ICT courses. However, teachers' interest in these advanced courses has been low. Possible factors include financial constraints faced by teachers in paying for the courses or the fact that the timing of the new initiative coincided with a major structural reform within the municipalities (Højsholt-Poulsen 2010b).

The current Pedagogical ICT License program began in 1998 and was later expanded, with support from the European Commission, to include an international version of the license known as the European Pedagogical ICT License (Højsholt-Poulsen 2010a, 2010b). Currently, the Ministry is also trying to map the license program onto the United Nations Education, Scientific and Cultural Organization (UNESCO) competency framework (Højsholt-Poulsen 2010b), which would extend its reach even further.

Priorities and Programs in This Area

Along with several smaller initiatives promoting the use of ICT to increase teacher capacity, there are other programs supporting this priority: e-learning modules for professional development; a national repository of learning resources; the well-fare agreement, which focuses on the professional development of vocational school teachers; and EMU, the national web portal (Højsholt-Poulsen 2010b). These are described below.

In response to the failure of the advanced classes for the European Pedagogical ICT License, the Ministry has developed a new program: pedagogical ICT professional development resources for compulsory schools (ages 6–16). These low-cost, user-friendly courses are available through the national education web portal discussed below. The pedagogical resources service was launched in the summer of 2010 and is available to teachers, schools and municipalities. The Ministry hopes to obtain materials from the municipalities and then share them at the national level, but does not yet know if the municipalities would be interested in participating or if they have resources worth sharing (Højsholt-Poulsen 2010b).

Another program, ITIF, has already been mentioned as an example of ICT infrastructure support. This program also included a component relevant to teachers, which was not nearly as successful as the infrastructure component. According to the OECD Denmark case study, the program has a more centralized top-down approach, compared to its bottom-up predecessor, "IT and media in compulsory education" (ITMF), which failed to disseminate digital learning resources best practices across the country (OECD 2009, 15). Through the ITIF program, the Ministry gave seed money (USD 9.0 million) to companies so that they could develop digital learning resources and sell them to schools on regular business terms. Part of the agreement with the government was that these products would not be given away for free and would not disrupt the market. Eleven products emerged from this initiative, of which only one has been really successful, Mingoville (online English lessons for children, available in many languages). The basic problem is that few schools or municipalities buy these digital products; teachers still prefer the "good old textbook" (Højsholt-Poulsen 2010b). The OECD report confirmed that digital learning resources have had little impact on teaching practices thus far: teachers do not have a strong desire to use digital learning resources from commercial publishers, preferring to use their own materials instead (OECD 2009). Due to the lack of teacher demand for digital learning resources and the small language market size, publishers generally are not inclined to take risks in innovating in the digital learning resources market but instead, under the ITIF Digital Textbook initiative, they simply digitize traditional textbooks without taking advantage of the features offered by the digital format and also without taking into account youth culture and ICT (OECD 2009, 16). As such, the case study concluded that the ITIF program "has not fully incorporated the pedagogical spirit of the Danish educational tradition … which suggests that DLR [digital learning resources] are for individual usage, communication, and collaboration" because the program has not focused on changing learning activities through digital learning resources (OECD 2009).

Perhaps the most prominent example of improving learning through ICT innovation is the "Electronic Meeting Place for the Educational World" (EMU), a national web portal run by UNI-C. This portal serves as a centralized location for learning resources for schools, colleges and adult education. It is considered the "backbone" of the entire digital learning resources system throughout the country (OECD 2009). The portal's ongoing annual budget is USD 2–3 million (Højsholt-Poulsen 2010a). An independent evaluation report commissioned by the Ministry was released in June 2010 (EMU website). The Ministry collects also statistics on the usage of this portal, such as the number of users, Internet provider (IP) addresses, usage of services, etc. (Højsholt-Poulsen 2010b). The Ministry uses the data for internal purposes to inform their decisions, make improvements and structure new initiatives.

EMU is widely used. In fact, it was ranked for several years in the top ten of all websites in Denmark. Now it is only in the top thirty because services that were originally centrally located on this portal have been migrated locally onto the school LMS, so teachers access these services there. This is considered a very important trend, even if it draws away traffic from the central site (Højsholt-Poulsen 2010b). According to UNI-C statistics reported in the OECD Denmark case study, the portal's unique users per week were 185,000, which is equivalent to 25 percent of the Danish primary and secondary education community, and penetration is expected to grow to 80 percent (OECD 2009). The main audience for this portal is teachers, but some students may use it. No training is provided on how to use the site. An ongoing study is looking at how to improve the portal's interface and make it easier to navigate and more intuitive (Højsholt-Poulsen 2010b).

The most popular resources accessed through this Web portal are subject-specific sites at the high school level. Other popular resources include subject-specific sites at the compulsory level, as well as cross-curricular themes (e.g., developing countries, climate change, etc.), which are very popular for project work in Danish schools (Højsholt-Poulsen 2010b). The national education portal also hosts a national repository of learning resources developed by professional publishers or teachers for all grade levels (Materialeplatformen).[20] This repository is part of the European network of repository initiatives, the Educational Repositories Network (EdReNe). This web service has also been utilized by smaller companies to market and sell their digital

[20] Materialeplatformen is governed by an agreement between the Ministry and two major publishing associations. The repository links to publishers' sites, where users can purchase products, so that there are sales of learning resources directly from Materialeplatformen. All contributions to the platform by teachers are screened for possible copyright violation prior to posting (Højsholt-Poulsen 2010b).

learning resources (OECD 2009). The Ministry considers traffic on the website satisfactory, although it would like to raise teachers' awareness of this resource. Users may find the user interface of the portal hard to navigate, so that they cannot locate the resource within the portal (Højsholt-Poulsen 2010a). There is a widget that can be installed to search the repository from within the LMS, but few schools have taken advantage of this.

The fourth example of a teacher-related initiative is the welfare agreement (*Velfærdsaftalen*). This initiative includes a program that focuses on the professional development of vocational school teachers. Based on the results of a survey of teachers' ICT competencies at these schools, the Ministry has required all vocational school teachers to have ICT skills at the level of the European Pedagogical ICT license. If they do not have the required skills, teachers should pursue further teacher professional development, but they have the freedom to decide which type of teacher professional development to pursue, and then apply to the state for subsidies (Højsholt-Poulsen 2010b).

Continuous Improvement Efforts

Investing in Data Systems

There is no ICT-supported process for regularly using data to improve performance at schools, districts, or programs (Højsholt-Poulsen 2010a).

National ICT Program and Policy Evaluation Efforts

Two recent reports evaluated Denmark's progress in the implementation of ICT for educational purposes. Both reports showed that Denmark achieved notable success as a leader in this area. The reports are described below.

In 2006, Denmark participated in an international study of ICT use, called the E-Learning Nordic 2006 Study of ICT. In addition to Denmark, the study also included Finland, Norway and Sweden. Data was collected via Internet-based surveys sent in 2005 to 224 Nordic schools, and follow-up visits to 12 of those schools. There were 8,000 survey respondents including teachers and students in grades 5, 8 and 11 (ages 11, 14 and 17, respectively), parents, principals and municipal representatives. Separate survey questionnaires were developed for each respondent group (Kiesa et al. 2006). This report found that ICT does have a positive impact on improving student learning in Nordic countries, and also improved student engagement, differentiation, creativity and efficient use of time. Nevertheless, the potential of ICT has not been fully realized in many schools. Although teachers tend to use ICT to support subject-specific content, they could still do much more to maximize their use of technology. The report also noted that some schools have invested in LMSs to improve education and knowledge-sharing, but it seems that use of the systems has been rather limited.

In addition to the international study, Denmark also recently conducted its own internal study, *The Use of ICT in Danish Schools.* The study was conducted in 11 schools and 11 municipalities. Data was collected through interviews and self-evaluations from teachers, school management, municipal authorities, students and parents (EVA 2009). This study found that there is a need for improved integration of ICT, since few teachers use ICT for subject-specific pedagogic purposes (EVA 2009). Like the Nordic study, the research found that schools do not tend to use their LMSs to full advantage, relying on them for administrative and organizational purposes, while ignoring their potential as a collaborative and educational tool. The study recommends that LMS should be used more extensively for collaboration between teachers as well as for communication between the school, teachers, students and parents (EVA 2009). In other findings, teachers are demanding higher-quality professional development that is related to practice and is user-oriented, based on their specific needs. Furthermore, teachers' professional development should focus on integrating ICT in individual subjects. Finally, the report recommended that school administrators should prioritize the use of ICT and follow up on recommendations to facilitate and ensure widespread ICT implementation at the schools (EVA 2009).

National ICT in Education Indicator Collections

There is no one central data collection program in Denmark, but instead many smaller, uncoordinated ongoing efforts. Data are shared among Ministry departments for analysis and discussion. Data are generally available to the general public in published reports. As the Ministry of Education's statistics department, UNI-C coordinates with another governmental agency, Statistics Denmark, to determine responsibility for various collections and analyses (Højsholt-Poulsen 2010a, 2010b).

The national web portal "Electronic Meeting Place for the Educational World" does provide some tools for central data collection on ICT in schools. Data collected on this national repository include number of visitors, number of downloads and IP addresses. Individual resource providers can also follow how many of their resources are being used and by whom.

Plans to Participate in International Data Collections

Denmark plans to participate in the Program for International Student Assessment (PISA) (Højsholt-Poulsen 2010a).

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England ICT in Education Profile

Country Statistics at a Glance

National Indicators

Total country population (2007)

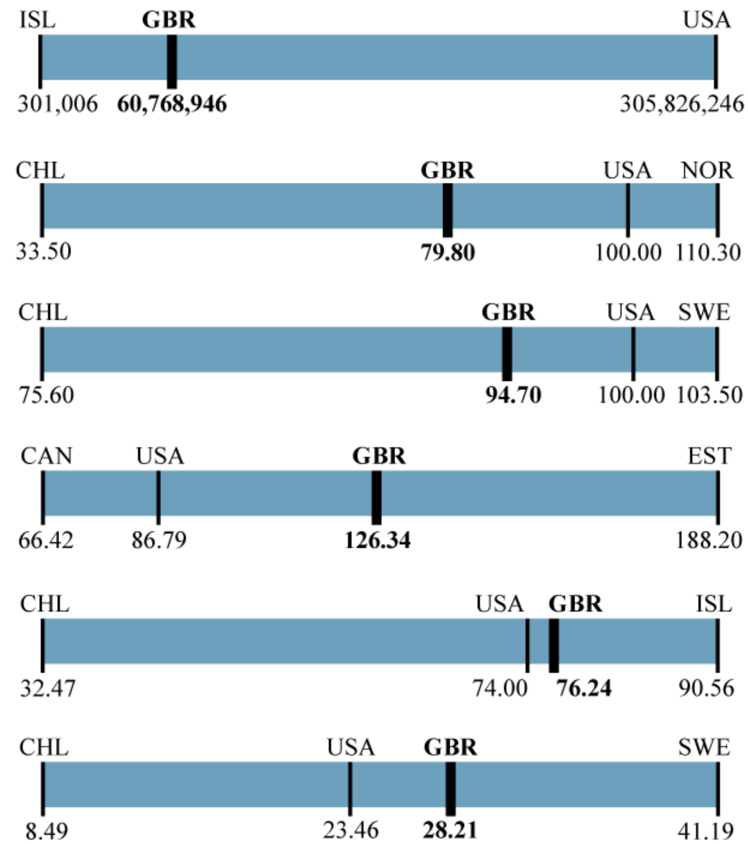
Labor productivity index (% US, 2009)

Network readiness index (% of US, 2009-10)

Mobile telephone subscriptions (per 100 population, 2008)

Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

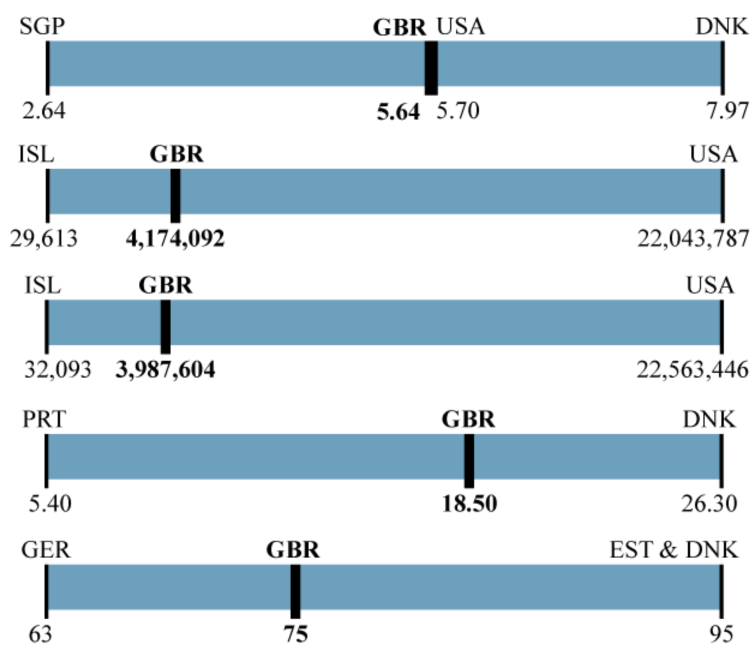
Public expenditure on education (% of GDP, 2006)

Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)

Percentage of schools with a broadband connection (2006)



England ICT in Education Profile

ICT in Education Highlights

Schools' learning platforms make student and teacher data available to parents, who are seen as critical partners working to ensure that a sufficient learning environment is provided. Schools determine access levels and take primary responsibility for safeguarding the sensitive nature of the data contained, although it could potentially be made available to various levels and agencies of the government given that the platform is hosted on the network of the Department of Education.

In response to the economic recession, the current administration has discontinued funding for ICT in education in order to reduce government spending; this includes the suspension of England's largest single investment in school buildings (Department for Education Building Schools website) and the closure of the British Educational and Communications Technology Association (BECTA). Previously, England had adopted a centralized model for all policy, program development, monitoring and research for ICT in education through this single agency, which had gained international recognition as one of the pioneer research and implementation agencies in the field. BECTA worked directly with schools and other government agencies to support the implementation and research of programs.

Structure and Nature of the Education System

Authorities Primarily Responsible

There is no unified department responsible for the education of the entire United Kingdom (UK). Rather, education oversight is given to the home countries—England, Northern Ireland, Scotland, and Wales—which have generally similar systems but implement different activities (Brown 2009b). The Secretary of the Department for Education in England is also the Secretary of State for Education and a member of parliament for the UK government.

In England, the national government is the primary driver for policy-making. This includes specifying the national curriculum, where ICT has been taught as a separate subject since 1995 (Cox 2009), the national curriculum assessments and funding and educational strategies. Local authorities also provide some guidance; however, final implementation decisions are typically made at the school level such that 90–95 percent of funding is given to schools (Brown 2009b). Each school is led by a head teacher (principal) and managed by a board with representation from the local authority, parents, teaching staff and community; this may include religious authorities where appropriate (Cox 2009).

Beginning in 2012, formal schooling in the UK will be compulsory for children ages six to 18 or 19, whereas it was previously required until age 16 only. The additional two to three years of schooling may come in the form of academic pursuits at an institution of higher education or professional training for those who are employed.

Political and Economic Context

On May 11, 2010, a new government assumed office in the UK. On May 12, the Department for Education was established, a new sector responsible for education and children's services in the UK (Department for Education website). As a result, all government education initiatives were in flux at the time of writing, including ICT initiatives and plans. *The data contained in this profile was compiled prior to May 2010 and does not reflect any consequences of the change in government*.

The recently formed Department for Education is responsible for education and children's services. Prior to the change in government, two departments shared equal responsibility for education in England (Brown 2009b). The Department for Children, Schools and Families (hereafter referred to as the Department) was responsible for the education of children up to age 19, while the Department of Business Innovation and Skills focused on people older than 19 years of age, dealing with higher education and professional training.

Under this former structure, additional agencies were set up to provide support services and monitor various sectors in education. The Training and Development Agencies for Schools manages all pre-service and in-service professional development of the school workforce (TDA website),[21] whereas the Office for Standards in Education, Children's Services and Skills is responsible for regulation and inspection of schools and other educational services (Ofsted website). The Department assigned specific strategy-making, monitoring and research related to ICT to BECTA (formerly known as the British Educational and Communications Technology Association),[22] a government agency that received the majority of its funding (almost 100 percent) from the Department, although it also received support from the Department of Business Innovation and Skills.

On May 24, 2010, the new government announced the closure of BECTA, as part of a larger effort to cut the government budget by USD 9.8 billion for 2010–11 (Arthur 2010). At present, some of BECTA's 240 employees are being reassigned to other government agencies, while support for ongoing ICT initiatives will be delegated to Department staff (Brown 2010). The future of ICT initiatives initiated by the former government was unknown at the time of writing.

National Plan for ICT in Education

Upon the request of the Department, BECTA published *Harnessing Technology: Leading Next Generation Learning, 2008–2014* (BECTA 2009) as an update to the initial *Harnessing Technology* strategy released in 2005 for which BECTA was given the role of lead delivery agency. Whereas the 2005 plan focused on building infrastructure and providing access, the primary goal of the update for 2008–14 was to develop a "technology-confident" system that supports personalized learning through the following five key priorities:

Enabling all learners to access and use technology effectively, safely and purposefully to support their learning both at home and in school.

[21] Funding also comes from the Department. Read more at http://www.tda.gov.uk.
[22] BECTA was set up in 1988 to promote the effective use of ICT in education.

Using technology to provide tools and supports to teaching professionals.

Improving access to powerful learning tools and content and support for family and informal learning.

Maximizing existing nationally recognized leadership networks to support innovation and knowledge transfer.

Developing a systemwide national digital infrastructure that supports the integration of personal devices and environmental sustainability.

Subsequently, BECTA released the *Harnessing Technology for Next Generation Learning: Children, Schools and Families Implementation Plan, 2009–2012* (BECTA 2009), which outlined 21 key actions and the national organizations working to support those actions. Targets and milestones were to be set, and implementation was to be monitored by the Harnessing Technology Children, Schools and Families Board.

However, the status of this plan is unknown and may not reflect current government policy. Updates to the national plan occur as needed and are dependent on the political context. As such, it is currently unclear what the status of this plan is, given the elimination of BECTA.

Details of National Plan

Title: Harnessing Technology: Next Generation Learning

Year of Publication: 2008

URL: http://partners.BECTA.org.uk/index.php?section=es&catcode=_es_ba_02

Private Sector Involvement

The involvement of the private institutions has been mostly in the form of contracts managed through BECTA (Brown 2009b). BECTA wrote specifications for the contract work, reviewed bids and then provided lists of approved vendors to local agencies and schools in order to streamline the procurement process and provide standardized services for all schools.

Increasing ICT Infrastructure and Support

England has the required ICT infrastructure in place, a goal it achieved as early as 2006 when 99 percent of schools had online access (Brown 2009b; Cox 2009). Nevertheless, the government continues to invest in improving the infrastructure for key audiences in order to be even more responsive to advancements in technology. More specifically, the National ICT Plan provided over USD 940 million in capital funding for distribution to local authorities that would determine the eligibility of schools applying for the grant. Funds were restricted to the purchase of ICT hardware, although digital curriculum resources could be purchased in some cases (Curriculum Online website). Local authorities and schools were to find alternate revenue funding streams for technical support services, software subscriptions and teacher professional development.

Priorities and Programs in This Area

Government provided USD 14.5 billion for rebuilding every secondary school over a 15-year period, the biggest single government investment in improving school buildings under its Building Schools for the Future program (BECTA 2009; Cox 2009; Department for Education Building Schools website). It focused on the physical structure, facilities and equipment, although there was a percentage (about USD 6 billion) allocated for improving ICT facilities in the school on the assumption that ICT is a component of what makes a “suitable education environment” (Brown 2009b). Through BECTA’s framework contracts, clusters of 7–10 schools partnered with architects, contractors and ICT providers, attending also to continuous improvement and costs associated with long-term sustainability. This program was halted by the Secretary of the Department for Education in July 2010 due to the financial crisis as the Department of Education conducts a comprehensive analysis of capital investments in schools (Department of Education B website).

Although not specifically an education program, the Home Access Program provided USD 474.4 million for extending computer access and broadband connectivity to every home in order to enhance learning beyond school hours. Lower income families that met specific eligibility requirements applied individually for a Home Access Grant to make purchases through approved suppliers. A package included a user device, Internet connectivity and service wrapper meeting predefined technical and performance standards. Opportunities for online learning were not an explicit component or objective of the program.

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

Students are required to take ICT as a subject area course from ages 5–15, and their progression is assessed regularly using locally identified assessments. Plans to implement a statutory national ICT assessment for students at the end of this period, between ages 11 and 14 (Key Stage 3), were cancelled in 2008 following requests from ministers to provide formative assessments that could better support teaching and learning. Offered by the Qualifications and Curriculum Development Agency to schools free of charge, the Key Stage 3 ICT Assessment (as it was known) was an online, task-based assessment available to teachers on demand, although schools must first install the software locally on computers or school networks (QCDA website). Feedback was provided to students instantly as they completed tasks in four activity areas: data handling, modeling, presenting and handling information and sequencing instructions. Teachers administered the test to the students at any point during ages 11–14, and reports were available for individuals or groups.

Priorities and Programs in This Area

The National ICT Plan was designed to support the overall strategy of the Department for Children, Schools and Families (DCSF) such that anything enabling students to improve their learning opportunities would be included where ICT is used to support and enable such opportunities (Brown 2009b). Among its many priorities, the plan focuses on extending access beyond the school day. Funding of about USD 1.6 billion since July 2007 has provided students with access to breakfast clubs, children (daycare) centers attached to a school or associated to the local community, out-of-hours tuition and after-school clubs. (Brown 2009b; Cox 2009,). It targeted less advantaged families and aims to extend home-school links. Although a generic education activity, technology is considered as an implicit enabler of the program (Brown 2009b).

Beginning spring 2008, the Department also set the expectation that every school have a learning platform that includes an administrative system with links to student performance records, the ability to communicate with parents and a virtual learning environment (BECTA website; Brown 2009b). It was designed for teachers to utilize the platform for planning lessons and preparing and distributing digital materials that have embedded assessments. The government aimed to provide all students with an online learning space in order to extend learning opportunities beyond the classroom and the regular school day.

In 2008, BECTA also launched a national media campaign aimed at increasing public awareness about innovations in the classroom that may be enabled by technology. Using print, billboards, TV campaigns and the like, the goal is to bring knowledge into homes about the idea that there is a different type of learning available than the former education system of parents, in which learning is more flexible, tailored to individual needs, assessed and monitored more frequently and accurately and at times and places more suitable to teachers and students (BECTA 2009). “This reflects the shift from developing the ‘supply side’ of education where the burden of responsibility is on schools to empower parents and the community, to the 'demand side' where parents and learners' are encouraged to exercise their rights and demands, for example, that schools provide home access to student school performance information" (Brown 2009b). Originally planned to run through 2012, the ultimate life span of the campaign is dependent on the priorities of the current government leaders.

Other programs related to this priority ended as people began to get more access to public resources available on the Web (Brown 2009b). Nevertheless, one significant program in this area was Curriculum Online, which ran for six to seven years, ending in 2008. Curriculum Online focused on creating a one-stop shop for teachers to access available resources and also disseminate their own through digital Web portals.

The Use of ICT to Increase Teacher Capacity

The Training and Development Agencies for Schools has a department that examines ICT training for pre-service and in-service teachers. The agency conducts its own research and monitoring on activities, such as collecting information from all teacher training colleges around the country (Cox 2009).

National ICT in Education Standards for Teachers

There are no national standards for ICT capacity for teachers. However, as a condition of receiving teacher qualifications, teachers in training are assessed on their ICT skills and required to demonstrate a minimum level of competencies by using basic ICT productivity tools and hardware, such as Microsoft Word, PowerPoint, printing and using the Internet. Teachers are not, however, assessed on how to integrate ICTs into instruction. Teachers receive approximately five hours pre-service training on the use of ICTs to facilitate instruction.

Priorities and Programs in This Area

Currently, there are no national programs that invest in this priority area, having completed a number of programs before 2005. One significant program in this area was Curriculum Online, which ran for six to seven years, ending in 2008. Curriculum Online focused on creating a one-stop shop for teachers to access available resources and also disseminate their own through digital portals. The website and catalog gave teachers access to digital learning resources that could be bought using e-learning credits. Over the course of the project, Curriculum Online funded over USD 791.4 million e-learning credits (Curriculum Online website).

Continuous Improvement Efforts

The Office for Standards in Education, Children's Services and Skills is responsible for regulation and inspection of schools and other educational services, including initial teacher training, publicly funded adult skills and employment-based training, and learning in prisons, the secure estate and probation (Ofsted website). The inspection of schools occurs every five to six years for an average visit of two to three days, although schools are required to conduct self-reviews as well. Inspectors conduct unannounced visits to "at risk schools" every two years and are given only 24-hours notice of such visits. Inspections examine the quality of teaching and learning as well as the provision of ICT equipment, and inspection reports are publicly available on the Office's website.

Investing in Data Systems

The learning platform required for each school includes an administrative system with links to student performance records, the ability to communicate with parents and a virtual learning environment (BECTA website; Brown 2009b). A subsequent enhancement targeted for 2012 will be online reporting to parents so that they have both full-time and real-time access to students' daily performance. Parents can see whether their child has been registered, view results from the embedded assessments during that day and view sanctions during the day. Schools determine the level of transparency, which is currently intended for parents. Although it is technologically possible to make the platform more widely accessible, such as for reporting to the Department or other national monitoring agencies, this is unlikely to materialize due to the political sensitivity around the use of student data for assessing school and teacher performance. It is also currently unclear if this program will be cut by the new government as part of its austerity program.

National ICT in Education Indicator Collections

Nationally representative data on ICT in schools have been collected annually since 1998 through a variety of efforts such as the ICT in Schools Survey (1998–2004), the evaluation of Curriculum Online (2002, 2003, 2005 and 2006 final report) and the annual Harnessing Technology Schools Surveys to assess the uptake of ICT in schools, the most recent of which was released in 2010. In order to track the progressive developments through increasing investments in ICT, BECTA was charged to collect data that could inform future plans related to the Harnessing Technology strategy with a focus on elements such as home access, learning platforms, school-parent communications, e-safety and the uses of technology for teaching and learning.

In addition to data on ICT usage in schools, a department within the Teacher Development Agency tracks ICT training for pre-service and in-service teachers. Data on teacher demographics, number of teachers completing requirements and employment within six months of completion is collected from all teacher training colleges around the country. Reports are aggregated by region, grade level and subject area, and available to the public online via the TDA website.

England also participates in The European SchoolNet, a network of 31 Ministries of Education in and outside of Europe that collects data on how ICT can support change in teaching and learning. Among other activities, the European SchoolNet completed a study of ICT use based on telephone interviews, including data from England. (Brown 2009b; SchoolNet website)

National ICT Program and Policy Evaluation Efforts

It should be noted that BECTA had funding to initiate research activities, and while their reports have reported links between ICT use and improved student achievement, policy-makers remained cautious (Brown 2009b). Although BECTA recognized the need for assessing areas apart from subject area achievement (e.g., behavior or student engagement), these nonachievement outcomes were not a national priority.

Plans to Participate in International Data Collections

England plans to participate in the Trends in International Mathematics and Science Study (TIMSS), the Program for International Student Assessment (PISA) and other Organisation for Economic Co-operation and Development (OECD) activities.

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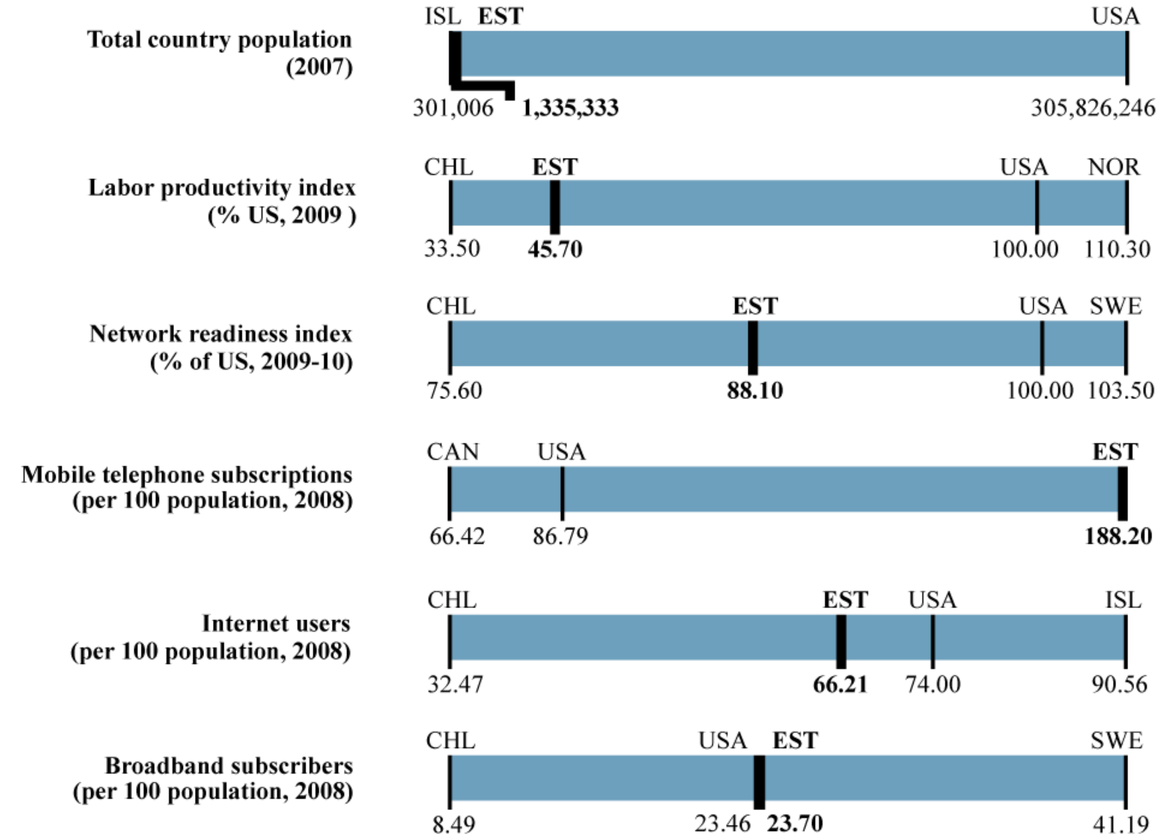
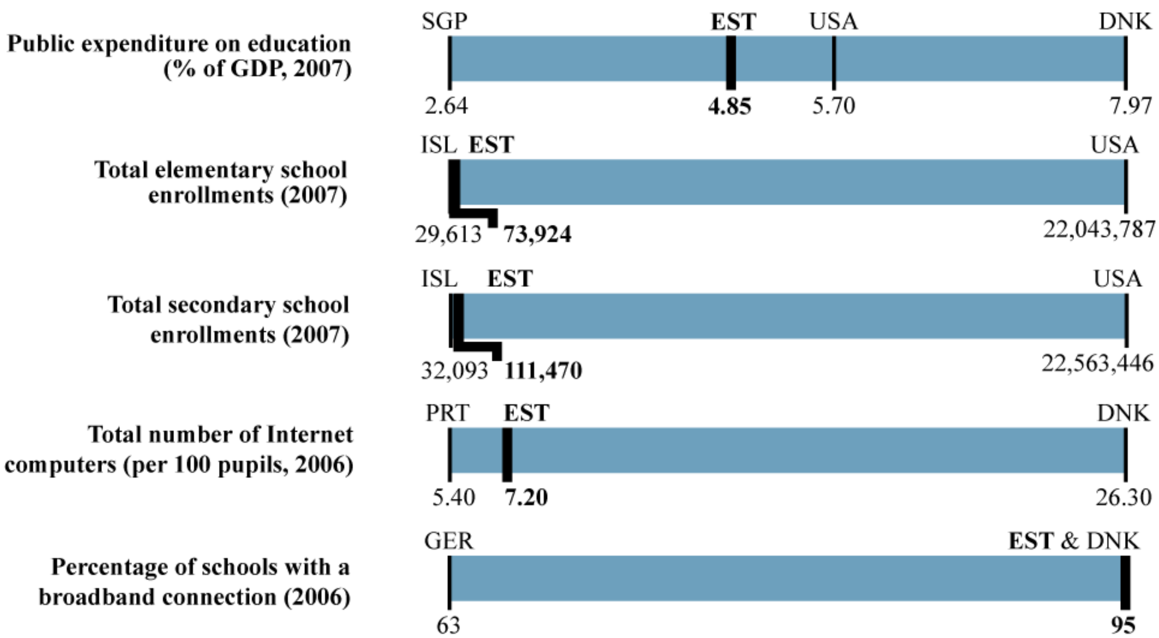
Estonia ICT in Education Profile

Country Statistics at a Glance

National Indicators



Education Indicators



ICT in Education Highlights

Estonia is a leader in continuous improvement. All Estonian schools have quality-management programs and conduct self-assessments on an annual basis. All schools enter data into a national system that tracks information on schools, along with approximately 45 indicators on students and 50 on teachers.

Estonia pursues a cross-sector e-government policy. Digital national identity cards can be used to securely conduct official transactions online. They can also be used to communicate with health care providers or even to shop. The information from the digital national identity card can be also encrypted on the Subscriber Identity Module (SIM) card of one's mobile phone through the Mobile ID program.

Structure and Nature of the Education System

Authorities Primarily Responsible

The Ministry of Education and Research is primarily responsible for the Estonian education system. The Ministry accomplishes its goals in collaboration with a number of semi-independent and independent organizations (Toots et al. 2009; Anton 2010a, 2010b), including partnerships with other ministries, foundations, universities and private companies. In discussion with the Ministry, the National Board of Examinations and Qualifications (NQEB) develops and revises a national curriculum and related assessments, and administers national examinations.

Nearly all Estonian students attend public municipal schools. Two percent attend state schools for special needs students and three percent attend private schools. The education system is strongly centralized at the national level, although local education authorities have some leeway in how to implement the national curriculum. Schools choose the language of instruction (mainly Estonian with a small minority in Russian) and can determine the focus of the curriculum at the high school level (ages 17–19), such as whether a school will emphasize the humanities or the sciences (Toots et al. 2009). Students have traditionally attended the same school from age seven through age nineteen. Because the student population has been falling in Estonia, the Ministry would like to close some schools and designate others for either 7- to 16-year-olds (general school) or 17- to 19-year-olds (high school). Pushback from parents and teachers on this plan has the Ministry rethinking its approach (Mägi 2010).

The Tiger Leap Foundation, an organization with close ties to but independent from the Ministry, manages ICT in education in Estonia. Tiger Leap's goal is to allow each Estonian student to excel in the information society and to provide all citizens with opportunities for lifelong learning (Tiger Leap Foundation 2009a; Tiger Leap Foundation, Tiger Projects website). Since its founding in 1997, Tiger Leap has completed three waves of strategic planning and is now embarking on its fourth.[23] The Council at the helm of Tiger Leap includes representatives from the Ministry, along with local government representatives, teachers and parents. The Ministry provides approximately 80 percent of Tiger Leap's funding, while European government monies, private companies and individuals provide the remainder (Anton 2010b).

National Plan for ICT in Education

The Ministry works closely with Tiger Leap on a regular basis to draft national educational technology plans. Although new strategy plans are published every three to five years, the Ministry mandates that Tiger Leap review its activities on an annual basis, assess whether those activities are accomplishing the objectives laid out in the plan and adjust its efforts accordingly. Revised action plans are thus drafted and carried out every year to ensure close alignment with the strategy documents (Anton 2010b).

Between 2006 and 2009, the Ministry completely revised the K–12 curriculum, and Tiger Leap's new strategic plan (2010–18), currently in draft form, is emerging as a response. This draft document addresses Tiger Leap's goals for schools while also defining its own internal strategy for the coming years.

The new strategy takes into account research and monitoring data from 2006–09 and aligns with both the General Education Development Plan (2007–13), the Teacher Education Strategy (2008–13) and the cross-sector National Strategic Development Plan. It prioritizes the 21st century skills of creativity, communication and collaboration, and outlines goals for students as well as teachers and administrators. It aims to provide students with individualized learning opportunities that use ICT to enhance approaches to traditional study materials, open interdisciplinary perspectives and introduce chances for international collaboration; to raise the percentage of teachers with high-level ICT competencies; to raise the percentage of administrators who can manage education innovation in their schools; and to streamline administrative tasks through the appropriate use of ICTs (Tiger Leap Foundation 2009b). There are no official action items or programs affiliated with the strategy to date, but the Ministry identifies its top three current ICT in education priorities as improving the quality of digital learning materials, linking ICT with science and improving the pedagogical effectiveness of teachers' use of ICTs.

Details of National Plan

Title: Tiger Leap Foundation, Strategy 2010–18.

Year of Publication: (new one not yet released)

URL: (no current URL)

[23] *Tiger Leap, 1997–2007* contains a useful account in English of the Foundation's first 10 years of activity (Tiger Leap Foundation 2007).

Private Sector Involvement

The Ministry and Tiger Leap pursue partnerships with private companies and foundations in order to expand ICT-related opportunities in schools. Neither the Ministry nor Tiger Leap has any formal incentives for such partnerships, yet contributions from private entities now provide approximately 15 percent of Tiger Leap's operating budget, an amount Tiger Leap is seeking to double in the next two years. Current partnerships involve not only hardware and software makers but also banks and telecommunications companies.

The Ministry manages to make these agreements without offering formal incentives by presenting them as mutually beneficial. For example, most Estonian adults use the internet for banking, so by investing in computer resources for young people, banks can increase familiarity with some of their products and thus potentially gain a return on their investment when those schoolchildren become adults (Anton 2010b). Further, raising more private funds can be a way of opening doors to a wider range of money from European Union (EU) government programs that require member countries to put up matching amounts.

The Ministry also partners with a number of wholly private foundations such as Look@World, with whom it partnered in the development of the school information system currently in use throughout Estonia. Look@World was founded in 2001 with the goal of helping all Estonians benefit more from the advantages of computers and the Internet. In addition to providing free computer classes to adults, Look@World raises awareness of new digital services such as the digital national identity card and Mobile ID, an encrypted national identity card stored in one's mobile phone (Estonian Ministry of Economic Affairs and Communications 2010; ID.ee website).

The Ministry is not directly involved in one current public-private partnership which merits discussion here, since it is sure to benefit all Estonian schools: the EstWin project for the national planning and implementation of the next-generation broadband network. The partners, several ministries and telecommunications companies, plan to use public funds to establish fiber-optic networks in rural areas, while the private companies will build the network in urban areas and offer services in both rural and urban areas. Project goals include universal access to a 100 Mbps connection by 2015, with fiber-optic cable running within a mile of 98 percent of all residences, businesses, public buildings, etc. The partners formed the Estonian Broadband Development Foundation to oversee the project (Estonian Ministry of Economic Affairs and Communications 2010).

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

Estonian schools already have quite good ICT infrastructure, so improving infrastructure is not a current Ministry priority (Anton 2010a). All schools already have nationally networked school information systems with centralized services and most schools have learning management systems (LMSs). Furthermore, a laptop-for-teachers program has been in place for a few years.

Further, as mentioned above, plans to improve the broadband network are underway through the cross-sector EstWin project.

The high levels of equipment and connectivity in Estonian schools reflects how highly new technology is valued in Estonian society generally. The Internet is ubiquitous in Estonia, the birthplace of the popular voice-over-Internet protocol, Skype. In a 2008 study, nearly three of five people ages 16–54 reported regularly using the Internet to access public services for citizens and to browse online databases, in addition to popular uses for social and work-related purposes (Estonian Ministry of Economic Affairs and Communications 2010).

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

The recently completed overhaul of the curriculum made obsolete the standards for students that had been in place under the old curriculum. Accordingly, the Ministry is now drafting new standards. There are not separate standards for ICT in education, however; rather, in the new standards, educational goals for ICT will be integrated throughout the curriculum.

Priorities and Programs in This Area

The Ministry supports the cross-sector goal of shoring up Estonia's position as a global leader in the knowledge-based economy through pro-innovation and pro-business policies (Estonian Ministry of Education and Research 2007). Top current priorities are to improve the quality of digital learning materials and to integrate ICTs more effectively into science courses. Using ICT to open interdisciplinary perspectives and to link theoretical and practical approaches are also priorities.

The Ministry would like to develop learning materials that use technology to the same degree and with the same level of appeal as the best computer games, as a means of increasing students' engagement with course content. The Ministry sees probeware and other devices that allow students to gather data and conduct their own experiments as another means of increasing student engagement. It is important to note that the impetus for investing in high-quality digital-learning materials and ICT devices is not to expand students' access to virtual, asynchronous learning outside the time and space of the school day but, on the contrary, to give students a reason to come to school—to use cutting-edge tools to which they do not have access elsewhere (Anton 2010b). Furthermore, the experiential learning associated with the devices—project-based learning with real-world applications—models what the students will be doing in their future careers. The goal is to transform traditional classrooms into a space that more closely reflects the state of the workforce and industry, particularly in science, technology, engineering and math (STEM).

The Ministry sees the devices as a promising means of increasing student interest in different subject areas, especially STEM. Currently, there is a shortage in the Estonian STEM pipeline that the government would like to correct. The government is taking a two-pronged approach to accomplish that, engaging Estonian students in scientific inquiry on the one hand, and improving research structures by investing more heavily, and more strategically, in innovation on the other hand. The new curriculum supports these goals, as do a number of small programs, including annual national competitions to which teams of students submit designs for robots that they have created and built using design software, such as cadware and computer-connected machines. The goal of the program is to unite theoretical and practical applications. The Ministry purchased the software and equipment for this program through a competitive bidding process (Anton 2010b; Tiger Leap Foundation TechnoTiger website).

In order to learn more about the impact of ICT on learning outcomes, the Ministry commissioned a two-year study of student laptop use, which was published in 2009. The study offered free laptops to approximately 100 eighth graders in 12 schools. The schools, selected by Tiger Leap, represent a range of contexts—urban, rural, geared towards special education, etc. The researchers analyzed data from interviews, surveys and site visits, as well as from spyware installed on the computers. The study had some negative findings; for instance, students' perception of the potential of ICTs to enhance learning actually decreased over the course of the project, and both teachers and students found that the laptops increased workloads rather than simplifying things. However, the laptops did make students more self-confident and led them to take more responsibility for their own learning. Although no positive correlation was found between laptop use and learning outcomes, the study's recommendations inform current Ministry priorities, such as the development of more high-quality digital curriculum materials. The study also found that it is not safe to assume that because young people are proficient with technology, they will instinctively be able to use ICTs toward improving learning. Rather, they still have to be taught some technical skills alongside the subject content.

Although some countries prefer to invest in equipping classrooms and others direct resources towards anytime-anyplace learning through mobile devices, Estonia falls somewhere in the middle. The Ministry does seek to equip classrooms, with probeware and other devices students would not have an opportunity to use outside of school rather, but prefers to invest in laptops for teachers and students rather than interactive whiteboards. This approach suits the goal of offering more experiential learning and authentic experience, while making school the engaging place where that learning occurs (Anton 2010b).

The Estonian school information systems can be considered another means by which ICT supports student learning although they do not have pedagogical features. They house information on each student (personal information, grades, transcripts, etc.) and support communication among parents, teachers, administrators and students. Parents are very enthusiastic about this and use the interface frequently. They log in to verify their children's assignments and check grades, and can even receive a text alert via their mobile phones if their child is absent. Engaged parents are known to call the school to ask when grades for a given test will become available once they see online that it has already been administered. Although some teachers at first resisted this level of transparency as intruding on their autonomy, the overwhelming enthusiasm of parents has kept this strategy in place (Anton 2010b).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

As is the case with the standards for students, the Ministry is currently revising standards for teachers in order to align them with the newly revised national curriculum. There are not separate standards for ICT in education for teachers. Teachers are evaluated for promotion according to a 15-item rubric which includes ICT skills (Anton 2010b).

Priorities and Programs in This Area

Improving teachers' uses of ICT constitutes a major priority. All teachers have the technical skills to use common software, but most need additional guidance in effective methodologies and techniques for teaching with ICTs: how much to use ICTs in lessons and how to do so effectively (Anton 2010b). Tiger Leap partners with specialists from universities and county vocational centers to offer a range of professional development courses. Over two-thirds of teachers took advantage of Tiger Leap's former professional development program, "Computers at School." A current program, "DigiTiger," picks up where the former program left off, training teachers in best practices in using curricular management systems and digital portfolios for student assessment, for example. Tiger Leap also helps teachers to work collaboratively with other teachers and professional Web designers in order to make higher-quality, more engaging digital learning resources (Anton 2010b; Tiger Leap Foundation DigiTiger website).

Tiger Leap also currently offers two smaller, more specific trainings, Anima Tiger and Project Kit. Anima Tiger instructs teachers on the basics of computer animation and its potential pedagogical applications. From there, teachers can pursue a more advanced animation class and request support for their students to participate in animation projects. Project Kit trains teachers how to use ICTs for project-based learning. Teachers in a subject attend as a group, so the program also encourages teachers to use ICTs in collaboration with one another. The Ministry believes that while students already collaborate using ICTs, through social networking sites for example, teachers can be encouraged to tap the potential for collaborative work that ICTs offer.

Teachers can already share resources through Learning Folders Net (Miksike website), a searchable online library of subject-specific lessons that teachers log into to download or upload materials, and that allows teachers to collaborate with other teachers through the main national Web portal, Koolielu. The Koolielu website, backed by Tiger Leap, is the hub for free software and tools (some of which are subject-specific, and some of which support ICT use generally), information and discussion. The site hosts communities of teachers, mainly smaller groups of teachers from a single school or subject.

Tiger Leap further supports the ICT of integration into pedagogy by providing a laptop to any teacher who requests one and meets certain conditions. To receive a laptop, teachers must agree to complete related professional development or otherwise prove their ICT competency (by an ICT emphasis in their teacher training program, for instance), and be employed at least half-time in a school that has sufficient ICT infrastructure to make the laptop pedagogically useful. The laptops are for use at school and home. Four thousand teachers, or more than a quarter of all teachers, have already received laptops through this program (Anton 2010b; Mägi 2010).

The Ministry seeks to support not only teachers, however, but also principals and other administrators, and would like to see higher participation in ICT-in-education professional development among these groups.

Continuous Improvement Efforts

Continuous improvement is quite well developed in Estonia, where schools were required to have quality-management programs in place since 2006, following a mandate from the Ministry. Schools are free to develop systems that suit their context, within the framework of the European Foundation for Quality Management Excellence Model (Kukemelk et al. 2008). Evaluation of schools' quality management programs began in 2008 with a preliminary study and the piloting of a teacher survey. The survey addressed things such as improving student learning (tracking and analyzing attendance, grades and grade completion rates), attitudes towards teacher pay-for-performance structures and the degree to which school leaders involve other stakeholders in decision-making. The study, conducted by university researchers with support from the European Regional Development Fund, continued at full scale in 2009 (Kukemelk et al. 2008).

The national educational plan now takes into account the research and monitoring data from 2006–09 (Anton 2010b). The "Research, Statistics and Databases" section of the Ministry's website provides links to recent research studies and results of national data collections.

Investing in Data Systems

A small population and lack of cultural resistance to data collections both contribute to Estonia's strength in this area. The Ministry conducts national data collections to inform its strategies and uses data systems as a means of communicating with educational stakeholders. At the school level, each school has one or two people responsible for entering into a national system data on students, teachers and the school itself (including languages, space and resources available and certifications granted). Electronic transcripts and diplomas are kept from students' first year in school (age seven) through the doctorate level. The national system tracks approximately 45 indicators on students, including grades, transcripts, diplomas and personal information, and 50 for teachers, including their specializations, training and workloads. Some results are published on the Ministry's website. The Ministry plans to expand this collection to include adult education programs as a means of tracking lifelong learning (Anton 2010a, 2010b).

Estonia conducts many of its own data collections but does not conduct national grade-level testing, except for the national exit exams administered to certify completion of general school (age 16) and high school (age 19). The National Board of Examinations and Qualifications (NQEB) is working towards administering state exams online. Estonia does regularly participate in international testing (e.g., the Program for International Student Assessment, PISA) and analyzes the results from those efforts alongside its own data.

Self-assessments conducted annually by schools according to Ministry guidelines provide another source of data. Every school must conduct the self-assessment, the results of which are used to inform school-level decision-making. Each year, schools in certain localities are required to report their results to a national database. The Ministry calibrates the results of the schools' internal assessments by administering an assessment within a portion of schools every three years. The results of these two forms of data collections are analyzed with the goals of aligning action plans with strategy documents and, periodically, of revising strategy documents (Anton 2010a, 2010b).

National ICT Program and Policy Evaluation Efforts

Policy evaluation generally occurs through the annual review of the data collected by the means described above. All programs incorporate an evaluation component, the results of which feed into that same ongoing review process, in that results are analyzed to inform action strategies and new policy documents. The student laptop pilot study, for instance, gathered data through surveys of students and teachers as well as directly from the laptops (through spyware). The recommendations from the study were part of the impetus behind the Ministry's current priority to improve the quality of digital learning materials.

National ICT in Education Indicator Collections

The Ministry examines how teachers use ICT in their pedagogy via surveys on teachers' practices administered to both teachers and students. Indicators include the frequency, type, and style of teachers' ICT use, as well as teachers' attitudes towards ICT. The Ministry stores the data in a national database and uses it to inform its planning for teacher professional development. Tiger Leap collects data once or twice per year via self-report surveys of students, teachers and administrators, and posts its surveys on its website (Anton 2010a, 2010b).

Plans to Participate in International Data Collections

Estonia, which prides itself on its strong performance in international data collections, plans to participate in the next instances of the Program for International Student Assessment (PISA), the Secondary Information Technology in Education Study (SITES) and the Trends in International Mathematics and Science Study (TIMSS).

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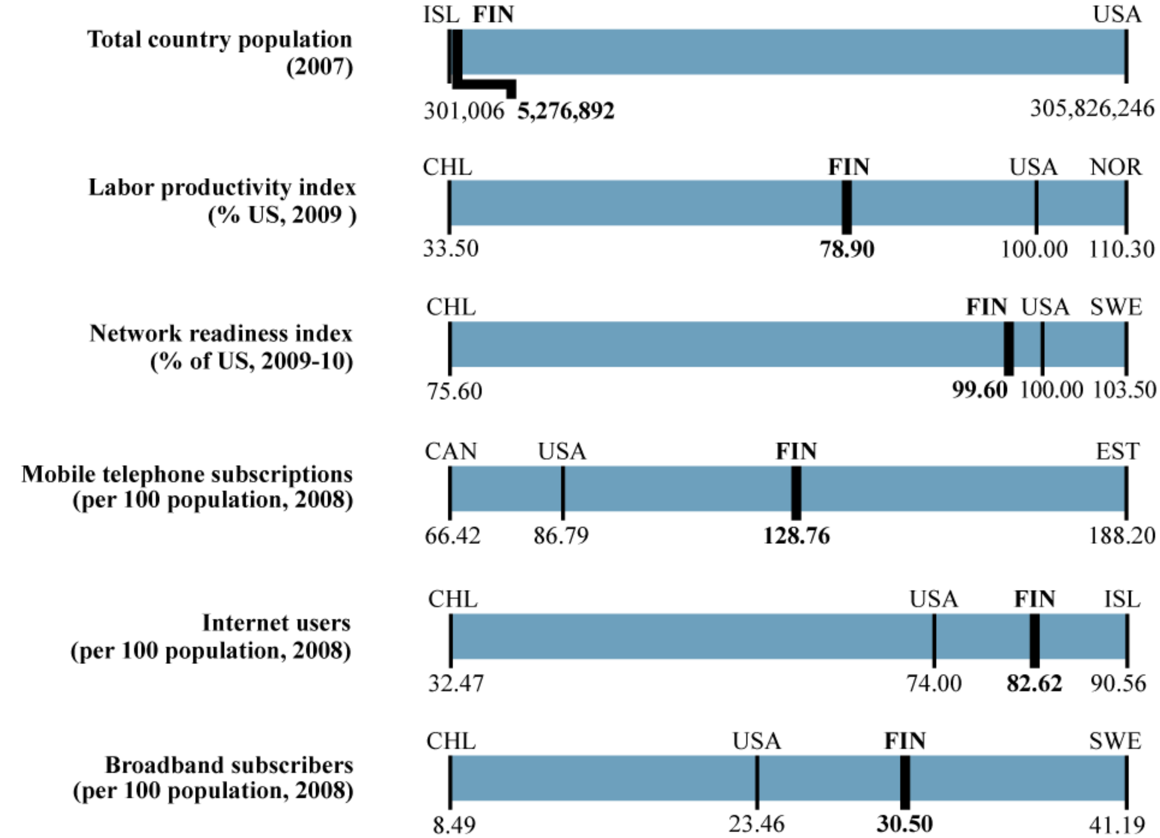
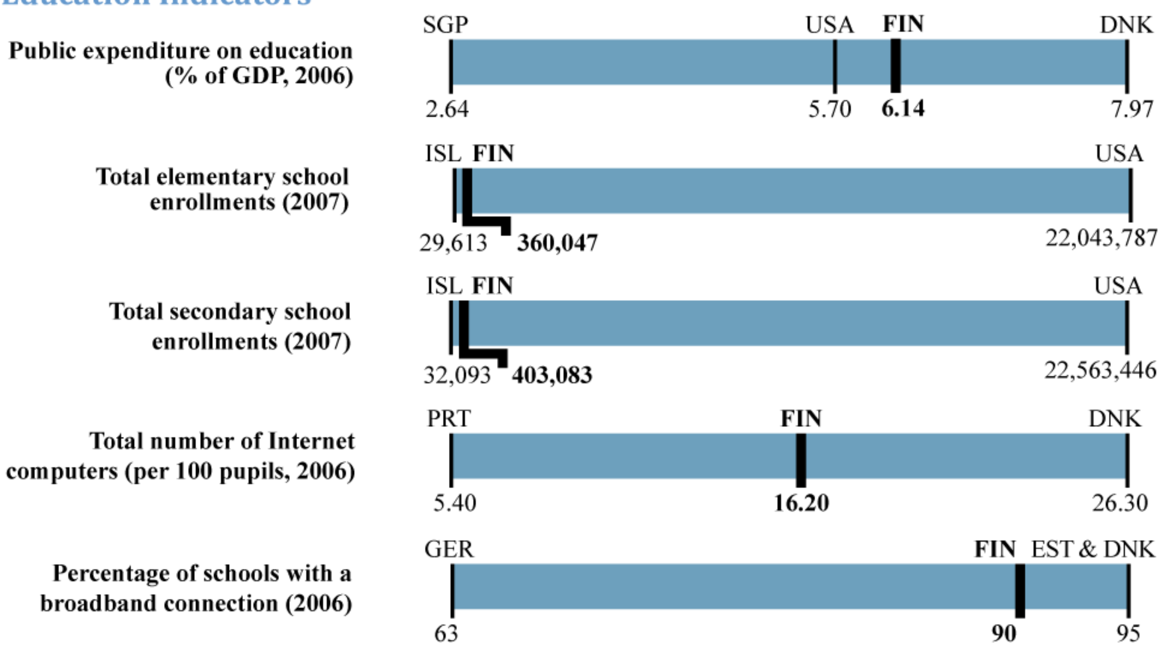
Finland ICT in Education Profile

Country Statistics at a Glance

National Indicators



Education Indicators



ICT in Education Highlights

Finland recently passed legislation declaring a broadband connection of 1 Mbps a legal right of every citizen.

All Finnish schools have advanced learning management systems (LMSs) networked to the national data collection and reporting organization, Statistics Finland.

Teaching, a highly respected profession in Finland, attracts some of the country's brightest students. Recognizing the potential of the teaching corps as a source for innovation, the Ministry of Education and Culture offers small, three-year grants to groups of teachers to develop, pilot and scale up their own ideas.

Structure and Nature of the Education System

Authorities Primarily Responsible

The national government is primarily responsible for educational planning. The Education section of the Ministry of Education and Culture comprises two parts: one part is a panel of experts that formulates recommendations, while the other part helps the government make policy. The Ministry works closely with the Finnish National Board of Education, a government agency subordinate to it, to develop national plans, projects and curriculum.[24] The Board of Education is responsible not only for the curriculum (and all associated certifications), but also for evaluation, research and training (Finnish National Board of Education website).

Municipalities share with the national government the responsibility of funding comprehensive and vocational schools (Finnish Ministry of Education and Culture website). Municipalities have a good deal of autonomy regarding how to teach the national curriculum and how to implement projects (Koivisto 2010a). More decision-making has shifted to municipalities over the last decade, a shift aligned with a policy emphasis on equality of access.

Most students are enrolled in free public schools for 10 years of compulsory school. One year of preprimary education (at age six) precedes nine years of primary and secondary school (comprehensive school, ages 7–16). Three years of upper-secondary school or two to three years of vocational school follow the other education levels (Kankaanranta 2009).

[24] The Organisation for Economic Co-operation and Development (OECD) report, *Beyond Textbooks*, notes that this structure, in which ministries focused on planning work closely with government or semi-independent agencies that handle programming, is typical of Nordic countries. The Finnish National Board of Education can be compared to UNI-C in Denmark or the Norwegian Directorate for Education (OECD 2009, 60).

Finland ICT in Education Profile

Political and Economic Context

The Board of Education is now working with a parliamentary committee to develop a new curriculum, as it does approximately every 10 years. The new version is expected to be approved in legislation by 2013, with implementation taking place in schools in 2013–14. Although discussions are not finalized yet, the Ministry suggests that in the new curriculum subjects will be more integrated with one another, particularly across the sciences, than in the current curriculum. The current model is characterized by disciplinary divisions inherited from the university structure, whereas the new model may feature an interdisciplinary approach that better supports 21st century skills, such as critical thinking and communication. In this shift, Finland will be following other Nordic countries, namely Norway and Sweden, where schools have already implemented a shift in emphasis from subject teaching, focused on subject content, to civic teaching, focused on skills that will allow students to become productive and civic-minded citizens. One anticipated challenge of the new model is that teachers' qualifications, still based in subject areas, will no longer be well aligned with the curriculum, so additional in-service training will have to be offered (Koivisto 2010b).

Finland has drawn international attention for its students' strong performance in international comparisons such as Program for International Student Assessment (PISA), as well as for its investments in ICT for education. Some of the country's successes with ICT-related educational innovations are discussed in the 2009 Organisation for Economic Co-operation and Development (OECD) report, *Beyond Textbooks: Digital Learning as System Innovation in the Nordic Countries*.

National Plan for ICT in Education

Finland's ICT in education policies can be found in cross-sector legislation and policy documents rather than in education-specific documents. Cross-sector planning is typical in Finland, where policy documents contain relatively little detail. Because policies may not remain in place when a new government takes office every four years, the Ministry puts more of its resources towards projects and "action plans" than policy documents (Koivisto 2010a).

The third and current cross-sector ICT strategy plan is *A Renewing, Human-Centric and Competitive Finland, 2007–15*. As a result of this plan, a resolution passed to create a broad national program called Ubiquitous Information Society. This cross-sector initiative, led by the Ministry of Transport and Communications, is run by an inter-Ministry advisory board organized into six working groups. One of these, The Benefits of ICT in Teaching and Studying, addresses the program's education-related goals. The objective of the Ubiquitous Information Society program is to improve Finnish productivity and international competitiveness through the use of ICTs. In a country where 83 percent of people ages 16–74 report using the Internet on a regular basis (Statistics Finland 2009), and recent legislation states that access to a broadband connection is a legal right for every citizen (YLE 2009), the Ubiquitous Information Society program addresses all aspects of Finnish life. For example, one program goal is for every citizen to have a unique log-in that would work universally for access to all public and private services (Finnish Ministry of Transport and Communications website).

Details of National Plan

Title: A Renewing, Human-Centric and Competitive Finland, 2007–15

Year of Publication: 2007

URL: http://www.arjentietoyhteiskunta.fi/

Private Sector Involvement

The government has no formal incentives in place for partnerships with private entities, but the Ministry does currently have a number of such partnerships. As policy goals move towards improving opportunities for lifelong learning and improving workforce preparedness for 21st century employment, business and industry are seen as increasingly valuable partners. Business leaders from a range of sectors sit on the advisory board of the Ubiquitous Information Society program, for instance, alongside representatives from several ministries and researchers. Furthermore, the Ministry works with private publishers to disseminate high-quality learning materials.

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

Finland has quite strong ICT infrastructure generally: high penetration of broadband, all schools online and learning management systems (LMSs) in all schools. Although in 2005 Finland lagged behind other Nordic countries in access to broadband Internet, with only 36 percent of its citizens benefitting from high-speed connections (Statistics Finland 2005), Finland would now like to achieve broadband access for all in 2010. That intention was given weight by legislation—the first of its kind—granting every citizen the right to a 1 Mbps broadband connection (YLE 2009). A consortium of telecom companies sponsors the Supermatrix program, which is laying more fiber-optic cable. The cable improves connection speeds enough to distribute high-definition television and make available to individuals the kind of offsite data storage typically only available within businesses and other large organizations (Supermatrix website). The pace of installation indicates that the goal of universal access in 2010 may not be met, however. The expense of extending lines to those in sparsely populated areas presents a challenge. Furthermore, despite concern that the quality of existing networks may be declining, municipalities are hesitant to invest in them right now, especially in the North and East of Finland (Koivisto 2010b).

Because of the role municipalities play in infrastructure improvements, municipal-level budget shortfalls can stymie efforts. Computers and networks are a separate line item in municipal budgets, so towns that find themselves strapped for funds may choose to cut back in this area. A national program that provided funds to municipalities to support hardware purchases has been discontinued, although it is expected to be refunded in 2011. A multiprong initiative implemented by the Board of Education in the late 1990s, Information Finland, has helped schools purchase computers and now helps integrate ICTs into pedagogy.

All schools have advanced LMSs, produced by one of a handful of companies, to house student data ranging from their teachers' evaluations to their certificates and diplomas. Municipalities purchase the systems and the manufacturers train teachers, administrators and school counselors to use them.

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

There are no separate ICT in education standards for students. Expectations for knowledge and skills across all areas are outlined in the national curriculum now being phased out to make way for the newly reformed version. As the new national curriculum is implemented, the Ministry would like to see a return towards instruction in technical ICT skills. For years, it has been assumed that young people are adept at using technology, since they have grown up with the Internet and use technology so frequently in their everyday lives, and that this expertise can allow them to use ICTs for higher-level problem-solving without technical instruction. The Ministry finds that students' technical skills do not entirely overlap with those they need to support lifelong learning and that therefore technical training should be reintegrated into the curriculum (Koivisto 2010b).

Priorities and Programs in This Area

In keeping with the Finnish preference for action plans over policy documents, the Ministry has only a few, wide-ranging national educational technology programs. One national program, The ICT in Everyday Schools Project, is overseen by the Ubiquitous Information Society program's Benefits of ICT in Teaching and Studying working group. This working group includes representatives from the Ministry of Transport and Communications, the Ministry of Education and Culture and the Board of Education, along with researchers and industry leaders. The group provides guidance and funding for top schools, one in each of 12 participating municipalities, to test innovative ICT strategies in the areas of infrastructure, learning environments, learning materials, school administration and cooperation between schools and businesses (ICT in Everyday Schools website). This program is the Finnish portion of a pan-European pilot program involving over 1,000 classrooms, called iTEC (Innovative Technologies for an Engaging Classroom). The goal of the pilot is to generate scenarios for the classroom dynamics of the future, e.g., supported by Web-3.0 technologies (RESEDA website).

One project developed through the learning-environment grant program is an online distance education program known as VIRTA, through which students can take foreign language and religion courses. The program began in 2008 and now offers courses in French and Swedish language and orthodox religion. The impetus for the program was Finland's recent immigrants, who hail from a wide range of countries (VIRTA website). The government would like to offer courses in immigrants' own languages and on their own religions while at the same time integrating them into Finnish society. The diversity of immigrants' countries of origin, and their geographic dispersal once in Finland, make online education a cost-effective way of meeting this need (Koivisto 2010b).

The LMSs in place in all schools also support student learning indirectly by serving as a communication channel between schools and parents. Parents do not have access to any information on students over 18 years of age but can access information regarding younger students with the students' permission. Depending on the system—different schools have different platforms—parents can follow a child's performance on assignments on an ongoing basis (Koivisto 2010b).

Thus far, results from Ubiquitous Information Society's ICT in education activities have been variable. According to the Ministry, changes to the classroom environment have been slow: teaching is still primarily lecture-based with students as passive receptors of information. The role of course materials is changing more quickly than the overall classroom dynamics, however. Students do not rely as heavily on textbooks and proactively seek information from a range of online sources, for example (Koivisto 2010b).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

Finland has no separate ICT in education standards for teachers, but it does have standards for teachers stated in legislation. However, teachers are not assessed in terms of these standards. Rather than a top-down model of standards to which teachers should aspire, the Ministry takes a bottom-up approach. Since teaching is a highly respected profession in Finland, many of the country's brightest students traditionally gravitate towards the profession. The Ministry recognizes the teaching corps as a great potential source for innovation and tries to support teachers in finding their own best ways of accomplishing their work. The Ministry finds that the freedom and autonomy that teachers enjoy makes them more committed to their work (Koivisto 2010a; Koivisto 2010b).

Priorities and Programs in This Area

At present, using ICTs to improve teachers' pedagogical skills and technical skills, and the integration of ICT into instruction, are top priorities, supported by a large, ongoing grant program and a good deal of research activity. The Ministry devotes USD 6.1 million per year to a grant program for the development of new learning environments including the use of ICTs. In the first phase of the program, from 1996 to 2007, its goal was to test and produce new methods for teaching and learning. In the current, second phase of the program, the focus has broadened and now includes ICTs as well as the physical space of the classroom and how teachers and students interact within it. Typically, groups of teachers within a school will apply for funds, and the grants are awarded to municipalities. Grantees receive funding over three years, with the expectations changing with each year. The first year is devoted to the development of an innovation, the second to piloting it and the third to scaling it up. Scaling involves working with teachers at other schools as well as disseminating the idea more broadly, as through presentations at an annual teachers' conference. The maximum award a municipality can receive through this program is USD 140,000. The Ministry has seen that small grants given over three years can be successful catalysts for supporting and scaling innovation (Koivisto 2010b).

Teachers are generally aware of the Ministry's current priorities since pre-service training programs place those becoming teachers in close conversation with current research. In-service training is available through the Board of Education's initiative, Information Finland, which also runs the teacher network, Edu.fi. On this website, teachers can search collections of high-quality digital materials and consult links to Finnish teacher TV (*Opetaaja.tv*) and numerous other resources that support teachers' improvement. Forty thousand teachers are active on Edu.fi, which receives 100,000 hits per month (Koivisto 2010b). It is important to note that the digital learning resources available through Edu.fi are developed by teachers hired by the Ministry and then vetted before distribution (Koivisto 2010b). This approach helps maintain consistent high quality but does not support much teacher-to-teacher interaction or allow teachers to freely upload materials, as do some other countries' digital portals for teachers.

The ongoing teacher training program run by Information Finland is part of Opedu, a lifelong learning organization offering training to professionals in a range of sectors. Previously, in-service training was offered in three stages: acquiring technical skills, applying those skills in pedagogical scenarios, and developing further skills suited to one's own specific classroom needs. Lately, a minimum set of technical skills has been assumed and training has centered more on integrating ICT skills into one's pedagogy. However, the Ministry proposes that it can be a mistake to assume a skills baseline for teachers as for students and that technical skills should still be taught to both groups (Kankaanranta 2009; Koivisto 2010a; Koivisto 2010b).

Continuous Improvement Efforts

Investing in Data Systems

Data relating to the educational system is collected on an ongoing basis by Statistics Finland, the national organization that is responsible for official statistics in every area. Founded in 1865, Statistics Finland publishes reports on its website on a regular basis. The Education collections include information on the numbers of students in compulsory schools, upper-secondary schools and vocational schools, as well as in special education, higher education and adult education; on students' paths and progress through the educational system (subject choices, graduation or completion rates, student placement after schooling, etc.); on schools and their resources (size, staff, courses offered, infrastructure available, etc); as well as on the fiscal picture of educational institutions (Statistics Finland website). Schools' LMSs are connected to Statistics Finland, so data can be entered directly by school personnel.

National ICT Program and Policy Evaluation Efforts

No data was available at the time of collection.

National ICT in Education Indicator Collections

In addition to its education-specific data collections, Statistics Finland collects data on ICT usage among individuals and businesses—and new reports in these areas are slated for fall 2010—but there is no separate collection on ICT in schools.

Plans to Participate in International Data Collections

Finland plans to participate in the next Program for International Student Assessment (PISA).

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France ICT in Education Profile

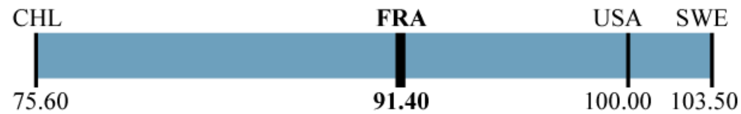
Country Statistics at a Glance

National Indicators

Total country population (2007)

Labor productivity index (% US, 2009)

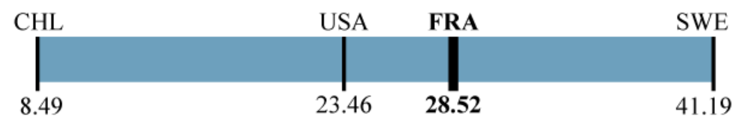
Network readiness index (% of US, 2009-10)



Mobile telephone subscriptions (per 100 population, 2008)

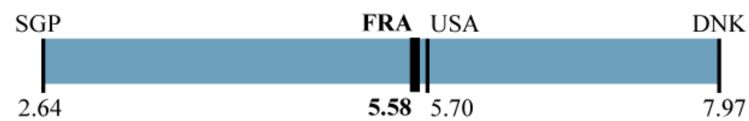
Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

Public expenditure on education (% of GDP, 2006)

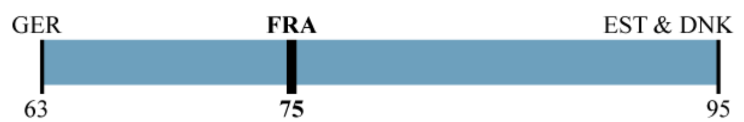


Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)

Percentage of schools with a broadband connection (2006)



France ICT in Education Profile

ICT in Education Highlights

ICT is integrated into the curriculum across all subject areas, for all grade levels.

The Ministry has partnered with private publishers to pilot digital textbooks in 69 middle schools.

The French Ministry of Education conducts an annual survey of ICT in schools and uses the results to inform policies and programming.

Structure and Nature of the Education System

Authorities Primarily Responsible

France has a centralized education system through the Ministry of Education that develops, oversees and periodically updates the national curriculum for elementary, middle and high schools (ages 3–8, 9–14, and 15–18, respectively). The level of local government responsible for schools changes with the ages of students. Towns are responsible for elementary schools, departments are responsible for middle schools and regions (comprised of several departments) look after high schools (Régnier 2009).

Ministry planning and oversight is carried out at the school level through regional administrative units called academies. Academies are run by governmental appointees known as rectors. Academies work in close partnership with municipal, departmental and regional governments. They are responsible for pedagogy and the delivery of the national curriculum, whereas fiscal responsibility for schools rest with local government. For example, local authorities would pay for the installation and maintenance of a learning management system (LMS), and the academies would train school personnel how to use it (Terrades 2010a). There are thirty academies total in mainland France and French overseas possessions.

Political and Economic Context

Local authorities have gained more autonomy through two waves of decentralization: one in the early 1980s and the second in 2001. With the 2001 law, the national government shifted towards a results-oriented approach, rather than disbursing earmarked funds as it had to that point (La documentation française). Local authorities now decide what investments will help them achieve the necessary results. One source of guidance in such decisions is the administrative council now found in each school. Councils comprise local officials, school administrators and staff, parents of students and students, and are responsible for drafting a “school working plan” that outlines how that school will implement the national curriculum in their own specific cultural and socioeconomic environment (Régnier 2009).

ICT in education in France is handled through the same combined central-local channels as other aspects of the educational system. At the Ministry level, the Office of Teaching Programs, Teacher Professional Development and Digital Development is responsible for matters related to

ICT.[25] The Ministry's ICT in education website, Educnet, provides a central portal to current policies and programs in elementary through higher education.

France has a number of current national programs whose goals are to improve infrastructure and support services; to support the development of high-quality digital resources; and to improve the pedagogical uses of ICT by spreading the word about successful innovations as best-practice examples. The Ministry works to make its ICT in education resources known both within and outside of France. Educnet has a good deal of its text available in English, Spanish and German as well as French and has translated nearly a third of its pedagogical videos into English. At the academy level, each academy has an ICT advisor who contributes to local decision-making (Terrades 2010b).

National Plan for ICT in Education

The new iteration of the national ICT in education plan is slated for release in late 2010. General educational objectives were defined in a 2006 official text (The Common Base of Knowledge and Skills) in terms of seven broad competencies, one of which was responsible mastery of common ICTs.

Since the new national plan has not been released, it is worth mentioning a recent comprehensive report, *Getting Digital Schools Right*, published in February 2010. The top priorities of this report, known as the Fourgous report after the name of its primary author, are to improve and universalize top-quality infrastructure and equipment (e.g., fast connections and interactive technologies); to train teachers and all school administrators regarding effective uses of ICT in education; to increase ease of access and use of ICT-related instructional materials, through innovative changes such as revising copyright laws; and to develop digital workspaces (LMSs) and require all schools to offer and maintain minimum services through them.

The Fourgous report takes an optimistic tone regarding the potential of technology to transform education, presenting an urgent need to invest in ICT in education as a means of shoring up a competitive place for France in the 21st century knowledge economy. The report details France's lagging position with regards to its European neighbors, namely Germany and the United Kingdom, and compares France unfavorably to other worldwide ICT-in-education leaders such as Denmark and Korea.

The High Council on Education (a governmental but non-Ministry advisory board) offered a cautionary response to the Fourgous report in April 2010, emphasizing that overconfidence in ICT could be to the detriment of basic skills:

> We should be wary of the oft-repeated idea that ICTs allow students to focus on reasoning without losing time on calculations, and to disregard content to focus on questions of method. Practicing calculations, learning notions of size and proportion, knowledge of historical

[25] The Ministry's ICT in Education office was known as SDTICE (Sous-direction des technologies de l'information et la communication pour l'éducation) at the time of data collection. However, in mid-2010, that office was folded into the Ministry's Office of Teaching Programs, Teacher Professional Development and Digital Development.

events, etc., cannot be delegated to internet consultation. ICTs are tools for, not substitutes for, knowledge and learning. (High Council on Education 2010)

Details of National Plan

Title: (Not yet available at the time of data collection.)

Year of Publication: (Not yet published.)

URL: (Not yet published.)

Private Sector Involvement

The French educational system relies on partnerships, not only among local authorities and the academies but also with private companies. The Ministry views the partnerships as necessary to ensure the production of quality material corresponding to current educational needs. The Ministry has partnerships to support research and development as well as agreements with publishers of digital learning resources. The Ministry also partners with private companies to fund pilot programs, such as a current effort to provide digital textbooks to students via their learning management systems in 69 middle schools across 12 academies. (Terrades 2010a, 2010b).

Economic Context

In France as in many nations suffering from the global recession, the government made stimulus funds available, some of which can be used for ICT in education. In 2009, the national government announced that it was earmarking USD 6.2 billion in stimulus funds for cross-sector investments in ICT: specifically, for improving broadband networks and for new digital services, new applications of digital tools, and new digital content. These funds support some ICT in education initiatives, including the Digital Rural Schools program, a grant program through which elementary schools in towns with fewer than 2,000 inhabitants can apply for support in expanding their ICT capacity.

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

France's current ICT infrastructure efforts center on improving connectivity for all schools and for rural schools in particular, encouraging the use of LMSs and equipping classrooms with hardware and software, such as interactive whiteboards and videoconferencing capabilities. France aims to establish and maintain high-quality Internet connections and LMSs in 100 percent of its secondary schools (Terrades 2010a). All schools have connection speeds of at least 2 Mbps; the government has established a goal of improving schools' connection speeds to over 10 Mbps by 2025. There is no plan to link all the LMSs nationally, as the systems are produced by several different manufacturers and have different operating systems. However, some schools are linked to academy-wide networks.

The Ministry collects data annually on the presence and level of equipment as well as on affiliated resources, such as teacher preparation levels and Internet security programs. Data collection occurs through a voluntary survey called the ICT Survey (Enquête TIC, or ETIC). There are two versions of the survey: one for elementary schools (ages 2–11) and the other for middle and high schools (ages 12–18). The Ministry estimates that 50 percent of elementary schools respond to the survey (Terrades 2010b).

Results from the 2010 survey indicate an average of one computer for every six students in middle schools, and one computer for every three students in high schools (ETIC 2010). These numbers do not account for the fact that some departments gave laptops to every student in certain middle school grades, for instance, or that rural schools generally have far fewer computers than urban schools (Fourgous 2010).

The annual survey also counts Internet connections for pedagogical uses, but does so at the school, not classroom level. Nearly all schools have internet connections. Approximately ten percent of schools (all levels combined) have connection speeds greater than 10 Mbps (ETIC 2010).

In order to address the digital divide between urban schools and rural schools, the Ministry launched Digital Rural Schools, a program that funds infrastructure improvements and hardware and software investments. In rural towns (fewer than 2,000 inhabitants) 8,500 schools applied, and 6,700 schools were funded. The program also includes detailed guidance from the Ministry on selecting the most appropriate material and training for teachers in using the new digital resources (Educnet Digital Rural Schools website; Terrades 2010b; Terrades and Capul 2010).

To improve ICT infrastructure in schools throughout the country, the Ministry has an incentive program for the development of ICT Infrastructure and Services. This program serves to both develop and support ICT use tailored to the needs of particular schools and their staff, including through LMSs. To achieve this, the Ministry draws on input from teachers, trainers, ICT Advisers, school leaders and local officials to create reference guides aimed at helping identify and meet a given school's needs (Educnet Infrastructure and Support website). A number of discreet initiatives take place as part of this broader incentive program, such as the Intranet-Internet project, which provides services for schools.

Within the framework of pilot projects, the Ministry sometimes offers guidance and funds for ICT infrastructure investments by partnering with schools regarding what kinds of investments best suit their needs and continuing to support schools in making good use of the new equipment and connections. This approach helps develop ICT uses suited to local contexts that are aligned with national recommendations (Terrades 2010a).

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

ICT is integrated throughout the curriculum, so all teachers have to incorporate ICT to some degree in their courses. The mastery of specific ICT competencies is reinforced by ICT-specific standards for students introduced in 2000 (French Ministry of Education B2i website). The competencies that make up the student standards are intended to demonstrate less a set of technical skills than a broader "ICT reasoning," in which students can use technology to facilitate higher-level thinking and problem-solving (Terrades 2010b). Still, technical skills are certainly included, for elementary, middle and high school students, along with responsible and ethical usage guidelines (French Ministry of Education B2i website).

Teachers in all subjects conduct assessments of the various competencies on an ongoing basis, according to a framework published by the Ministry. The Ministry plans eventually to have students of all ages assessed in terms of the standards (Terrades 2010; French Ministry of Education B2i website).

For university students, another set of standards applies. Students can pursue two optional levels of certification, which can be the means of proving one's ICT-competency for future employers. Level 1 is for general use, while Level-2 certifications pertain to specific professional fields of education, law, health, engineering and the environment (French Ministry of Education C2i2e website).

Priorities and Programs in This Area

The Ministry generally pursues a goal of improving student learning through technology-enhanced instruction by means of the national curriculum and the B2i and C2i standards, rather than through separate student-targeted programs. Programmatic emphasis is on the resources that support student learning—teacher professional development and improving infrastructure and support—and students benefit from these efforts. One such initiative, 1000 Videoconferences for Schools, gave more elementary students access to videoconferencing so that they may connect with native speakers of English, Spanish, German and Italian (Educnet 1000 Videoconferences website; Fourgous 2010; Terrades 2009).

France is also pursuing the development of digital learning resources through partnerships with private publishing companies. Some of these materials are housed in portals for teachers and will be discussed below. In terms of digital textbooks, the Ministry is just getting its feet wet with a pilot program, launched in September 2009. The digital textbooks are housed in participating schools' LMSs. They were developed by private publishers through an agreement with the Ministry, which has paid USD 537,500 to secure rights to the materials for a period of four years. Sixty-nine middle schools spread throughout 12 academies are participating. While digital textbook pilot continues, the Ministry is preparing for the national launch in September 2011 of digital class notebooks, a tool by which teachers and administrators can communicate with parents. The digital version replaces the traditional paper version that French teachers had filled in by since the 1960s (French Ministry of Education Digital Class Notebooks website).

Different departments in France (several departments make up an academy) invested in different LMSs. Approximately 35 percent of schools have LMSs in place, and interactive maps on the Ministry's website demonstrate that such systems are either already in place or soon will be in place. Local educational authorities are free to choose from among several competing producers and the Ministry provides guidelines for teachers on effective uses. The Ministry has agreements with seven developers and endorses seven different systems for French schools, with the belief that competition supports innovation.

ICT is not widely used for student assessment in France. At present, students' test scores and grades are stored in the LMSs, but tests themselves are not generally administered online. (Exceptions to this include the written portion of the national driving license exam and a few sections of the high school exit exam.) The Ministry hopes that the LMSs will soon hold more student work, such as digital portfolios (Terrades 2010b).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

The ICT standards for teachers are the aforementioned university-level standards, tailored for educators. The standards were drafted in 2005 and updated in March 2010; new teachers have been assessed according to the standards since 2006. The total number of pre-service teachers meeting the certification increased since then, with 69 percent teachers certified in 2009. Certification varies a great deal by academy, from as low as 17 percent (Créteil) to 95 percent or higher (Alsace, Limousin and Reunion Island) (French Ministry of Education C2i2e website).

The Ministry focuses on assessing and certifying new teachers with the view that this approach is more cost-effective than trying to train and certify all in-service teachers. In-service teachers may take advantage of other current professional development programs on a voluntary basis.

Priorities and Programs in This Area

In-service teachers have nine school days per year allotted for professional development of all kinds. Teachers may choose to devote some of this time to ICT training. The ICT training program Pairform@nce operates on a targeted, need-based model, guiding teachers in creating and experimenting with pedagogical scenarios, and then sharing them with their peers. This program is the French incarnation of the Intel teacher training program, Teach Advanced Online (Pairform@nce website). Innovative uses and best practices can be shared through the Pairform@nce website, the Éducnet website as well as via seminars and conferences (Educnet Panorama website).

In addition to formal training programs, French teachers of all levels and subjects have anytime-anywhere access to a range of digital resources online. The main web portal Educnet contains resources for all educational stakeholders and especially for teachers. Features include a searchable online library of subject-specific lesson plans involving ICT, a how-to video library for integrating ICT into one's pedagogy and links to additional information and resources

(Educnet Channel website). For primary-school teachers, the specialized Web resource PrimTICE, launched in November 2009, offers similar how-to videos, each annotated with a host of supporting documentation (French Ministry of Education PrimTICT website).

The ongoing Digital Resources Program provides support funding to private publishers in order to promote the development and distribution of quality digital resources, including resources specifically for disabled students. The goals of the program are to improve the overall quality of digital educational resources and to ensure that such materials continue to be produced in France and in French. The Ministry reviews and rates digital educational resources, attributing a special label to high-quality resources (Educnet RIP website). Resources reviewed are not limited to those for which the Ministry has provided support funding. The rating system is meant to guide teachers and other school personnel in selecting the most appropriate, high-quality programs for their needs. The program is still in place although teachers may no longer rely as heavily on Ministry guidance with the advent of substantive new products, including online video demonstrations (Terrades 2010b).

Although it works with private publishers, the Ministry does also promote the development and use of open-source digital learning resources. On the SIALLE[26] website, where the Ministry houses such materials, teachers can find a catalog of free and open-source software programs for Mac, PC and Linux platforms. The site supports searching by subject area and grade level. It has interactive features that allow teachers to review software they try and consult others' reviews. The site also proposes specific programs based on a user's profile (French Ministry of Education SIALLE website).

Continuous Improvement Efforts

Investing in Data Systems

National-level data collection is a culturally sensitive endeavor in France, where the National Center for Information and Liberty (CNIL) closely regulates how lists containing any personal information of French citizens are compiled and used. Thus, the Ministry collects qualitative data and local-level quantitative data, but does not engage in formal, national-level data collections with mandatory participation. For example, the Ministry does study the usage of LMSs and has observed variations in use patterns per academy (e.g. teachers in some academies may log on mainly to access the message service, while teachers elsewhere may use LMSs mainly for administrative purposes, such as the e-grade book) (Terrades 2010b).

National ICT Program and Policy Evaluation Efforts

The Ministry uses data to inform program and policy goals and to inform reports such as the recent Fourgous report. Data also informs collaboration among France's educational administrative units (Ministry, academies, departments, towns, schools) and partnerships with

[26] SIALLE stands for Service d'Information et d'Analyse des Logiciels Libres Éducatifs (Open Educational Software Information and Analysis Service).

the private sector. For example, data from the evaluation of the pilot program for digital textbooks is shared to determine the feasibility of broader implementation. Programs are generally coupled with evaluation efforts. For instance, the Ministry studies the ICT Uses program to compile and update an Overview of ICT Use in Middle and High Schools (Educnet Panorama website), which in turn will be used to inform future programs and policies.

National ICT in Education Indicator Collections

The Ministry collects national-level ICT data through the voluntary annual ETIC survey, which measures the presence, condition and uses of ICTs in schools. France's participation in European and international studies—such as STEPS, a recent study of the impact of technology in European primary schools—provides the Ministry with additional sources of data.

In addition to the ETIC survey, France participates as mentioned below in European and International collections.

Plans to Participate in International Data Collections

France plans to participate in future editions of the Progress in International Reading Literacy Study (PIRLS), the Program for International Student Assessment (PISA) and the Trends in International Mathematics and Science (TIMSS). France also participated in the first round (1994) of the International Adult Literacy Survey (IALS) and would participate in that data collection again (Terrades and Capul 2010).

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Country Statistics at a Glance

National Indicators

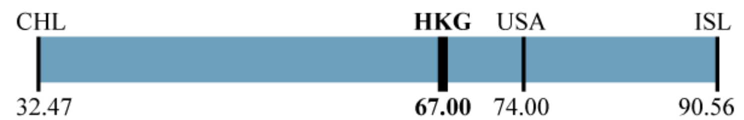
Total country population (2007)

Labor productivity index (% US, 2009)

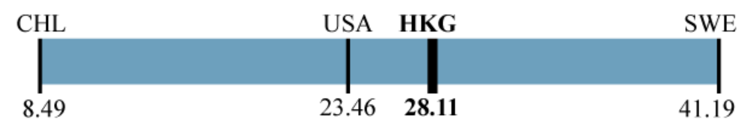
Network readiness index (% of US, 2009-10)

Mobile telephone subscriptions (per 100 population, 2008)

Internet users (per 100 population, 2008)

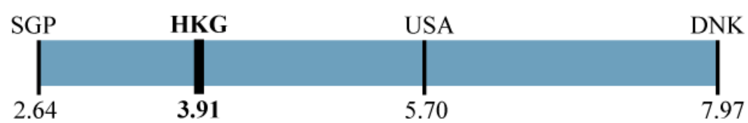


Broadband subscribers (per 100 population, 2008)



Education Indicators

Public expenditure on education (% of GDP, 2006)



Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)

Data not available.

Percentage of schools with a broadband connection (2006)

Data not available.

ICT in Education Highlights

- The Ministry has provided resources and supports for an ICT-enabled learning environment that extends learning opportunities beyond the traditional classroom.
- The Ministry looks to private corporations to develop sustainable ICT resources for the classroom, similar to its successful experience with the textbook publishing industry.
- The Ministry uses an online system for the administration of teachers' continuous professional development, although courses continue to be delivered primarily face-to-face.

Structure and Nature of the Education System

Authorities Primarily Responsible

The Education Bureau of the Government of Hong Kong Special Administrative Region is responsible for the implementation of all educational planning, policy-making and funding in Hong Kong, including curriculum development, the monitoring of teaching standards and funds administration (Law 2009; She 2010a). Members of the Curriculum Development Council, a free-standing advisory committee comprised of representatives from institutions of higher education, businesses and school principals, are appointed for two-year terms by the Chief Executive of the Government of Hong Kong Special Administrative Region (Hong Kong Government 2003; She 2010b). The Council develops all curricula, provides recommendations on textbooks and advises the government on all matters related to curriculum development (CDC website). Nevertheless, decisions regarding textbook adoption and instructional techniques are made at the school level such that schools are even encouraged to adapt the central curriculum in order to better respond to students' needs (Law 2009).

Similarly, the government is responsible for providing ICT infrastructure in schools. In its first ICT national plan released in 1998, the government identified the provision of an ICT-enabled learning environment as a priority (Education and Manpower Bureau 1998). However, schools are still the final decision-makers on how budgets are spent based on guidelines and recommendations for suppliers provided by the Ministry.

The government provides a subsidy only to students in need; thus, the majority of parents bear responsibility for providing textbooks and other resources for students.

Political and Economic Context

In the next few years, the government will revise the school system. Currently, Hong Kong's education system is similar to the United Kingdom (UK) system, with six years of primary school, seven years of secondary school and three years of tertiary school. They will soon require students to complete six years of secondary education and four years tertiary education, while keeping the same six-year requirement for primary schooling (She 2010b).

The Education Bureau is report to take a "down-to-earth, pragmatic approach" to policy-making and program development that is largely driven by recommendations from its professional officers, in consultation with academics and schools, and in response to developments in other parts of the world (She 2010b). A combination of internal reflection and inferences from practices in other countries serve as the basis for shifting priorities and developing recommendations related to ICT in education.

National Plan for ICT in Education

The current national ICT plan is the third strategy of its kind. The government published its first strategy in November 1998 when ICT was virtually nonexistent in schools. Prior to 1998, computers were used for teaching computer studies, a specific subject in school. The first national ICT plan involved making large financial investments in ICT infrastructure (Education and Manpower Bureau 1998) in order to provide greater access to computers with Internet connections and in-service training for teachers on basic, technical use. The second plan, published in July 2004, provided less funding, as the focus became helping schools deal with hardware upkeep and enhancements to the IT environment (Education and Manpower Bureau 2004).

The current strategy, *Right Technology at the Right Time for the Right Task* (Education Bureau 2007), shifts away from infrastructure towards ICT integration in teaching and learning. Taking a more systemic approach, the current plan defines goals for the major stakeholders—school leaders, teachers, students, IT in education support staff and parents—and provides targeted supports at these different levels. Built on the premise that ICT is one of many mediators for teaching and learning, the plan aims to empower students and teachers to decide whether ICT is appropriate and how it can best be used for particular teaching and learning activities, with an eye towards ICT for daily learning. In addition, ICT is seen as a means for facilitating and supporting the desired paradigm shift from teacher-centered to student-centered learning. The six proposed Key Actions of this strategy (Education Bureau 2007) are to:

Action 1. Provide a depository of curriculum-based teaching modules with appropriate digital resources.

Action 2. Continue to sharpen teachers' IT pedagogical skills.

Action 3. Assist schools to draw up and implement school-based IT in education development plans.

Action 4. Enable schools to maintain effective IT facilities.

Action 5. Strengthen technical support to schools and teachers.

Action 6. Raise parents' information literacy and assist them in guiding children to use IT at home.

The Education Bureau does not expect to publish a new national plan soon. (She 2010b). It takes a needs-based approach to updating national ICT plans, assembling a steering committee chaired by the Under Secretary with broad representation from the public and private sectors, including government officials, IT experts, school leaders, parents and representatives from teacher associations. The committee reviews the implementation of ICT in schools, analyzes the results and then drafts recommendations, publishing a consulting document for public comment. The Secretary for Education at the Education Bureau then approves the plan before it can go to the legislature for funding.

Details of National Plan

Title: Right Technology at the Right Time for the Right Task (third strategy)

Year of Publication: 2008

URL: http://edbsdited.fwg.hk/3ITED/

Private Sector Involvement

Overall, the Education Bureau seeks to develop strategic partnerships with private organizations as a key strategy for sustainability. The Education Bureau makes the initial investments then engages with key stakeholders at the development stage in order that ICT programs and resources become commercially viable for long-term private investments in the education market (She 2010b). This strategy makes the market more attractive to both the supply and demand sides (businesses and teachers/parents/students, respectively), which in turn leads to sustainable programs and services that are valued, even when purchased for a fee. This sustainability model has proven effective for Hong Kong, particularly in the current multimillion-dollar textbook industry. The government is taking a similar approach towards the adoption and development of e-learning resources, by promoting ICT use in schools so that businesses can appreciate the market potential and continue to make related investments.

At present, the Education Bureau has established several memoranda of understanding with Information-technology (IT) companies to help kick-start their ICT strategies via small projects and training opportunities for teachers. For example, Microsoft Partners in Learning provides teacher professional development with a focus on Web-2.0 technologies, while the Fung Kai Innovative School is engaged in the Microsoft Innovative Schools Program as a test bed for the transition to digital curricula and assessments collaboratively developed by teachers in the school (Shear et al. 2010). The Education Bureau also has a memorandum of understanding with Oracle to provide access to resources on database development for students in senior secondary school (ages 15–18).

On a smaller scale, companies provide licenses for operating systems as part of the Education Bureau's program to subsidize students in need. Other smaller projects and teacher training initiatives exist as well, but not aligned with any particular strategy. Financial contributions are also accepted, although no systematic agreements, e.g., tax incentives or rebates, are in place (She 2010a).

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

The Education Bureau achieved its targets related to ICT infrastructure and support after the successful implementation of the first and second national ICT plans, released in 1998 and 2004, respectively. At present, improvements take place on an as-needed basis as determined by school leaders, in alignment with Key Actions 4 and 5 of the third strategy: "to enable schools to maintain effective IT facilities and to strengthen technical support to schools and teachers" (Education Bureau 2007). On average, there is one computer for every six students in primary schools and slightly more than one computer for every four students in secondary schools. Schools benefit from broadband connection speeds greater than 100 Mbps (She 2010b).

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

The Education Bureau does not assess students' ICT skills nor prescribe standards for students. However, it has, in consultation with academic leaders, developed a framework to support teachers' development of teaching and learning activities that are consistent with the Education Bureau's goals for creating an "information-literate person," able to function in a knowledge-based society and use digital tools to compete in a globalized environment, as described in the *Information Literacy Framework for Hong Kong: Building the Capacity of Learning to Learn in the Information Age* (Education and Manpower Bureau 2005). Furthermore, it includes standards and indicators provided as guidelines for the development of expected learning outcomes along four key dimensions—cognitive, metacognitive, affective, and sociocultural, which addresses ethical, legal and political issues, such as respect for copyright, intellectual property and privacy.

Priorities and Programs in This Area

The third national ICT plan specifies the development of e-Learning solutions as its top priority. This includes enhancing the capabilities of school leaders and the related goals of creating a collection of digital resources (e-Depository), as well as and increasing private sector involvement in the production of e-Learning materials. The objective is to create environments conducive to learning, in which ICT is used for learning rather than just for teaching. Moreover, the Education Bureau is looking to transition to electronic materials as a complement to rather than a replacement for printed textbooks, given that electronic formats are cheaper in the long-term, updated more easily and provide more opportunity for inquiry.

The Education Bureau is pushing for a paradigm shift in education, away from direct instruction towards student-centered and self-directed learning, in which ICTs support students in constructing knowledge through inquiry and collaboration. The e-Learning Solutions program goes beyond the integration of ICT in teaching and learning by promoting whole-person development and an orientation towards lifelong learning that is no longer bounded within the physical space of the school (She 2010b). "The letter 'e' in e-Learning is more than electronic. It also means efficient, effective and enjoyable," (Education Bureau 2009). It is also an attempt to create a concerted effort among schools to develop their own ICT development plans as a key component of their whole-school approach (She 2010b).

To achieve these goals, the program supports schools in their development of school-wide ICT solutions with attention to hardware, pedagogy and, to ensure scalability, buy-in from teachers and parents (She 2010b). During the pilot, e-Learning in Schools—primary, secondary and special schools[27]—partnered with institutions of higher education, the ICT sector, educational publishers and content providers in order to develop a whole-school implementation package and relevant measures. The Education Bureau will invest between USD 17 and 18 million in total funding to scale e-Learning solutions to more schools, of which approximately USD 6.5 million will be disbursed to schools to enhance their e-Learning resources. Participating schools are expected to roll out the program beginning in academic year 2011–12.

Hong Kong Education City (HKedCity) is the largest and most popular one-stop educational Web portal in the country, providing information, learning resources and interactive tools. Launched in 2000 as part of the country's first national ICT plan, the portal was the Education Bureau's novel solution to providing teachers with resources, support and a platform for communicating with their peers via online forums on strategies to improve teaching and learning. Student and teacher participation is voluntary; nevertheless, it has since grown to over 2 million members—mostly teachers and students, with some representation from parents and the general public. Membership is required primarily to safeguard copyright, although most resources are accessible to nonmembers as well. It is run by HK Education City Ltd., a wholly owned subsidiary of the government managed by an Executive Director and a Board of Directors that includes representation from the government and private institutions. The company receives a government allowance of up to USD 3.4 million per year for its operations. In addition, the Education Bureau will provide an additional USD 1.3 million[28] to build a mechanism that will allow members to also purchase e-Learning resources for a nominal fee, akin to transactions in iTunes, making it more attractive not only to members but also to businesses interested in providing content.

Moreover, the Education Bureau developed and hosts a collection of curriculum-based learning and teaching resources (e-Depository) through the HKedCity portal. This collection was developed in September 2008, in response to teachers' citing time as the primary barrier to their use of ICT in the classroom. This depository is a collection of free resources for teachers, online as well as printed, provided by local and overseas government organizations, higher education institutions, schools and nonprofit organizations. The content is organized in a curriculum tree based on the national curriculum so that the links between ICT resources and curriculum topics are transparent to teachers. The site includes instructions and teaching suggestions with videos to explain concepts for whole-class or individualized learning; interactive, simulated scenarios for learning and extension activities; and online assessment tools and practice exercises. Content for the four major learning areas in the primary curriculum—Chinese language, English language,

[27] Hong Kong has special schools catering to students with mild, mild and moderate, moderate or severe intellectual disabilities as well as physical disabilities.
[28] This funding is part of the USD 18 million allocated for e-Learning Solutions.

mathematics and general studies (e.g., science, social science and health education)—is being added during the first phase of the program (2008/09–2010/11). The next phase (2010/11–2012/13) will accelerate and expand coverage to most key learning areas through ages 12–15 (secondary 1 to 3). Funding for the program, under the third strategy, amounts to a total of USD 5.6 million over five years, most of which is allocated to the hiring of experts who will add to the depository and incorporate suggestions on pedagogy.

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

Between the 1998 plan and 2007 plan, ICT in education standards for teachers went from focusing on technical competence to skills for integrating ICT into teaching and learning. The first national ICT plan (1998) invested heavily in teacher training and assessed teachers according to four levels of technical competence. The program achieved its target in 2001–02 of having 100 percent of teachers achieve the basic level established at that time, 75 percent reached the intermediate level, 25 percent the upper intermediate level and 6 percent reached the advanced level (She 2010b). Basic ICT competency included understanding rudimentary operation of a personal computer, including word processing, web browsing and search engine use, email, presentation software use and a general understanding of the framework of using ICT in education. Training at the intermediate level required teachers to submit a portfolio of their work to their principal who would then determine their level of competency. A commissioned university provided courses and a corresponding certificate of completion for teachers at the advanced-level. Subsequently, teacher pre-service education incorporated ICT training as a requirement for graduation.

Priorities and Programs in This Area

In 2007, the Education Bureau produced a framework for ICT for Teaching and Learning that provides recommendations on teacher ICT professional development. Among the suggestions are the formation of school clusters to promote reflection and collaboration, and active learning while also encouraging higher education institutions and professional bodies to take an active role in all stages of implementation (Joint Consultation Service Team 2007). Teacher professional development remains high on the list of priorities of the third national ICT plan, given the Education Bureau's appreciation for the need to change teachers' mindsets in order to facilitate the effective use and integration of ICT in teaching and learning.

As a general requirement, teachers complete 150 hours of continuous professional development in order to maintain their teaching status, although they independently elect into specific courses, most of which are provided by the Education Bureau. A budget of USD 770,000 is allocated each year to providing courses related to ICT use and integration, the majority of which are provided by universities with institutional expertise on the pedagogical integration of ICT. The Education Bureau recognizes training from other providers, but credits must be certified by the head of school.

The Education Bureau provides an online system for the administration of teachers' continuous professional development. It contains an online calendar with postings for upcoming professional development courses and tracks enrollments and teachers' hours in order to ensure compliance. Even courses from unaccredited providers can be entered into this system by the head of school certifying the credit. Teachers determine how to allocate their hours for continuous professional development, of which ICT is one of the strands, and report these hours to the Education Bureau via their individual e-service account. However, there is no specific initiative to promote the use of ICT for the delivery of teacher professional development. Face-to-face training remains the standard format, although the Education Bureau plans to transition all content, ICT and otherwise, on an e-Learning platform that will facilitate ongoing exchange of ideas and materials beyond the training session (She 2010b). The e-Depository of the Education Bureau's main education portal also functions as a channel for building informal communities of practice as members voluntarily engage in discussions both online and offline to comment on and rate materials or discuss relevant issues. There are also voluntary professional associations for teachers, such as the Hong Kong Association for Computer Education, that bring together teachers promoting the integration of ICT in education. Most interactions in these associations occur offline and include conferences at international sites.

Continuous Improvement Efforts

Investing in Data Systems

Hong Kong has national assessment and evaluation programs in place for monitoring student learning and overall school performance, carried out by the HK Examination and Assessment Authority and the Education Bureau's Quality Assurance Division, respectively. The Hong Kong Examination and Assessment authority is a self-financed, quasigovernmental entity set up in 1977. As an independent statutory body, i.e., not part of the Education Bureau, it is responsible for administering the systemwide assessments for (1) primary and secondary students (taken at years three, six and nine), to track performance in general, i.e., not specific to ICT skills, (2) university admissions and (3) adults seeking professional qualifications. The Education Bureau, under its Quality Assurance Division, manages a system for evaluating school performance whereby schools conduct annual self-evaluations and are subject to an external review every one to two years (She 2010a, 2010b; Hong Kong Evaluation and Assessment Authority website). Schools are required to publish the results of these evaluations on their website in order to promote greater accountability to the general public rather than just to the government.

Nevertheless, the Education Bureau has had mitigated success in developing an assessment system for students' basic competencies in Chinese language, English language and Mathematics. A system was developed that provided diagnostic assessments against basic competencies expected of students with links to remedial and reinforcement materials but, the Bureau reported, the depth of expertise required and the challenges of data validation have made this a difficult endeavor (She 2010b).

National ICT Program and Policy Evaluation Efforts

The Education Bureau supplements program evaluation activities to address specific issues of public concern. For example, the Chief Executive of the Government of Hong Kong Special Administrative Region convened a working group to explore the development of electronic learning resources as a means for enhancing students' ability for self-learning and interactive learning while also possibly reducing the growing burden of costly printed textbooks (Education Bureau 2009).

National ICT in Education Indicator Collections

Currently, there are no other national data collection efforts. Because the Education Bureau prioritizes attention to the use of ICT for learning, assessments of ICT competency are primarily embedded in subject matter tests complemented by localized, i.e., school-based, and university research efforts that have adopted instruments from the Second Information Technology in Education Study 2006 (She 2010b).

Plans to Participate in International Data Collections

Hong Kong plans to participate in the Trends in International Mathematics and Science Study (TIMSS), the Program for International Student Assessment (PISA), the Progress in International Reading Literacy Study (PIRLS) and the International Civic and Citizenship Education Study (ICCS).[29]

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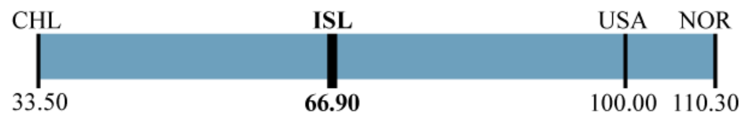
Country Statistics at a Glance

National Indicators

Total country population (2007)

Labor productivity index (% US, 2009)

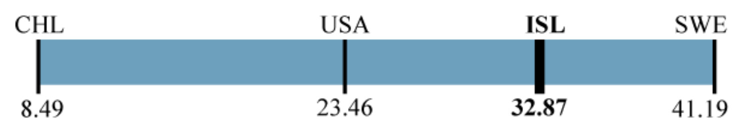


Network readiness index (% of US, 2009-10)

Mobile telephone subscriptions (per 100 population, 2008)

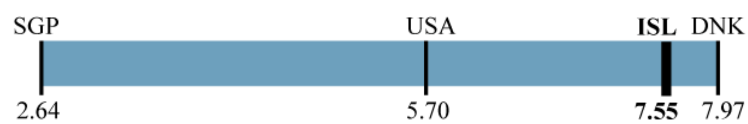
Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

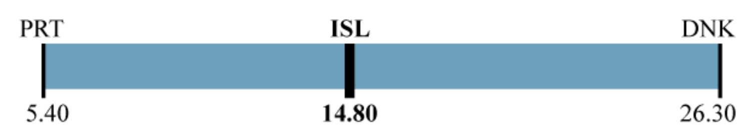
Public expenditure on education (% of GDP, 2006)



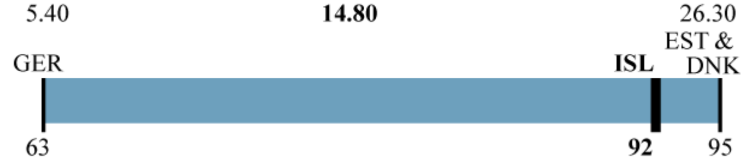
Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)



Percentage of schools with a broadband connection (2006)



ICT in Education Highlights

- Distance learning is popular in Iceland for teacher training, for students in schools with limited teacher capacity, and generally to increase flexibility in learning.
- Ninety-eight percent of schools use third-party learning management systems (LMSs) or school administration systems
- School Web (digital materials) and The Language Studio (virtual learning) are two examples of privately run initiatives that are used widely in schools.
- Iceland has plans to computerize its national examination system.

Structure and Nature of the Education System

Authorities Primarily Responsible

The Ministry of Education, Science and Culture (Ministry) is the main governing body of education at the national level. It is responsible for defining the national curriculum and providing support to schools via the local authorities. In the past, it has released key policies on ICT in education. The MESC makes small implementation grants to teachers and schools on an individual basis. The MESC ICT policy is coordinated with national ICT policy, which is managed by the Prime Minister's office. The Prime Minister's office also provides supplementary funding for special programs (Macdonald 2008; Gundmundsson 2010b).

During the mid-1990s, Iceland's education system underwent a series of important changes, most notable among them was the transfer of authority from the national government to local municipalities. As a result, local authorities now have more control over day-to-day administration of preschools and compulsory schools and are responsible for coordinating schools, paying staff and, to some degree, for monitoring school quality and progress (Gudmundsson 2010a).

Iceland's school system serves approximately 45,000 students in 170 compulsory schools (through age 16), along with an additional 25,000 students in upper-secondary education. Significant control over teaching and learning is concentrated at the school level. Each school publishes a school working guide containing an administrative plan for the school. Individual teachers can structure their assessments as they see fit. At the secondary level (ages 16–18), many students enroll in unit-credit schools, which allow them to study topics of interest at their own pace. The national curriculum guide states that "an effort should be made to help all students find a suitable program of study in which they can control their progression of learning as much as possible" (Ministry of Education, Science and Culture 2004).

Political and Economic Context

Throughout the late 1990s and early 2000s, Icelanders were enthusiastic regarding ICT in education. Expectations have faded, however, as ICT initiatives had mixed results, and ended up costing more than anticipated (Gudmundsson 2010a). Moreover, in 2008 Iceland's economy collapsed. The country continues to suffer the repercussions of severe debt and an economic recession, and funding for most initiatives in ICT in education has been slowed considerably.

ICT in Education

National Plan for ICT in Education

No new education-specific ICT policy document replaced the Ministry's *Risk with Responsibility* plan, which was in effect from 2005 to 2008. That plan outlined goals for access and infrastructure, content, innovative practices, ethics and safety (Ministry of Education, Science and Culture, 2005). In 2008, however, the Prime Minister's Office released its whole-government policy on the information society. This plan, Iceland, the e-Nation, outlines a strategy for becoming "the leading nation in electronic services and the utilization of information technology." There is a section devoted to education, which outlines the following goals:

Use of ICT in classrooms.

Implementation of personalized online examinations.

Creation of digital learning resources.

Use of interactive materials around a given theme (e.g., soil conservation).

Application of distance learning for hunting and firearms exams.
(Prime Minister's Office 2008)

Details of Cross-sector National Plan

Title: Iceland, the e-Nation
Year of Publication: 2008
URL: http://eng.forsaetisraduneyti.is/information-society/English/nr/2974

Private Sector Involvement

Iceland's small market limits the formation of private partnerships, as few companies have been willing to involve themselves in Iceland's educational system (Gudmundsson 2010a). That said, one of the major success stories in Iceland's ICT experience is School Web, a commercially developed, subscription-based online educational Web portal to which 98 percent of schools subscribe (Macdonald 2008). Private companies are also involved in the production of interactive learning resources through the National Center for Educational Materials. In addition, private companies provide classroom administration systems. A separate broadband initiative also relies on contracts with private companies to provide Internet access in rural areas (Gudmundsson 2010b).

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

Iceland enjoys robust Internet infrastructure, even in rural areas. That said, the Ministry of Communication is supporting connectivity initiatives in areas where it is not commercially feasible for telecommunications companies to establish service (Gudmundsson 2010a).

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

The national curriculum contains general guidelines for ICT learning outcomes (i.e., computer skills) and teaching recommendations (Gudmundsson 2010b). In addition, the general curriculum guidelines specify that "[e]mphasis is placed on making information technology (IT) a natural aid in all school subjects. The enormous advances in this area have changed many aspects of work and society. Each subject must take advantage of the opportunities which information technology offers to achieve its own objectives" (Ministry of Science, Education and Culture 2004).

Priorities and Programs in This Area

Distance learning, especially in remote areas, is an important feature of the learning environment in Iceland. Students in upper-secondary schools, for example, can take a number of distance learning courses (Gudmundsson 2010a). Many schools, especially in areas where there is a shortage of foreign language instruction, pay fees for their students to enroll in The Language Studio, which provides virtual learning in Norwegian, Swedish, Polish, Danish and English. In this way, The Language Studio replaces the need to offer foreign language instruction onsite. The studio is funded by development grants from different sources, including the Nordic Council (Macdonald 2008).

More generally, the Educational Gateway serves as Iceland's national education Web portal, allowing teachers to search for educational materials and curriculum guidelines. It hosts a directory of schools and gives portal access to schools using learning management systems (LMSs). Although when released in 2003 it was considered an innovative application of technology to education, its current lack of Web 2.0 features have made it somewhat obsolete (though it is still used widely). However, there are plans to expand its use: according to the website the future gateway will serve "to disseminate curricula, support development work, provide information on the school system and build up communications within Iceland as well as abroad" (Macdonald 2008).

LMSs and online digital repositories accessible through the portal are used by 98 percent of schools in Iceland. LMSs in use in compulsory schools aid teachers and students in managing their work. Teachers already use LMSs to plan lessons, record attendance, communicate with parents and, increasingly, to administer assessments. The company developing the system has recently integrated functionality for viewing curriculum goals, creating student contracts and implementing surveys to monitor student well-being. Nearly all schools are using the system, but currently there is little data on which schools use the available features (Gudmundsson 2010a).

The National Center for Educational Materials (NCEM), Iceland's official curriculum provider, publishes online content available through the gateway. Although NCEM is wholly funded by the government, it determines what to produce semi-independently (materials must align with the national curriculum). As of 2008, approximately 15 percent of the materials produced by NCEM were online materials, including websites, videos and PDFs of activities. Access to online materials is open to everyone. In practice, the NCEM's online materials are mostly used by teachers in a print format (pdf) and consist of classroom activities that do not require the use of ICT. One reason given for this trend is that few classrooms in Iceland have more than one computer. Occasionally, however, students use the materials in computer labs during whole-class activities (Macdonald 2008).

School Web is another source for educational materials open to teachers and students at subscribing schools. Available materials include online texts, worksheets and presentations. Originally funded by development grants from the government, it now operates independently as a business and in parallel to other resources such as the Educational Gateway. Compulsory schools are 98 percent of subscribers, and the website is one of the most visited in Iceland. With a staff of only 10 people, School Web relies heavily on the active participation of teachers to both submit and revise materials (Macdonald 2008).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

There are currently no ICT in education standards for teachers, but teachers are required to participate in professional development programs throughout their tenure. These programs are offered by the country's teaching colleges, and courses in ICT skills and integration have been very popular (Gudmundsson 2010b).

Priorities and Programs in This Area

Approximately 50 percent of teacher professional development courses in Iceland are offered via distance learning. Several universities, such as the Education Department at the University of Iceland, use a mixture of face-to-face and distance learning in their four-year teacher qualification programs (Gudmundsson 2010a).

Teachers can also develop their skills by utilizing the resources mentioned above—the Educational Gateway Web portal and the subscription-based service, School Web—as well as by applying for special grants through MESC to develop their own e-learning materials (Gudmundsson 2010b). At the time of collection, however, there was no specific information about teacher-focused capacity building on the portal.

Continuous Improvement Efforts

Investing in Data Systems

In Iceland, there are currently national exams for students administered during the 4th, 7th, and 10th years. There are plans to develop an online examination system, in which students can take their exams online. This aligns well with Iceland's highly individualized instruction (Gudmundsson 2010b).

National ICT Program and Policy Evaluation Efforts

Other than grade-level testing, Iceland does not collect data on teaching and learning at a national level. Schools and local authorities monitor policies and program success (Gudmundsson 2010a).

National ICT in Education Indicator Collections

Data was not available at the time of collection.

Plans to Participate in International Data Collections

Iceland participates in the Program for International Student Assessment (PISA), the Teaching and Learning International Survey (TALIS), and the Adult Education Survey (Gudmundsson 2010b).

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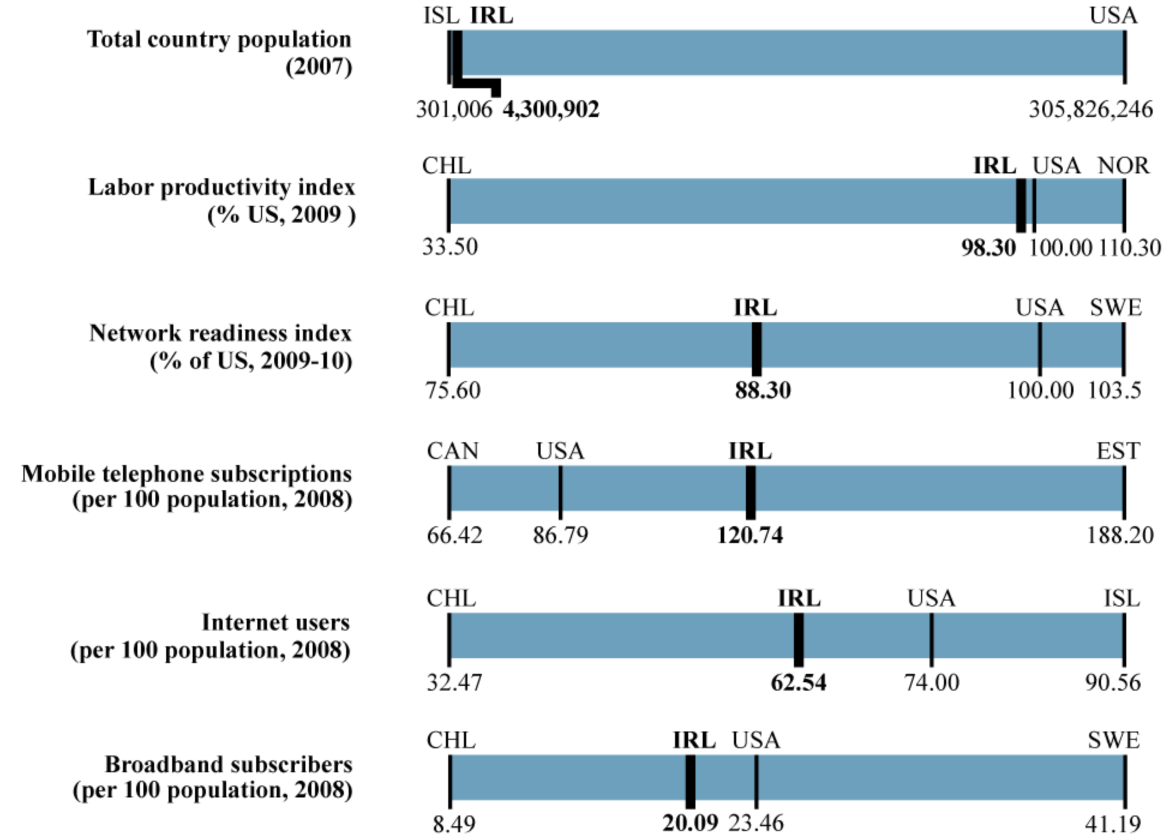
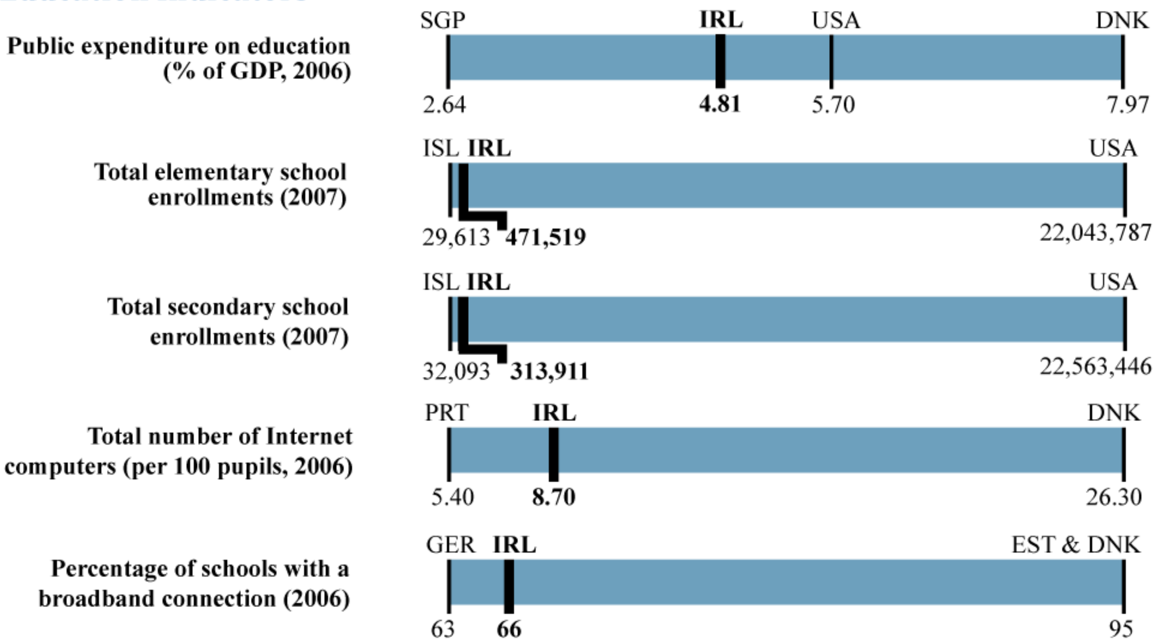
Country Statistics at a Glance

National Indicators



Education Indicators



Ireland ICT in Education Profile

ICT in Education Highlights

Irish schools independently invested in purchasing ICT in advance of policies, programs and funding from the government, which has been adversely affected by the 2008 economic recession.

The Department collaborates closely with the private sector in its development of policy. About 70 percent of the members of the leading advisory group for ICT in schools represent the private sector; the advisory group is chaired by a representative from Microsoft.

Structure and Nature of the Education System

Education in Ireland is free and compulsory for children ages 6–16, with some children beginning as early as age 4 and completing their schooling at age 18. The government funds salaries, capital and operational costs; but many schools, particularly in postprimary (ages 13–16), are affiliated with the Roman Catholic Church or the Church of Ireland (Conway and Brennan-Freeman 2009; White 2010). Each school is run by a headmaster who reports to a board of management and holds a dual role as administrator and classroom teacher. About 2,000 schools, or two-thirds of all schools serving students ages 6–13, employ only six teachers, with class sizes averaging 25–35 students. Postprimary schools, serving students 13 years old and older, include secondary, vocational, community and comprehensive schools, each of which have a modified management structure.

Authorities Primarily Responsible

The Department of Education and Science is responsible for education policy for all levels of education, including the tertiary sector. The National Council for Curriculum and Assessment (NCCA) is the statutory body that reports directly to the Department with the charge of creating a framework and developing state curriculum and assessments (White 2010). In 1998, the Department established the National Center for Technology Education (NCTE) as the government agency responsible for matters related to ICT in education. It provides information, support and advice to schools, various education bodies, parents and other education partners (Conway & Brennan-Freeman 2009; NCTE website,). It is in charge of primary (ages 6–13) and postprimary schools (ages 13–16) as well as pre-service and in-service teacher training. The NCTE is not a statutory body and reports directly to the Department, which is its sole source of funding.

In addition to receiving state funding and prior to following any national educational technology plans, Irish primary schools (ages 6–13) raised funds independently for ICT investments. For example, many schools invested in interactive whiteboards without any assistance from the state. Schools decided autonomously what to purchase, sometimes in accordance with their technology implementation plan and sometimes in response to pressure from parents and nearby schools with different ICT access. Since funds are not from the state, schools can spend the money and use the technology according to their needs (White 2010).

Political and Economic Context

Hard hit by the economic recession, Ireland decreased spending on ICT in education, resulting in the withdrawal of USD 353.8 million for the National Development Plan. Beginning in March 2009, the Irish government instituted a public sector moratorium that allowed hiring only under exceptional circumstances. This particularly impacted schools that are experiencing a surge in teacher retirement. Retiring incumbents who held dual posts—for example, assignments to both mathematics and visual arts—were only replaced in their primary subject area. The ICT coordinator position was greatly affected by this moratorium, and the momentum that followed 2008 Inspector's report results, emphasizing the importance of an ICT champion in schools, has been lost (White 2010). At the time of data collection, the future of government programs related to ICT in education remained uncertain (White 2010).

National Plan for ICT in Education

Ireland has no official or formal educational technology master plan; nevertheless, the country has paid considerable attention to promoting the use of ICT in teaching and learning since the late 1990s and has consistently revisited the subject to respond to changing needs (White 2010).

Schools IT 2000 launched the drive to integrate ICT into schools from 1997–2000, focusing on technology integration and teaching skills. During this time, Scoilnet was established as an online resource for students, teachers and parents in order to promote the development and dissemination of digital content (Conway and Brennan-Freeman 2009). The report "Blueprint for the Future of ICTs" was published in 2001 to continue the drive for ICT policy in schools through 2007 (NCTE 2001). A key initiative during this phase (2003–07) was the rollout of affordable broadband for all schools, led by the Department and NCTE in collaboration with the Department of Communications, Energy and Natural Resources and the private sector.

Nonetheless, education researchers, policy-makers and leaders of IT companies expressed the need to develop an updated ICT policy for schools and called for coherent planning and support in efforts to further integrate ICT into schools. In response, the government launched its National Development Plan in February 2007, allocating USD 354 million to enhance ICT access and use in schools for 2007–13. The Minister at the time convened a group to develop recommendations on how to spend the allotted funding, which led to the release of "Investing Effectively in Information and Communications Technology in Schools" (Minister's Strategy Group 2008). This report recommended seven objectives for investment. Although not intended for this purpose, the report directed future policy for ICT in schools and provided a foundation for further reports or recommendations (White 2010).

Due to the economic recession, funding for ICT in schools was not made available through the National Development Plan. Industry representatives thus sought to find creative solutions to support schools and the Department to obtain funding that could sustain ICT access in schools, working under the assumption that a flourishing economy necessitates smart schools. This resulted in publication of the *Smart Schools = Smart Economy* (SSSE) report in 2009, which reiterated many recommendations from the earlier report "Investing Effectively in ICT in Schools" and was later adopted as policy (Department of Education and Science and ICT Ireland 2009). The recommendations of the report focus on seven key areas:

1. Governance, specifically the establishment of an ICT in Schools Steering Group to oversee recommendations in the report.
2. Professional development for teachers, focusing particularly on initial teacher training and increasingly flexible opportunities.
3. The expansion and enhancement of digital content and the development of a national learning environment.
4. Broadband connectivity for all postprimary (ages 13–16) schools.
5. Core teaching principles that embed ICT in teaching and learning activities.
6. Technology principles that centralizes expenditures, standardizes equipment and facilitates interoperability and sustainability, among other things.
7. ICT planning that is embedded in school management.

The report cites the Forfás "Statement on Education and Training" (2009) as part of its rationale:

> Ireland's ability to maximise the benefits of ICT and to remain a leading provider of ICT goods and services is dependent on ICT literacy levels. Ireland's future competitive advantages are likely to be in internationally trading sectors (e.g., software, high-technology manufacturing, financial services, and other business services) that depend on advanced telecommunications infrastructure and an ICT-literate population. ICT has the potential to enliven learning in science, engineering and technology subjects, which underpin the skills on which future competitiveness will be based.

A total of USD 209 million over a three-year period was allocated to SSSE, beginning with an initial USD 30.6 million released to primary schools (ages 6–13) in 2009. The goal was to "accelerate the deployment and adoption of ICT within the classroom" by following recommendations previously stipulated in "Investing Effectively in ICT in Schools." It equips all classrooms with baseline technology access, including one teaching computer that is fixed in the classroom and attached to a digital projector, a wireless keyboard and mouse (Department of Education and Science and ICT Ireland 2009). Funding will be released for additional technology only after baseline requirements are met.

At present, there are no plans to update recommendations from SSSE. Instead, the Department convened an implementation committee of industry representatives and other education partners, who form subgroups to focus on specific areas such as digital content development (White 2010).

The majority of primary schools (ages 6–13) in Ireland have an ICT plan, but many postprimary (ages 13–16) schools do not. Moreover, plans typically focus on ICT infrastructure, rather than on policies and practices designed to enhance ICT integration into teaching and learning (Conway and Brennan-Freeman 2009).

Details of National Plan

Title: Smart Schools = Smart Economy[30]

Year of Publication: 2009

URL: http://www.ite.ie/download/smartschools.pdf

Private Sector Involvement

The Department fosters collaborative relationships with private industry, seeking their advice, opinions and support in ways it deems appropriate (White 2010). In particular, the Minister of Education and Science commissioned an ICT in Schools Advisory Group, chaired by the managing director of Microsoft Ireland and comprised of government members and key industry players, to draft recommendations on supporting the use of ICT in education. Members of the Advisory Group include representatives from the Department, NCTE, ICT Ireland (the umbrella group of leading players in the high tech or knowledge sector) and the Department of Communications, Energy and Natural Resources.

Historically, the Department and industry have established mutually beneficial arrangements that fostered the implementation of innovative projects, such as the Intel Teach for the Future, the Microsoft Innovative Schools Program and peer mentoring programs that assist the Department and NCTE in furthering their goals. For example, Intel initially hosted Scoilnet, Ireland's official education Web portal, but the Department has since begun to host it in-house. Private companies have provided job training to the unemployed through a state program that allows unemployed workers to obtain unpaid internships without jeopardizing their eligibility for government financial assistance. Additionally, matched contributions to schools for ICT equipment purchases have allowed the Department and NCTE to maintain a "healthy, fair if not generous relationship with industry in developing ICT projects" (White 2010).

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

The 2008 report "Investing Effectively in ICT Technology in Schools" found that 20 percent of computers in schools were more than six years old, and 89 percent of schools had no available technical support. As a result, increasing ICT infrastructure and support is a priority for the Department, as evidenced by its allocating USD 210 million to increase ICT infrastructure in schools. Money is provided directly to schools for specific purposes, with USD 31 million distributed as of June 2010 for the purchase of equipment in primary schools, which serves

[30] Although *Smart Schools = Smart Economy* was not officially released as a national ICT plan, both the government and private sectors adopted it as the primary driver for ICT policy.

students ages 6–13 (White 2010). Schools receive USD 2,370 in their first year and USD 48 per student in subsequent years. Funds are distributed as capital grants and are not to be used for teacher professional development.

The broadband initiative for schools, Schools Broadband Program, works in collaboration with the Department of Communication with the goal of providing broadband access to all schools serving students ages 6–12 and 13–16. Schools must provide their own technical support. Before the implementation of this initiative, 26–27 percent of schools still relied on satellites since many Irish schools are located in rural areas.

Access to high-quality technical support is a challenge for most schools in Ireland, as schools bear primary responsibility for supporting their own needs. The NCTE ran a program to train primary school (ages 6–13) principals on technical support for schools. Although some schools have ICT coordinators, this position is considered a supplemental assignment to teaching and is supported by little public funding, so coordinators often lack time to resolve all of their school's ICT issues (White 2010). Often, coordinators are teachers who champion ICT in the classroom but are interested in pedagogical aspects and ill-equipped to provide technical support. The NCTE currently runs a service desk to support the implementation of the broadband initiative for schools (NCTE Schools Broadband website). It has also considered prescreening potential vendors of technical support more generally, but funds are currently not available to initiate the process.

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

The National Council for Curriculum and Assessment (NCCA) released its developmental framework for ICT in schools in 2006–07. This framework defines skills for teachers and students that would contribute to the full integration of ICT across the curriculum for the purpose of problem-solving, inquiry, communication and collaboration, among other things. It also emphasizes the importance of ethical and responsible use of ICT, as well as practices related to safety, maintenance and ergonomics.

Priorities and Programs in This Area

Scoilnet is the official education portal of the Department for primary (ages 6–13) and postprimary (ages 13–16) teachers, students and parents (NCTE Scoilnet website). Launched in 1998, it is currently under the management of the NCTE and contains a database of over 11,800 digital resources that are vetted by a team of teachers contracted to review existing online resources. NCTE has undertaken the development of additional content, but staffing and funding constraints have kept this to a minimum. In 2010, Scoilnet adopted a digital content framework for reference materials and recently made *Encylopedia Brittannica* and *World Book* accessible to schools free of charge.

The Department recently introduced project maths, a syllabus change in school mathematics that will be the standard in 2014 (White 2010). NCTE is looking at how ICT and teacher professional development could support the promotion of project maths, with teacher-created resources and information on how to use ICT in teaching particular strands of mathematics already available online.

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

There are no ICT in education standards for teachers (White 2010). Rather, there is an implicit expectation that teachers' instruction aligns with the ICT competence framework created by the National Council for Curriculum and Assessment (NCCA) (Conway and Brennan-Freeman 2009; White 2010).

Priorities and Programs in This Area

The NCTE fosters a robust teacher professional development environment by offering courses that are fully funded by the Department, delivered by the NCTE and developed with teacher input. However, it remains largely voluntary, and courses are taken outside of school hours and focus on skills that will enable teachers to meet curriculum standards. In recent years, there has been a movement toward online teacher professional development, and the NCTE hopes to increase capacity in this area. Nevertheless, in-person workshops remain important to teachers, and the NCTE does not have the staff to manage virtual learning environments.

From 1998–2008, a professional development program focused on ICT in education was implemented for primary (ages 6–13) teachers, but insufficient access to the Internet and equipment, combined with a lack of unifying objectives across schools, created challenges for implementation. However, the flexibility of the primary curriculum often allows for more innovation in the use of ICT.

At the postprimary (ages 13–16) level, ICT has been discussed alongside new methodologies and curriculum objectives during in-service teacher professional development for the new developmental framework released by the NCCA in 2006. There has been no in-service teacher professional development exclusively focused on ICT at the postprimary level (ages 13–16).

Continuous Improvement Efforts

Investing in Data Systems

Ireland conducts no regular research and evaluation activities aside from various reports conducted over the years. The most strategic of these reports, the Inspectorate Evaluation Studies, released in 2008, examines teaching and learning across the board.

Evaluation of instruction in Ireland primarily occurs at the school level. The Department inspectors conduct whole-school evaluations in which they look at the quality of teaching and learning. In the past, whole school evaluations occurred every five to seven years, but have been reduced due to staffing limitations within the Department. Individual teachers are evaluated through inspections in their first year of teaching and subsequently through random, brief inspections. Literacy and numeracy assessments for students are kept within schools rather than tracked at the national level. Reports are publicly available on the Department website.

National ICT Program and Policy Evaluation Efforts

The NCTE has limited funding for evaluation of ICT program and policy efforts. Because schools have autonomy over their spending and equipment purchases are not centrally tracked, the NCTE plans to survey schools to obtain basic metrics, such as a count of the number of machines, in order to inform the next allocation of funding.

National ICT in Education Indicator Collections

The NCTE conducted its fourth and most recent Census of ICT Infrastructure in Schools in May/June 2005 with participation from over 80 percent of schools in all levels (Shiel and O'Flaherty 2006). Data was collected on student-computer ratios; the types and age of ICT available; ICT expenditures, including grant money received, technical support investments and providers; Internet access and other networks; planning for ICT; professional development for teachers; and use of digital content. The NCTE sampled respondents by school and distributed hard copies of the questionnaire.

Plans to Participate in International Data Collections

The government plans to participate in the Organisation for Economic Co-operation and Development (OECD), the Program for International Student Assessment (PISA), the Trends in International Mathematics and Science Study (TIMSS), and European School Network data-collection activities.

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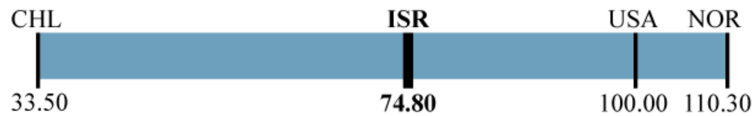
Israel ICT in Education Profile

Country Statistics at a Glance

National Indicators

Total country population (2007)

Labor productivity index (% US, 2009)

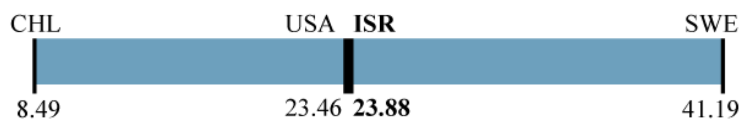


Network readiness index (% of US, 2009-10)

Mobile telephone subscriptions (per 100 population, 2008)

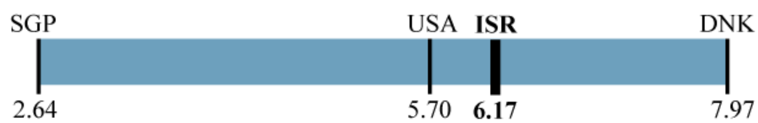
Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

Public expenditure on education (% of GDP, 2006)



Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)

Data not available.

Percentage of schools with a broadband connection (2006)

Data not available.

Israel ICT in Education Profile

ICT in Education Highlights

Israel enjoys broad support from the private sector for its ICT in education initiatives. Typically, 50 percent of the cost of infrastructure programs is funded by third-party organizations.

The Ministry of Education, Science and Technology connects professional development programs with its ICT programs to help teachers integrate the technology more effectively into the classroom. The Ministry identifies teachers who need support for ICT and assigns them expert mentors to help enhance their ICT integration.

A laptop program for teachers provides laptops and 120 hours of ICT training to teachers at no cost. The program hopes to double in size from 5,000 teachers to 10,000 teachers by the end of 2010.

Many of Israel's ICT programs are geared towards the periphery, where access to resources is more limited. For example, struggling students in certain areas are eligible for one-on-one online tutoring sponsored by the Ministry.

In Israel, most ICT in education programs begin as pilot initiatives, operating on a smaller scale.

Structure and Nature of the Education System

Authorities primarily responsible

Israel's education system serves approximately 1.8 million students in grades K–12, 15 percent of whom are recent immigrants and 20 percent of whom are Arab, Bedouin or Droze minorities. The public education system encompasses nearly all schools in Israel. Education is free and compulsory for students through age 16, and free but not compulsory through age 18. The education system is centralized under the control of the Ministry of Education, with responsibility for school oversight divided among six geographical districts. Each district manages budgets, staffing and pedagogy for its schools, although in recent years there has been a push to give schools more control over curriculum, spending and scheduling (Nachimas et al. 2009).

Due to this centralization, educational programs and policies are primarily initiated by directives and support coming from the central Ministry. The Ministry often develops programs for specific regions. In some cases, however, local innovations designed by teachers also trickle up through seminars and conferences (Ministry of Education, Science and Technology Administration 2008).

National Plan for ICT in Education

Israel's national plan for ICT in education, last updated in 2005, and is refreshed every four to five years. At the time of writing, a new plan was set for release in 2010 (Dayan 2010a, 2010b). The current plan positions ICT as a key piece to Israel's educational and economic prosperity and focuses on using ICT to redefine teaching and learning for the 21st century. Some of the high-level goals outlined in the plan include:

For students: Developing ICT skills, reducing the digital divide, stimulating inquiry and creative expression and promoting ethical ICT use.

For teachers: Promoting ICT integration into the classroom, providing pervasive online learning communities and encouraging creative expression.

For schools: Promoting a culture of learning, implementing school portals, using management systems and sharing information.

For regional/national authorities: Providing services and support, fostering partnerships and conducting evaluations.

To reach these goals, the Ministry proposes a set of programs along four axes: infrastructure, maintenance, teacher training and development of digital learning resources. Several of Israel's projects are nationwide, while others are region-specific initiatives or smaller-scale pilot projects. Israel's plan also includes standards for students and teachers, which are described in more detail below. The independent non-profit Educational Technology Center and the Ariel University Center, a large public college in Israel, both provided input for the plan (Dayan 2010b).

Details of National Plan

Title: Computer Service Plan (Google translation)
Year of Publication: 2005
URL: http://cms.education.gov.il/EducationCMS/Units/tikshuv_ict

Private Sector Involvement

Israel's ICT in education initiatives rely heavily on partnerships with nongovernmental organizations (NGOs) and other private institutions. As a general rule, the Ministry provides roughly 50 percent of the cost of its hardware-related initiatives, with philanthropic organizations based in Israel providing the rest. For example, the teacher laptop program is funded jointly by the Athena Fund, a collection of high-profile businessmen in Israel who believe in the promise of ICT use in education (Dayan 2010). Digital content for the Ministry is also developed in partnership with independent organizations, including the non-profit Education Technology Center. Widespread belief among Israelis in the value of education and a concurrent emphasis on developing a high-tech industry to further the country's prosperity are both enabling factors for public-private agreements that encourage ICT in education. Israel has also cooperated with international companies, such as Microsoft, for its Partners in Learning program, and Intel, for its Intel Teach program (Ministry of Education, Science and Technology Administration 2008).

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

Israel continues to pursue initiatives to improve ICT infrastructure in its classrooms. One of the largest programs, run in association with the Athena Fund, provides laptops to teachers for classroom use, along with 120 hours of ICT training (Dayan 2010a). The program, called Laptops for Teachers and Smart Classrooms, currently reaches 5,000 teachers and plans to double its reach to 10,000 teachers by the end of 2010. As part of the arrangement, the Ministry funds 50 percent of the cost of the laptops, with the Athena Fund (a third-party organization) covering the remaining half. The Ministry directs the software and support aspects of the program, specifying the educational resources available on the laptop and defining the ICT training that accompanies the laptop acquisition (Dayan 2010b).

Israel also has high hopes for the interactive classroom project, which aims to equip 10 classrooms in each school with interactive whiteboards, laptops and wireless Internet (Kadima Mada website). As with other infrastructure programs, teachers receive ICT training for two years following installation. Approximately 500 classrooms were equipped between 2009–10 (Dayan 2010a).

Other programs in pilot phases include a one-to-one laptop program in 20 schools (Dayan 2010b) and small-scale experimental projects to explore the use of mobile devices (Ministry of Education, Science and Technology Administration 2008).

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

Israel has national ICT in education standards for students (Dayan 2010a). They are brief and define goals such as specific tasks students should be able to accomplish using a computer (e.g., give a presentation) and working in online environments (e.g., use efficient search strategies, locate resources and evaluate their quality, communicate with others). The standards also specify that students should learn what constitutes ethical ICT use. Students are not directly assessed using these standards (Israel Ministry of Education Student ICT Standards website).

Priorities and Programs in This Area

The Password for Each Student project provides a set of online services for schools, including a school Web portal and a learning management system (LMS) for teachers and students, allowing students to remotely access educational resources (Dayan 2010a; Sisma website). The program currently reaches 60,000 students in 70 schools located in the country’s periphery (North and South regions) and has plans to expand to 100,000 students in 120 schools. The project is funded jointly by the Ofer Group (shipping), Israel Corporation (investments in chemicals, shipping), Israel Chemicals and the Zen Association.

A range of online supports are also available for students, including study materials to help students prepare for their secondary school exit exams (similar to Britain's A-level, or France's *baccalauréat*) (Ministry of Education, Science and Technology Administration 2008). In some areas, struggling students are eligible for one-on-one online tutoring. In order to participate, teachers must submit an application to the Ministry on behalf of the student (Dayan 2010b).

Another arm of the national plan aims to make a host of digital learning resources available to schools. Israel's Education Technology Center currently develops many of Israel's digital learning resources for science, math and language arts. The Ministry pays subscription fees for school access and, in some cases, funds the development of specific digital resources. The Education Technology Center and Ministry staffs work with teachers and students to help them learn to use the system. At the end of each year, evaluations are conducted to determine whether teachers need additional support using the resources (Dayan 2010b).

The Digital Library project is a parallel initiative being developed by the Ministry. It aims to expand the availability of digital learning resources beyond core subjects (Dayan 2010b).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

According to Dayan (2010a), Israel has national ICT standards for teachers. However, from the information provided, it appears that they are folded into general standards for information science—with expectations focused on the ability to understand and evaluate information sources, locate relevant information and integrate and present complex ideas (Israel Ministry of Education Teacher ICT Standards website). Data estimates in 2010 show that 8 percent of teachers are meeting these standards. A new push by the Ministry requires teachers to demonstrate an ability to teach using ICT in order to qualify as teachers. If they are unable to do so effectively, more support is provided until they pass the exam (Dayan 2010b).

Priorities and Programs in This Area

Teachers have access to a great deal of ongoing professional development geared towards technology-enhanced instruction since the Ministry integrates substantial teacher training into all of its programs. For example, teachers at the 500 schools now participating in a Ministry program to extend the elementary school day by a few hours receive 60 hours of training per year for the first two years of the program, focused on ICT integration (Dayan 2010a).

Both pre-service and in-service professional development courses contain elements that are delivered online. Additional ICT-related support is also available to teachers via expert mentors—either former or part-time teachers experienced in the use of ICT in the classroom (Dayan 2010b).

Continuous Improvement Efforts

Investing in Data Systems

The Ministry collects a wide range of data in the spirit of continuous improvement. Results from students' national examinations are used to rate teacher effectiveness. Those teachers identified as poor-performing are given additional support from the Ministry, which plans to computerize the national teacher examination system. Teachers are also evaluated in terms of what they have learned in ICT training affiliated with national programs, such as the use of digital learning resources. In the same manner, this allows the Ministry to target additional support for those who need it.

National ICT Program and Policy Evaluation Efforts

The Ministry collects indicator data on many of its programs under the national ICT plan. For example, for the Password for Each Student program, the Ministry evaluates the quantity of materials available on the site and how often students use the tool (Dayan 2010b).

National ICT in Education Indicator Collections

Data was not available at the time of collection.

Plans to Participate in International Data Collections

Israel plans to participate in the Second Information Technology in Education Study (SITES) follow-up, the Program for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMMS).

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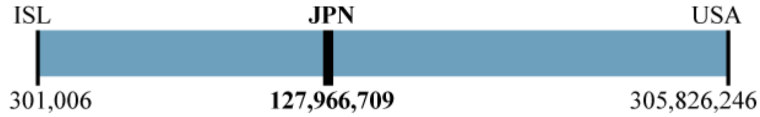
Japan ICT in Education Profile

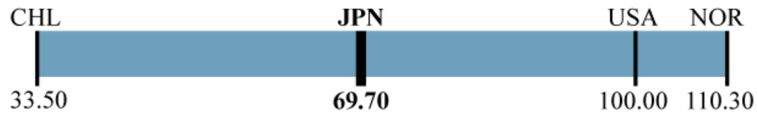
Country Statistics at a Glance

National Indicators

Total country population (2007)



Labor productivity index (% US, 2009)

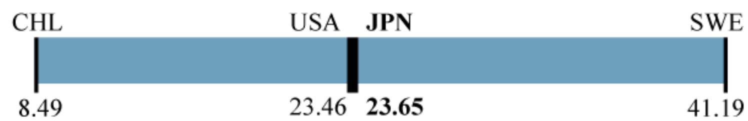


Network readiness index (% of US, 2009-10)

Mobile telephone subscriptions (per 100 population, 2008)

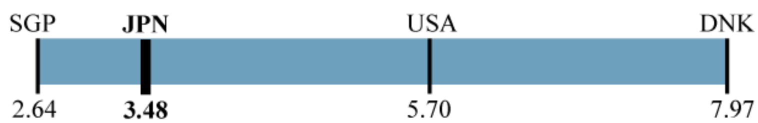
Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

Public expenditure on education (% of GDP, 2006)



Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)

Data not available.

Percentage of schools with a broadband connection (2006)

Data not available.

Japan ICT in Education Profile

ICT in Education Highlights

Increasing attention has been paid to ethics and moral issues related to ICT. The new national curriculum standards explicitly address the need for students to learn these issues. Additionally, a new cabinet office group has been organized to create a network among interested Ministries and agencies to facilitate the learning of ethics and moral issues in the classroom as well as at home.

Every year, the Ministry surveys all public schools about their ICT infrastructure and teacher ICT proficiency. The latter is measured through an 18-item teacher self-report measure.

In June 2010, the Ministry of Internal Affairs and Communication launched the Future Schools project—one of Japan's largest national ICT projects in education. The project aims to provide digital textbooks and learning resources through one-to-one computing to every student age 6–15. The project's focus thus far has been on infrastructure and tools.

Structure and Nature of the Education System

Authorities Primarily Responsible

Educational administration in Japan is the responsibility of different bodies at the national, prefectural and municipal levels (Watanabe 2000). Prefectures are Japan's large area local governing units, similar to the states in the United States. There are 47 prefectures in Japan. Municipalities are Japan's smaller, basic local-level governing units. Japan's decentralized education system is evident in how the money for maintaining and updating ICT is distributed and used. The national government allocates approximately USD 1.6 billion to local governments for this purpose, but since decisions about how to use these funds are left up to the governors and mayors at the prefectural and municipal levels, and since these funds may be used for purposes other than education, there are growing differences in the ICT equipment and infrastructure available in schools in different localities of Japan (Shimizu and Koizumi 2010a).

At the national level, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) is the central organization responsible for establishing legislation, the basic curricular framework and standards to assist localities in organizing their educational structures. However, the implementation of specific educational policies is left to prefectural and municipal governments. Each prefecture and each municipality has a board of education responsible for educational activities within their boundaries. In addition to the boards of education, prefectural governors and municipal mayors have certain powers and responsibilities for educational administration. The jurisdiction of the local government is more extensive than it was previously due to decentralization and democratization efforts in the last 40 years (Sakaguchi et al. 2009). Japan's education system is more centralized than the United States but more decentralized than Singapore (Shimizu and Koizumi 2010a).

Although the Ministry of Education is the central organization responsible for orchestrating the use of ICT for educational purposes, the Ministry of Internal Affairs and Communications as well as the Ministry of Economy, Trade and Industry are involved in promoting ICT in schools, and each of these Ministries' budgets for this purpose tends to be 10 times larger than that of the Ministry of Education (Shimizu and Koizumi 2010a). In fact, Future Schools— one of the largest national ICT projects in education—is currently carried out by the Ministry of Internal Affairs and Communications, while the Ministry of Education's ICT-related budget got significantly cut for the 2010–11 year (The Future Schools project will be described in details in the Increasing ICT Infrastructure and Support section below).

Political and Economic Context

The new Democratic Party came into power in September 2009, breaking the Liberal Democratic Party's rule of almost 50 years. One of the key pledges of this new administration was to free the government from dependency on bureaucracies and instead have politicians take the lead. The practical implication of this is that at each Ministry, the top three politically appointed officers (i.e., ministers, senior vice ministers and deputy ministers) take full responsibility for developing the most important policies in their jurisdiction (Shimizu and Koizumi 2010a). This new policy formulation process, however, is a long process; thus, specific policies and initiatives regarding educational uses of ICT have not yet been fully launched apart from the establishment of an expert working group on "informatization of schools," that released a interim report in late August 2010 (Shimizu and Koizumi 2010a) (for details, see National Plan for ICT in Education below).

There has been widespread expectation that this new administration would make a drastic change from the policies of the Liberal Democratic Party. Cutting wasteful government spending is one such change promised by the new administration (Martin and Hongo 2010). Against this background, the Ministry of Education's budget request for ICT in education for 2010–11 (approximately USD 8 million) was rejected after the budget screening review (E-Education Association of Japan n.d.; Shimizu and Koizumi 2010a), making it impossible for the Ministry to launch any major initiatives in ICT in education. Instead, the Ministry of Internal Affairs and Communication is carrying out Future Schools, the national program to provide one-to-one computing, interactive whiteboards and a "collaborative education" platform connecting schools and home, in close coordination with the Ministry of Education.

Japan ICT in Education Profile

ICT in Education

National Plan for ICT in Education

Japan's nationwide IT strategy is formulated by the information technology (IT) strategy headquarters of the Cabinet Office every five years. Released in May 2010, a draft of a new IT strategy identifies three target areas: 1) improving lessons to facilitate student learning through such instruction as student-to-student collaboration, 2) reducing burdens on teachers and school administrators and 3) establishing adequate infrastructure that enables teaching and learning suitable for the 21st century. The draft strategy also calls for the Ministry of Education to develop basic principles and visions for ICT-supported 21st century learning through one-to-one computing (Cabinet Office IT Strategy Headquarters 2010; Shimizu and Koizumi 2010c).

In accordance with the national IT strategy, in late August 2010 the Ministry of Education has released an interim report, "Visions for Informatization of Education" (MEXT 2010b), which was developed through expert panel meetings and public comments. A more comprehensive and detailed report on the topic will be released by the end of March 2011.

The interim report underscores the affordances of ICT in individualizing learning to meet each student's needs and enabling collaborative and interactive learning across geographic and time boundaries. The report also defines student ICT proficiencies as "abilities to independently collect, judge, process, edit, produce, express, and communicate necessary information" (MEXT 2010c) and views them in alignment with "key competencies" identified by the Organization for Economic Co-operation and Development (OECD 2005).

According to the report, the ICT education in schools consists of the following (MEXT 2010a, 2010c):

Information education: This fosters student mastery of basic ICT skills as well as application of skills for learning in other subject areas. This also includes ethics and moral issues.

Use of ICT for better teaching and learning: This includes the development and research of digital textbooks and other digital learning resources, and the provision of an ultra high-speed wireless local area network (LAN) to support the one-to-one computing initiative and other ICT tools, such as digital blackboards and digital TVs.

Use of ICT for increased productivity in school and classroom administration: This includes gaining efficiency in classroom and school management through ICT so that teachers can focus on teaching. This also includes standardizing school- and student-related data to create a centrally managed, sharable data system, such as Korea's National Educational Information System. The vision document also mentions the potential of cloud computing in this area.

Use of ICT for students with special needs: This refers to assistive learning technology as well as data systems that can be shared among teachers, between schools and homes and among professionals helping students with special needs (e.g., social workers, specialists in job placement and public health)

Provision of supports for schools and teachers: At the national level, this includes providing professional development to teacher educators through e-learning so that they can train teachers at the regional levels. Instructional design is called out as one of the key topics to be covered in the teacher educator training. The report also calls for a national-level effort to develop curriculum for chief information officers and support schools to employ them.

Details of National Plan

Title: Visions for Informatization of Schools: Designing Learning and Schools for the 21st Century

Year of Publication: August 2010

URL:
http://www.mext.go.jp/b_menu/houdou/22/08/__icsFiles/afieldfile/2010/09/03/1297089_1_2_1.pdf

Private Sector Involvement

In Japan, there is a long-standing tradition of maintaining a discreet distance between the public and private sectors, largely due to fairness considerations. This tradition is even more emphasized under the new Democratic Party administration, which has the explicit objective of converting Japan from a bureaucrat-led to a politician-led society. An implication of this, for example, is that when a national government launched an initiative in the past, it generally contracted projects to extra governmental organizations, such as incorporated associations and government-established foundations, which then solicited support from the private sector. This practice has been under scrutiny in the new administration (Shimizu and Koizumi 2010a).

However, this does not mean there is no private sector involvement in ICT in schools. The most noteworthy private sector involvement is the launch of Digital Textbooks and Teaching (DiTT, http://ditt.jp/) by major telecommunications and IT companies such as Soft Bank and Microsoft (CNET-Japan 2010 July 28). This consortium aims to support the government’s national goal to provide students 6-15 years old with digital textbooks and learning materials on a tablet PC by 2015 through conducting research and development activities. Additionally, the Ministry of Internal Affairs and Communications contracted two private companies, NTT Communications and Fujitsu Research Institute, to carry out research with 10 “model” Future Schools (for details, see Increasing Infrastructure and Support section below). Furthermore, Microsoft Japan and Intel Japan are regarded as major providers of teacher professional development in ICT. However, teacher professional development is largely a jurisdiction of local governments, and thus the involvement of these two companies in teacher professional development takes place at the regional level (Shimizu and Koizumi 2010c).

Increasing ICT Infrastructure and Support

Priorities and programs in this area

Future Schools aims to provide digital textbooks through a tablet PC for all school students ages 6–15 by 2015 and complete the nationwide implementation by 2020 (Ministry of Internal Affairs and Communications 2009). As of September 2010, two major studies are underway for the project: 1) a 2–part empirical study on the introduction and implementation of an ICT-supported learning environment and 2) a review of exemplary cases of ICT use in education in Japan and abroad (e.g., the United States, the United Kingdom, Korea and Singapore). The former was launched at the end of July 2010 with a budget of USD 11 million (Ministry of Internal Affairs and Communications 2010). Two private companies, the NTT Communications and Fujitsu Research Institute, contracted to conduct the empirical study (the former is responsible for a sub study with five schools in eastern Japan, while the latter is responsible for another sub study with five additional schools in western Japan). In addition to providing each student with a tablet PC, the project will provide an interactive whiteboard in every classroom as well as wireless LAN in the participating schools. The study will focus on the deployment of the one-to-one initiative, investigating such issues as 1) ICT infrastructure, network and security policies, 2) costs and support systems for schools, teachers, students and parents and 3) benefits of using ICT for collaborative education using qualitative and quantitative data (collected through questionnaires).

The second study, a review of exemplary cases launched in June 2010, is being conducted by a working group composed both of scholars and of officials from the Ministry of Internal Affairs and Communication and the Ministry of Education. The final reports from the two studies, the empirical study and review study, are due by end of March 2011. Findings from these studies will be used to establish national guidelines for Future Schools, which will cover the following topics:

- Establishing ICT and network infrastructure in schools.
- Use of ICT in the classroom to facilitate collaborative education.
- Use of ICT to link schools and home.
- Use of a collaborative education platform utilizing cloud computing technology.
- Other policy issues for facilitating collaborative education.

In addition to the national guidelines, the Ministry of Internal Affairs and Communication plans to provide teachers and school leaders with “demonstration” lessons and visual and textual information about the use of ICT in the classroom and beyond. The Ministry of Education and the Ministry of Internal Affairs and Communication plan to collaborate on the Future School project beginning in 2011(Shimizu and Koizumi 2010c).

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in education standards for students

Currently, there are no national ICT standards for students. However, the national curriculum guidelines, known as the Course of Study, give suggestions about how ICT should be used in various subject areas. The most recent Course of Study and its manuals, which were released in 2008–09 and 2009–10, respectively, include clearer and more concrete descriptions of how ICT should be used in both stand-alone ICT courses (e.g., informatics) and regular subject areas (e.g., mathematics, history) than their previous versions (Shimizu and Koizumi 2010a). One of the most notable changes in the current Course of Study is the emphasis on ethics and moral issues related to ICT. This topic is seen as important across all grade levels (ages 6–18). Additionally, the current Course of Study specifies progressively higher-level ICT competencies for middle school and high school students (ages 12–18). The standards call for elementary school students to become familiar with different ICT tools and learn basic operations such as word processing, while the standards call for middle school and high schools students to "proactively and practically" use a computer and information networks in their learning (Shimizu and Koizumi 2010a).

Although there are some commercially developed certificate exams on ICT specifically targeted for students ages 12–18, there is no national assessment of student ICT proficiency (Shimizu and Koizumi 2010a). However, if ICT skills are broadly considered to include student abilities to extract information from multiple sources, analyze and evaluate it to draw conclusions, one of the two types of the National Achievement Tests assess such abilities in the context of reading and mathematics (Watanabe 2010) (for details about the National Achievement Tests, see Continuous Improvement Efforts).

Priorities and Programs in This Area

Three noteworthy priorities and programs exist at the national level in Japan. First and foremost are the new curriculum guidelines that have more specific treatment of ICT as a subject of study as well as a means to foster teaching and learning of other subject matter knowledge. The new curriculum guidelines and manuals provide a template for classroom activities involving ICT, and these have directive power. However, they are merely a plea to teachers; how ICT is actually used is up to local boards of education and classroom teachers (Shimizu and Koizumi 2010a). The survey respondents noted that more discussions are necessary not just on what new ICT tools are available, but also on how these tools can transform teaching and learning processes (Shimizu and Koizumi 2010a).

Second is a growing concern for student inappropriate uses of ICT and online bullying (Shimizu and Koizumi 2010a). Japanese students can easily access the Internet through their cell phones and without the knowledge of their parents and teachers. Students may be affected by harmful information or could send inappropriate and discriminatory messages, which may harm other students. For the purpose of facilitating the learning of the ethics and moral issues in classrooms and in students' homes, a new cabinet office group has been organized to create a network among interested Ministries and agencies including those involved with law enforcement

(Cabinet Secretariat Information Technology Policy Office website; Shimizu and Koizumi 2010a).

Lastly, there is a national archive of online learning resources developed by the National Information Center for Educational Resources (NICER; http://www.nicer.go.jp/).The archive contains materials in all subject areas and is targeted at teachers and students ages 6–18, as well as at lifelong learners. Using the Learning Object Metadata model, the Center for Education Resources systematically organizes the materials according to the national curriculum guideline topics as well as to the table of contents of major textbooks so that teachers and students can easily find the materials they need. Additionally, NICER not only collects and organizes existing learning materials but also develops original materials. NICER was established in 2001, and its annual budget is approximately JPY 100 million (USD 1 million). In 2008, the number of visits to the online archive exceeded 5 million, averaging 14,000 visits per day. Government officials believe this speaks to efforts to improve online content and to disseminate the archive to a wider audience at various education events (MEXT 2009b).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

The ultimate goal of Japan's "informitization of education" is to improve teaching and learning through ICT. To achieve this goal, the Ministry sees both the ICT infrastructure and teachers' abilities to take full advantage of the infrastructure as essential. With this recognition, the Ministry developed a checklist on teachers' abilities to use ICT in instruction at the end of the 2006 fiscal year. This is a self-report instrument to determine the extent to which teachers are competent in using ICT in their work. There are two versions of the instrument: one for elementary teachers and the other for middle and high school teachers. Each checklist includes 18 items, which are grouped into the following five major categories:

1. Apply ICT to analyze curriculum, prepare instruction and evaluate student learning.
2. Use ICT during a lesson.
3. Teach students how to use ICT.
4. Teach students about ethics and moral issues related to ICT.
5. Use ICT for school duties other than instruction (e.g., communicating with parents, school management).

The checklists are publicly available online (in Japanese) at the following websites:

For teachers of students ages 6–12:
http://www.mext.go.jp/b_menu/shingi/chousa/shotou/039/check/07021605/001.pdf.

For teachers of students ages 12–18:
http://www.mext.go.jp/b_menu/shingi/chousa/shotou/039/check/07021606/001.pdf.

All teachers at all public schools in Japan were asked to rate themselves on a four-point scale (from “almost incompetent” up to “reasonably skillful”) on an annual basis. The results are reported in terms of prefecture ranking (note: Japan has 47 prefectures). In some prefectures, these results are used to guide their teacher training policy. For example, the governor of Tokyo set as a goal for his prefecture to become the highest ranked prefecture after Tokyo ranked low on teacher self-reports (Shimizu and Koizumi 2010a).

Priorities and Programs in This Area

The highest priority is to have 100 percent of teachers reporting “reasonably skillful” on all of the 18 points on the checklist (Shimizu and Koizumi 2010a). According to the survey respondents, this list needs to be improved periodically to keep up with the changes in ICT; however, currently there is no plan to do so.

Additionally, as mentioned in National Education Plan section, the “Visions for Informatization of Education” report emphasizes the need to provide professional development for teacher educators especially on instructional design through e-learning at the national level (MEXT 2010c). The trained teacher educators will then provide professional development for teachers at the regional levels. The report also recognizes the importance of developing curriculum for ICT support personnel at higher education institutions, and it supports schools to hire chief information officers and the ICT support personnel.

CONTINUOUS IMPROVEMENT EFFORTS

Investing in Data Systems

As mentioned above, the Ministry’s interim report, “Visions for Informatization of Education,” calls for the need to standardize school- and student-related data to create a centrally managed, sharable data system, such as Korea’s National Educational Information System. The report also points out the potential of cloud computing in this area (but no further details are provided in the report).

One of the most noteworthy recent changes in Japan’s data system is the reintroduction of the national achievement testing program in 2007–08 after a 43-year hiatus (Ishizuka 2010; MEXT 2010d). This decision was made partly because of declining Japanese students’ achievements as evidenced in the drop of Japan’s ranking in the international standardized tests such as the Program for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMMS). This data collection was explicitly targeted to analyze and grasp student achievements nationwide, evaluate the results of educational policies and programs and establish a continuous improvement cycle in public education.

Initially, the achievement tests were administered to all public school students in the final year of elementary schools (age 11–12) and of middle schools (age 14–15). However, beginning with the academic year 2010–11, the Ministry decided to draw a representative sample of schools (30 percent of all public schools) as a way to minimize costs. The Ministry allows schools that are not chosen as the sample to participate in the tests if they can bear the costs of test administration, scoring and analysis themselves. Consequently, 70 percent of the public elementary and middle schools participated in the tests in 2010, revealing local governments' great interest in tracking children's academic abilities even if they had to bring their own resources for the effort. Currently, students are tested in Mathematics and Japanese language, but the Ministry plans to add Social Studies, Science and English in the near future.

Although scoring and analysis of data are left to local governments, in 2007 and 2008 the Ministry supported special committees established at the local level to develop data analysis and utilization plans in collaboration with experts at the National Education Research Institute and local universities. The Ministry also investigated best practices around the data use to facilitate changes at the school level and disseminate findings at the national level (MEXT n.d.).

National ICT Program Policy Evaluation Efforts

The most recent evaluation of Japan's ICT in Education policy focused on the attainment of three broad goals, which include: Goal 1: increasing access to learning opportunities especially for lifelong learners; Goal 2: supporting teachers and school leaders via the national archive of digital learning materials); and Goal 3: improving teaching and learning through cutting-edge technologies (MEXT 2008). Different metrics of success were identified for these policy goals; for Goal 1 and Goal 2, quantitative metrics were identified, such as viewer ratings for national educational TV programs. For example, more than 4.5 million hits per year were set as the highest performance target for Goal 2— providing digital learning resources through the National Center for Educational Resources. In 2008, the number of visits to the online national archive was a little more than 5 million, which exceeded expectations. As for Goal 3—improving teaching and learning—a more qualitative metric is used to judge whether a high-quality implementation case of a particular ICT tool, such as high-definition digital TV, is reported from a Ministry-funded piloting research. In 2008, the Ministry reported that Goal 3 was achieved at the highest level because high-quality implementation cases of classrooms integrating a digital TV and other ICT tools were reported from a Ministry-funded three-year piloting study with six districts involving 21 schools. The study revealed that the use of a digital TV and other ICT tools contributed to improving the lesson quality by providing powerful and beautiful images and increasing student interest in the subject matter (MEXT 2008).

In program evaluations, recent years have seen increased attentions to the effect of ICT on student learning (Shimizu 2010). For example, in a recent study of the interactive blackboard, researchers used a cross-over design to investigate differences in student learning and interest between treatment and comparison groups (the two study conditions were switched midway). The study found that the use of the interactive blackboard indeed had positive effects on student learning and interest (Shimizu 2010).

National ICT in Education Indicator Collections

The Ministry collects two types of ICT in education indicators: 1) infrastructure and equipment in schools, and 2) teachers' self-reported abilities to use ICT in instruction.

The annual survey on the status of ICT infrastructure and equipment in schools has been administered to all public elementary, middle and high schools since 1989[31] and the data has been publicly available since 2003. The annual budget for these surveys is approximately JPY 14.7 million (USD 160,000), although this is subjected to change (Shimizu and Koizumi 2010a). The types of data collected with this survey include the following (MEXT 2009a):

Computers in schools:

- Computer installation and conditions.
- The number of computers for student use for educational purposes by locations (e.g., regular classrooms, computer labs, special rooms).
- The number of computers for educational purposes by operating system.
- Computer peripherals.
- Computers owned by teachers and administrators.
- Computer training attended by teachers and administrators.

Internet connectivity:

- Type of connection.
- Connection speed.
- Provider.
- E-mail addresses given to teachers and school leaders.
- Policies to deal with harmful information.
- Information security policies.

[31] The survey is filled by each school; however, because school infrastructure is partially implemented by a board of education sometimes the survey is filled out by the board (Shimizu and Koizumi 2010a). The ICT infrastructure survey is not available for the public.

The most current goals and the progress made as of March 2009 are summarized in the table below (MEXT 2009a).

	Goals identified by the National IT Strategy	Progress achieved as of March 2009
Number of students assigned to a single computer	3.6 students/computer	7.2 students/computer
Percent of regular classrooms with LAN	100%	64%
Percent of regular classrooms having ultra high-speed Internet connections (more than 30 Mbps)	100%	60.5%
Percent of teachers having computers for professional use	100%	61.6%

As for teacher ICT proficiency, the Ministry collects the data from all teachers in public elementary, middle and high schools annually since 2006. According to the data collected in 2009, the ICT skills in which the majority of teachers reported themselves as skillful include: use of ICT to develop curriculum materials (79.9 percent of teachers surveyed reported reasonably or somewhat skillful); and use of ICT to collect information and develop documents for school administrative tasks (75.1 percent). In contrast, the skills in which the smallest number of teachers reported themselves as skillful include: help students use ICT to express and communicate their ideas and understanding (52 percent reported reasonably or somewhat skillful); and use ICT to display curriculum materials to facilitate student acquisition of knowledge (54.4 percent) (MEXT 2009a).

Plans to Participate in International Data Collections

There are plans to participate in PISA 2012 and TIMSS 2011 (Shimizu and Koizumi 2010a).

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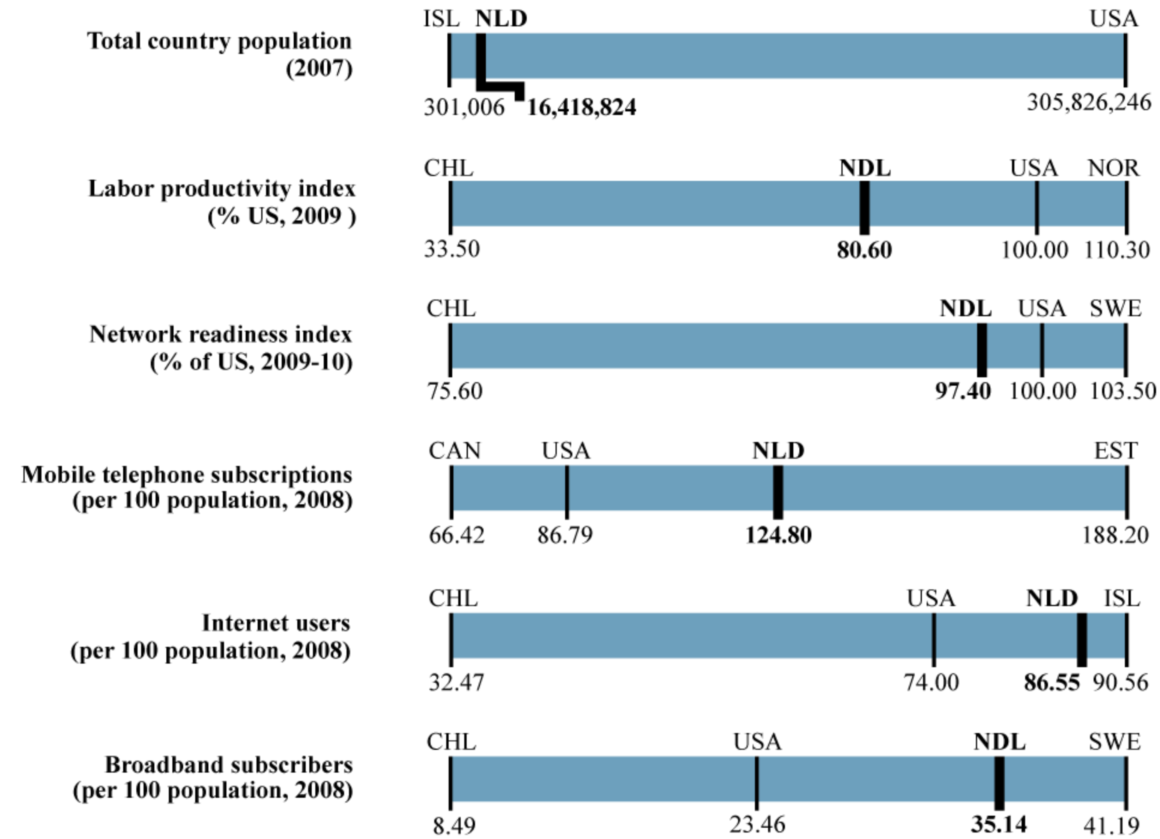
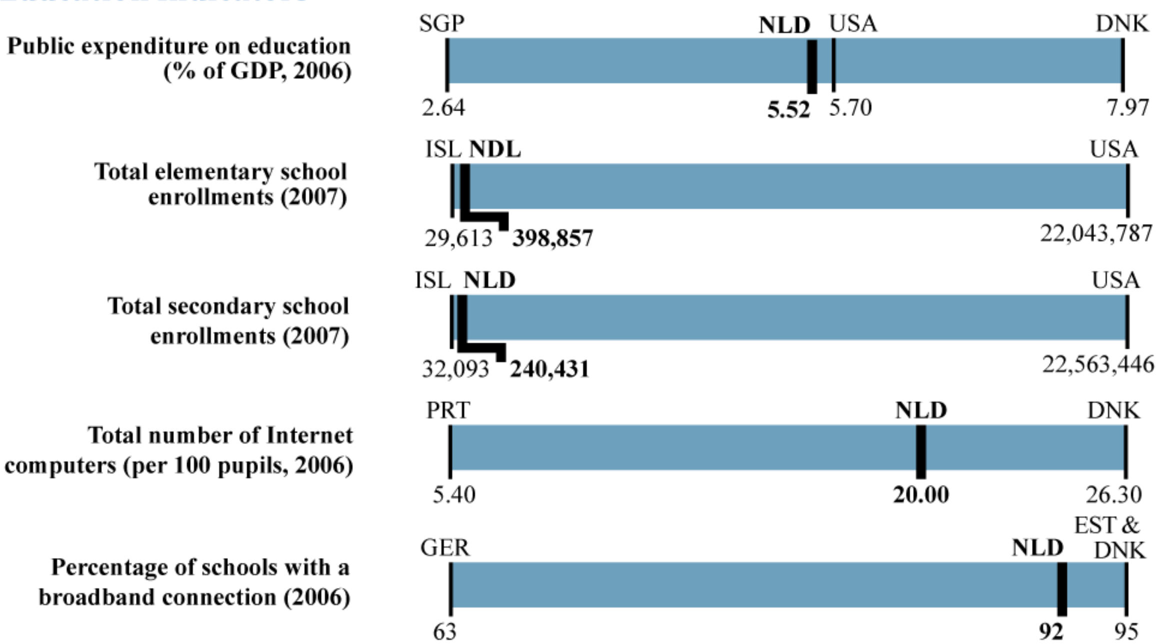
Country Statistics at a Glance

National Indicators



Education Indicators



ICT in Education Highlights

Two national public ICT-support organizations in the Netherlands, the Kennisnet Foundation (for primary, secondary and vocational education) and the SURFnet Foundation (for higher education), offer schools and educational institutions independent services for the effective and secure use of ICT.

The Four in Balance Monitor is focused on data collection in four areas: ICT infrastructure, professional development, digital learning resources and vision. In theory these four areas should be in balance to incorporate ICT properly in education.

The Ambassadors Network facilitates exchange of ideas between teachers and ICT coordinators. These communities of practice meet to discuss their needs to integrate ICT in education.

Structure and Nature of the Education System

Authorities Primarily Responsible

Overall, the Dutch education system is decentralized, and the individual schools have extensive autonomy. Schools are funded by the Ministry of Education, Culture and Science (MECS), which sets the quality standards and statutory requirements for both public and private schools. Within this accountability framework, schools develop their own school plans and have the freedom to spend money at their own discretion (ten Brummelhuis et al. 2009). Although the Ministry supplies guidance and direction, local schools are ultimately responsible for implementing ICT in education, and the extent of that implementation often depends how much funding individual schools apportion to ICT from their overall budgets (ten Brummelhuis et al. 2009).

Primary education is for children ages 5–12. After primary school, students choose between three types of secondary education: pre-university (ages 12–18), general secondary (ages 12–17), or vocational secondary education (ages 12 and older) (ten Brummelhuis et al. 2009).

Political and Economic Context

There are two national public organizations that promote ICT in schools: the Kennisnet Foundation (for primary, secondary and vocational education) and the SURFnet Foundation (for higher education). These institutions offer schools independent services for the effective and secure use of ICT to improve the quality of teaching and learning. These services include educational content, technical and pedagogical support, research, evaluation and monitoring. Kennisnet is entirely financed by public funding, with an annual budget of over USD 40 million. This includes basic funding of USD 29.3 million and additional project funding of USD 10.9 million (ten Brummelhuis 2010). Kennisnet was originally responsible for connecting schools to the Internet as well as building a national Web portal for ICT in education (ten Brummelhuis et al. 2009, 522). SURFnet is publicly supported but also receives some private funding as well (Coskun 2010b). Kennisnet and SURFnet report to MECS four times per year and must submit an annual plan describing the coming year's activities in order to comply with funding requirements.

National Plan for ICT in Education

For primary, secondary and vocational education, there was a national plan set out by the Ministry, called Connected with ICT, which was created in collaboration with Kennisnet. This plan was in effect from 2004 to 2007. The Kennisnet annual plan has replaced the national plan because Kennisnet, not the Ministry, assists schools directly with ICT in education, and also because of the Netherlands' strong tradition of local autonomy in schools. For this reason, the previous national plan was not labeled as a master plan or a national strategy, but rather named an action plan (Coskun 2010b).

Kennisnet's activities are developed in the following three program areas:

- Helping teachers improve their ICT competencies and use ICT more effectively.
- Making digital learning resources easier to locate and access.
- Helping school administrators formulate their vision of ICT by incorporating ICT infrastructure and other ICT components into their school plan. (Coskun 2010b)

Each year the Ministry reviews and approves the Kennisnet annual plan, which details objectives on helping schools integrate ICT in education. Kennisnet also gets input on their annual plan from two groups of stakeholders: the Kennisnet Ambassadors Network and sector organizations. The Kennisnet Ambassadors Network consists of communities of practice for teachers and ICT coordinators. This Network focuses on the most important challenges of implementing ICT in schools. It also provides feedback to Kennisnet on their activities. Sector organizations in the Netherlands include advocacy organizations for primary, secondary and vocational schools (Coskun 2010b). Kennisnet has strategic partnerships with all of these stakeholder groups, and requests their input as part of its annual review process.

Details of National Plan

Title: Kennisnet Annual Plan (primary, secondary and vocational education)

Year of Publication: 2010

URL: http://jaarplan2010.kennisnet.nl/

Private Sector Involvement

Kennisnet works occasionally with partners such as Microsoft, HP, Smart, IBM and Apple, as well as with private partners in the field of education such as publishers, while organizing courses, seminars and short term it-exploration projects. Further details were not available at the time of data collection.

Private sector publishers participate as strategic partners in two national programs "Stimulating the Use of Digital Learning Resources" and "Open Access" (Bok et al. 2010). These programs work with publishers to add their content to a digital portal, so that teachers can locate the content more easily and efficiently. Some content is open and can be downloaded for free, and some content is closed, meaning that teachers need to purchase content from publisher websites. There is no special negotiated rate for teachers using this service. The Ministry is now trying to connect this portal to an open, Internet-based wiki platform (Wikiwijs) where teachers can find, download, develop and share digital learning resources without paying (Coskun 2010b). Kennisnet has other partnerships with the private sector, such as publishers and other media organizations through programs such as the digital learning resource wiki and the national media literacy program (Mediawijsheid).

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

In the past, the Netherlands' focus on the integration of ICT in education was primarily on ICT infrastructure and the availability of digital educational resources. Their focus is currently shifting towards a greater emphasis on teachers' professional development and on providing school leadership with an integrated vision of ICT (Bok et al. 2010).

There are currently no national educational programs focused specifically on ICT infrastructure. There used to be a national program to promote Internet connection in schools, but now 98 percent of schools has Internet connectivity and local area networks (Coskun 2010b). Primary schools have an average of one computer for every five students. Secondary schools have on average one computer for every four students, while the ratio is one computer for every 4.5 students in vocational schools (Coskun 2010b).

In keeping with the Dutch tradition of local autonomy in schools, the Ministry provides money directly to local schools for developing ICT-related programs. Funding includes USD 400 million, and goes to primary, secondary and vocational schools. This translates into about USD 110 per student. Ninety percent of this amount goes to schools, which can spend the money with complete discretion. The structural annual budget of the Kennisnet Foundation is USD 28.9 million. Kennisnet uses the funds to support its previously mentioned ICT goals (Bok et al. 2010; Coskun 2010b).

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

Because of the Netherlands' tradition of local school autonomy, there are no national student standards for ICT education (Bok et al. 2010). Instead, local schools decide internally what the ICT standards are for students. In most of these schools, ICT is integrated within the subjects rather than presented as a separate topic of study. The national curriculum development organization (SLO) also assists schools in the process of measuring student achievement regarding ICT skills (Coskun 2010b).

Priorities and programs in this area

Many programs support priorities related to improving learning through technology-enhanced instruction. Personalized learning is a new focus for policy and research, with emphasis on the development of programs for individual learners with varying educational needs. An example of personalized learning at primary and secondary levels is Acadin, an online learning platform to enable flexible and accelerated learning for gifted students (Coskun 2010b).

In an effort to spur greater innovation in this area, the Ministry provides USD 5.6 million for the SURFnet-Kennisnet Innovation program, which aims to stimulate proposals for creative new ICT projects at schools (Bok et al. 2010). This program funded a number of valuable local projects. One Innovation project is experimenting with specialized schools for top athletes who need flexible scheduling provided by online learning. Another project emphasizes peer learning via social media. A third project is called the Classroom of the Future. This project provides students access to all ICT tools for one week, and studies the associated learning effect (Coskun 2010b).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

Since most educational policy is established at the local level, there are no national teacher standards for ICT in education (Bok et al. 2010). However, there are ICT standards embedded in the schools' human resources policy. ICT standards are incorporated as part of the broader rubric under which teachers are evaluated by school management, in particular as part of their personal development plan. School administrators are responsible for emphasizing the importance of ICT competency for all teachers (Coskun 2010b).

Local ICT teacher standards are also informed by Kennisnet's Four in Balance Monitor, an ICT-in-education data-collection program that tracks professional development. In this program, teachers evaluate themselves on how they use ICT in their teaching. The program is designed to assist teachers' self-reflection about their teaching practices and is not in any way an evaluation of actual capability. For this reason, the Four in Balance Monitor does not test or evaluate teachers' ICT capabilities, but rather provides a benchmark and a framework for how to use ICT in teaching.

Another potential influence on local ICT teacher standards is the Kennisnet Ambassador Network, which provides evidence of the effectiveness of ICT in education. This Network along with the Monitor Program inspires and assists teachers in discussing and reflecting on ICT in professional development. The Kennisnet Ambassador Network, and Kennisnet more generally, does not train teachers, but rather inspires them to use ICT more efficiently and effectively. For this reason, Kennisnet does not test teachers on their ICT competency but rather offers assessment tools for teachers' self-evaluation (Coskun 2010b).

In terms of teacher incentives to use ICT in education, the Ministry published a plan that includes financial incentives for teachers to develop innovative solutions for pressing problems in Dutch education, including those utilizing ICT. This plan is called Agenda for Innovations in Education and was published in 2009 (Coskun 2010a).

Priorities and Programs in This Area

As mentioned previously, the Netherlands' focus is currently shifting towards a greater emphasis on teachers' professional development and on providing school leadership with an integrated vision of ICT (Bok et al. 2010). Professional development is a key program area for Kennisnet (Coskun 2010b), and many programs use technology to provide teachers with professional development opportunities, curricular materials and other resources to improve teaching. For example, the Mediawijsheid program provides online content for teachers to educate their students on media literacy. Also, there are two open Web-based platforms, called Leraar 24 and Wikiwijs, which allow teachers to create and exchange ideas, experiences and digital content. Kennisnet also helps teachers to network. Almost all teachers in the Netherlands are part of the Kennisnet-sponsored Digischool online teacher network, and Kennisnet's Ambassadors Network creates local networks of teachers and ICT coordinators to facilitate the physical and online exchange of ideas.

The Netherlands' national media literacy program, Mediawijsheid, targets teachers across the entire educational system with tools for online communication and professional growth (Bok et al. 2010). This Kennisnet-sponsored program helps students to understand the role of media in society and to develop their skills of inquiry and self-expression (Bok et al. 2010). It has an annual budget of USD 2.1 million and duration of three years (2009–12). It teaches students how to use online social media. It is incorporated into the curriculum of schools, so that students can learn how to discern valuable content on the Internet. Primary schools previously offered other Internet safety programs that aimed at preventing digital media abuse, and the current media literacy program represents the next phase of those programs. Partners in the program include publishers, libraries and media organizations, all of whom work together to create content for the website (Coskun 2010b).

The online platform Leraar 24 allows teachers to exchange professional development ideas and experiences quickly and easily. It mostly contains videos, but also provides documents created by teachers for teachers (Bok et al. 2010). This platform is somewhat similar to the British professional development program "Teachers' Tube," and encompasses broad themes ranging from how to use games to healthy nutrition (Coskun 2010b). Its Web traffic was approximately 50,000 visitors in March 2010 (Coskun 2010b). The platform is sponsored by the Kennisnet program and has an annual budget of USD 3.9 million. It is scheduled to last four years (2009–13).

Inspired by the wiki concept, the Wikiwijs platform promotes the collaborative development of educational content by teachers, for teachers. This large-scale national initiative provides teachers with a platform to work together on the development and publication of digital learning resources. The platform is completely open-source and free, and is designed to help teachers find, download, develop and share their resources (Bok et al. 2010). Resources available on the wiki address all educational levels: primary, secondary, vocational and higher education. Prior to the introduction of this platform, there were similar, smaller initiatives from sector organizations and schools. These local initiatives have now been subsumed by the national program (Coskun 2010b). Wikiwijs is a Kennisnet-sponsored program with an annual budget of USD 2.1 million and a duration of three years (2009–12) (Bok et al. 2010). The program is currently ending its first phase of implementation, focused on web-portal design as well as devising strategies to encourage teachers to engage with the portal and to populate it with content. In the second phase, teachers will be invited to collaborate and create content. Current partners include Kennisnet, universities, sector organizations, advocacy organizations, publishers and other partners who deliver content (Coskun 2010b). The Open University, a UK-based accredited university that relies entirely on distance education, is providing online training to teachers and other participants.

Digischool is a new, nonprofit initiative, which has the support of Kennisnet to build what may be the largest online teacher network in the country. With over 200,000 teachers, the initiative includes almost all teachers in the Netherlands. Primary and secondary teachers are organized by subject and grade. Some teachers play the role of “community organizer” and receive a stipend for stimulating activity on the network. Another initiative that is associated with Digischool, DigilessenVO.nl, currently comprises a cooperative group of 30 schools that each pay USD 3,200 per year for access to an online repository of digital learning objects, allowing them to both share in the repository and create new content (CoSN 2010). At a minimum, each school in the cooperative must produce 10 lessons or learning objects per year. In this cooperative, teachers are considered “arrangers” rather than “authors” of content. Teachers create their own digital objects and lesson arrangements, and then send them to a team of editors for review and adaptation. The proceeds from members’ annual fees cover all of the cooperative’s expenses, including the software, editorial staff and one senior level program director. Through the cooperative, schools work collaboratively on the creation and dissemination of digital learning content (CoSN 2010).

The Ambassadors Network, with annual funding of approximately USD 1.1 million, serves primary, secondary and vocational schools, and currently comprises approximately 900 teachers and ICT coordinators. It facilitates the exchange of ideas between teachers and ICT coordinators. There are several communities of practice that meet four times a year for a face-to-face workshop in which members discuss their plans to integrate ICT in education. In addition to the workshops, Kennisnet has relation managers who visit schools across the country and invite them to join the Ambassadors Network. If there are at least 20 teachers/ICT coordinators with interest in a particular content area, they start a network. Networks may exist for up to two years. Within each network, coaches facilitate and ask members what themes they want to work on for the next two years. After the first year, members and coaches evaluate their progress and decide whether to extend the network for the second year (Coskun 2010b).

Continuous Improvement Efforts

The Education Inspectorate supervises the education system and the performance of educational institutions in the Netherlands (primary, secondary, special, vocational and adult education). All institutions are visited and evaluated on a regular basis by using a rating framework consisting of 13 quality aspects that are named in the Education Supervision Act. Some of these aspects include student learning outcomes, curricular content, school safety, various aspects of teaching and legal compliance. The same standards are applied by the Inspectorate to schools, whether they have public or private boards (Bok et al. 2010). Data may be collected from documents (e.g., financial statements, audit records), group observations and interviews with students, parents, teachers and senior management (Education Inspectorate 2009). The key indicators collected make up the Periodic Quality Assessment.

The Education Inspectorate publishes an annual report regarding the overall quality of education in the Netherlands. This report focuses on the big picture and does not publish data on individual schools. Schools receive individual reports and feedback privately from the Education Inspectorate. Public financing to underperforming schools can be cut off on the basis of the evaluation (Coskun 2010b).

In addition, Kennisnet conducts the Four in Balance Monitor program, a regular data collection about ICT in education. To provide educators with insight on the use and benefits of ICT in education, the Four in Balance Monitor program collects data in four areas, which correspond to Kennisnet’s four program areas: ICT infrastructure, professional development, digital resources and vision. The data collection gathers information about such topics as pedagogical methods, prioritization of pedagogical use of ICT on school policy agendas, whether the schools have developed a centralized vision and plan of pedagogical use of ICT and implemented it, and whether teachers feel a need for a shared vision of ICT. Based on prior research, the theory behind this conceptual model is that these four program areas should be in balance to incorporate ICT properly in education. Since 2001, this monitor has collected data on key factors which influence the use of ICT in education. The Four in Balance Monitor collects data from a representative sample of school boards, administrators, teachers and students. Data is collected by several research institutes as well as the Dutch inspectorate for education (ten Brummelhuis et al. 2009).

The Four in Balance Monitor is an annual collection. The data from this collection is used as a benchmark for schools and to report developments of ICT in education to the Ministry and to shape Kennisnet’s annual plan and programs (Coskun 2010b).

In addition, schools can use this framework to reflect on how well they use ICT in education and to compare their results with other schools and national indicators (CoSN 2010). The monitor helps schools to improve and integrate ICT into their administrative plans and acts as an electronic tool to inform their use of ICT in education. In addition, there are workshops organized as communities of practice through the Ambassadors Network to facilitate schools in comparing their situations with other schools in their area (Coskun 2010b).

Investing in Data Systems

Data not available at time of collection.

National ICT Program and Policy Evaluation Efforts

Data was not available at the time of collection.

National ICT in Education Indicator Collections

As mentioned previously, Kennisnet conducts the Four in Balance Monitor, a regular program of data collection regarding ICT in education.

Plans to Participate in International Data Collections

The Netherlands plans to participate in the Program for International Student Assessment (PISA), 21st century skills, ICILS 2013 and the Trends in International Mathematics and Science Study (TIMSS) (Bok et al. 2010).

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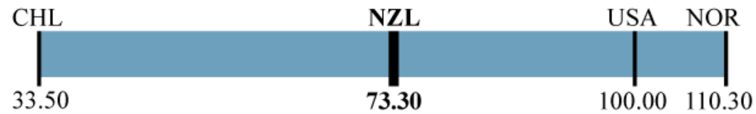
New Zealand ICT in Education Profile

Country Statistics at a Glance

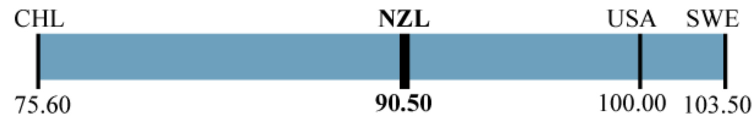
National Indicators

Total country population (2007)

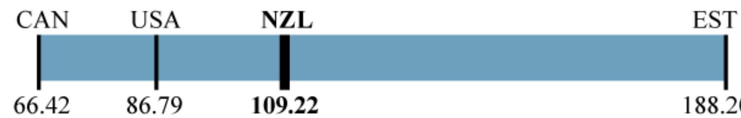
Labor productivity index (% US, 2009)



Network readiness index (% of US, 2009-10)

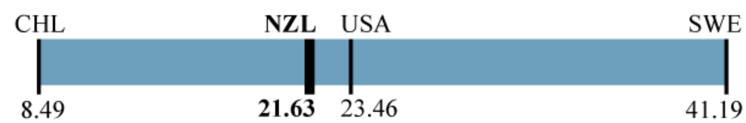


Mobile telephone subscriptions (per 100 population, 2008)



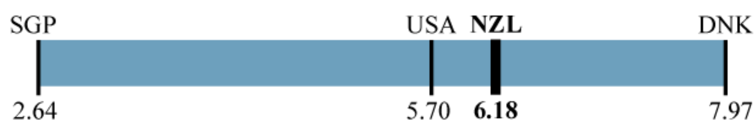
Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

Public expenditure on education (% of GDP, 2006)



Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)

Data not available.

Percentage of schools with a broadband connection (2006)

Data not available.

New Zealand ICT in Education Profile

ICT in Education Highlights

New Zealand is investing heavily in its School Network Upgrade Program to prepare its schools for 100 Mbps fiber-based Internet connectivity being implemented in 97% of schools nationwide.

The Laptops for Teachers (TELA) Scheme partially-subsidizes a three-year laptop lease for teachers; 90 percent of teachers in New Zealand participate in the program.

The ICT PD program in ICT allows clusters of schools to apply for professional development (PD) funding focused on a particular ICT-related theme.

New Zealand's recently renovated education portal, Te Kete Ipurangi (TKI), gives teachers access to digital learning object content through Digistore, as well as to online resources, and communities of practice, where teachers with similar interests share ideas and stories from their classrooms.

New Zealand supports the use of videoconferencing in education through its Virtual Learning Networks program. Under the program, mainly rural high schools with teacher subject shortages can "share" teachers.

Structure and Nature of the Education System

Authorities Primarily Responsible

New Zealand's 4.3 million people are served by approximately 2,650 K–12 schools—roughly 1,000 of which are under 100 students and 100 of which are over 1,000 students (Baldwin 2010b). Generally, K–12 education in New Zealand is centralized at the national level, such that planning and supervision are distributed among several government agencies; however, most ICT spending and investments happen at the school level.

The Ministry of Education allocates resources to schools, implements broader policy initiatives and develops national curriculum guidelines and associated resources (e.g., textbooks).The Educational Review Office evaluates schools and holds them accountable for their spending and decision-making (Brown and Chamberlain 2009). School review officers investigate teacher and school performance every three years and can recommend supports when necessary (teachers and school leaders are only fired in exceptional circumstances) (Baldwin 2010b). The New Zealand Teacher's Council certifies New Zealand's teachers, the New Zealand Qualifications Authority carries out the country's academic and trade credentialing (Brown and Chamberlain 2009).

As for school administration, it is the individual schools themselves that, through parent-elected boards, manage day-to-day operations, set goals, objectives and budgets; determine pedagogical approaches; and draft strategic plans. These "self-managed" schools are mostly state schools, but some are also state-integrated schools—formerly religious schools that decided to buy into the state system. Maori students may elect to study in English-language or Maori-medium schools. A small percentage of students also attend the Correspondence School, which allows students in isolated areas to learn via mailed and, increasingly, online materials (Brown and Chamberlain 2009).

Because schools decide how they spend their operations grant, they are forced to make their own decisions about whether and how to invest in ICT. According to Brown and Chamberlain (2009), forcing schools to think about their ICT use has contributed to a focus on ICT use for teaching and learning rather than for ICT skills. At the same time, a recent review by the Ministry of Education concluded that leaving investments up to schools has resulted in differences in the quality of ICT access across schools and difficulty managing ICT infrastructure in some schools; and although there has been an overall increasing pressure/desire to invest in ICT (New Zealand Ministry of Education Overview website), there are still differences in enthusiasm for ICT among schools.

Political and Economic Context

In 2005, New Zealand released its first Digital Strategy, an overarching framework to orient ICT efforts across sectors, including governance, education, commerce and health. The Strategy built on previous, more piecemeal efforts to promote ICT use across society and committed up to USD 250 million to the effort. In 2008, the government released its Digital Strategy 2.0, which reflected changes in the technological landscape since the first strategy was released (increased possibilities for ubiquitous high-speed broadband, Internet-enabled interactions, etc.). The biggest change from the original strategy is an investment in fiber-based broadband, with different approaches for urban and rural areas.

National Plan for ICT in Education

It is within the original Digital Strategy and Digital Strategy 2.0 that New Zealand has drafted its national policy frameworks for ICT in Education in recent years. In 2006, the Ministry released its new ICT Strategic Framework for Education for the 2006–07 to align with the first Digital Strategy.

New Zealand’s current ICT Strategic Framework for Education, originally intended for the period 2008–12, is undergoing significant revision and has yet to be released. The delay was caused by a change in government and the need to update the plan to align with the Digital Strategy 2.0. While general goals have stayed the same (see below), the plan revisions incorporate the integration of high-speed broadband in schools and the possibilities such a connection affords for education (videoconferencing, online communities of practice, etc.) The framework is also being updated to align with Digital Strategy initiatives in other sectors (e-government strategy, digital content strategy, etc.).

The plan, as it currently stands, covers primary, secondary and tertiary education and is organized around the following four main priorities, which overlap with the Digital Strategy:

Connection: Improved access and shared resources.

Capability: 21st century learning, online learning communities.

Content: Open resources and data systems.

Confidence: Emphasis on cybersafety and a safe digital environment.

In addition to the ministries mentioned above, the Tertiary Education Commission (which provides oversight and support to tertiary education providers), New Zealand Teachers' Council and the National Library are all involved in the development of the plan (Baldwin 2010b). In particular, the National Library's role has been to help think about how to make use of digitized cultural artifacts in schools (Baldwin 2010b).

The Ministry also made an effort to align the framework with its action plan, *Enabling the 21st-Century Learner: An e-Learning Action Plan for Schools 2006–2010* (New Zealand Ministry of Education 2010). This document supports the general Schooling Strategy outlined by the Ministry and is therefore more focused on teaching and learning in schools than the ICT framework, which is a policy document oriented towards the education sector as a whole. The e-learning action plan aims to place students and teachers at the center of education and include these goals: widespread use of ICT-facilitated teaching using evidence-based practice, frequent ICT-enabled communication with parents and communities, improved school administration and ICT-focused professional development for teachers.

Details of National Plan

Title: ICT Strategic Framework for Education 2008–12

Year of Publication: expected 2010

URL: not available; most recent public version: http://www.minedu.govt.nz/~/media/MinEdu/Files/EducationSectors/PrimarySecondary/Initiatives/ICTStrategy/ICTStrategicFrameworkEducation.pdf

Private Sector Involvement

The Ministry attempts to facilitate private-sector investments by engaging them in discussions with the schools about their plans and programs as a way of informally brokering relationships and providing soft incentives. For example, private providers participate in online communities of interest in order to gain access to the self-managed schools that make the key investment decisions.

On a larger scale, the Ministry relies on contracts with commercial vendors for a number of its initiatives, such as the procurement of ICT hardware for the TELA Laptop Scheme (see

Increasing ICT Infrastructure and Support section below). A national ICT facilitation team, a third-party contracted by the Ministry, oversees and provides support and interventions for the ICT PD program (described under Use of ICT to Increase Teacher Capacity section below) where schools have reporting responsibility to both this team and the Ministry (Baldwin 2010b). The digital opportunities program (http://www.digiops.org.nz/), a series of projects to develop and disseminate innovative practices with ICT, relies heavily on support from businesses such as Microsoft and IBM (http://www.digiops.org.nz/about/partners/index.html). Examples of concluded projects include:

Moblap, a partnership between ITAS/Renaissance, Telcom New Zealand, the Ministry of Education and 16 secondary schools to use mobile "pods" of wireless-enabled laptops in the classroom.

Mindspring, a partnership between Unisys New Zealand, Microsoft and schools around the country to develop a collaborative online learning environment.

Kopu, a partnership between many companies (including Hewlett-Packard (HP)) and a cluster of rural schools to develop a culture of lifelong learning by rethinking pedagogy in the rural space.

The Ministry withdrew support from the program due to questions about its sustainability when businesses pulled support a difficult economic climate (Baldwin 2010b). Importantly, the Ministry also plays a role in facilitating partnerships between third-party providers of software, hardware and professional development and the self-managed schools (Baldwin 2010a).

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

In the past, New Zealand's efforts in ICT in education faced challenges due to poor connectivity and insufficient infrastructure. As a result, the overall thrust of its current policy relates to infrastructure—the goal being to build a foundation for attaining desired reach, scalability and sustainability with its other initiatives. In the future, the government anticipates making more significant investments "in the people, rather than just the wires" (Baldwin 2010b).

New Zealand's School Network Upgrade Program–Phase 3 (SNUP-3) aims to prepare all schools for the fiber-based, 100 Mpbs connectivity being implemented by the Ministry of Economic Development. Beginning in 2005 to the present, SNUP-3 has a current annual budget of USD 4.8 million, while the umbrella program is estimated to cost USD $146 million over five to six years. The program builds upon previous efforts, specifically SNUP-1 and SNUP-2, which primarily focused on delivering connectivity to small schools in rural areas. As part of SNUP-3, a new set of schools receive a network audit and upgrade, which includes faster cables that link to the fiber connection (present or future) running past the school property. The order in which schools are upgraded depends on a number of factors, including whether a fiber-based connection is currently available in a given school's locale and whether the school participates in activities that would benefit from a school network (e.g., ICT PD) (New Zealand Ministry of Education School Network website).

The TELA Laptop Scheme (Ministry of Education TELA website) began in 2003 with an annual budget of USD 13.7 million. It provides partially subsidized laptops to teachers via a three-year lease. In a recent survey, 90 percent of respondents indicated that their school chose to fund the cost of the laptops, rather than share the cost of the lease with the teachers or ask the teachers to purchase them on their own (Baldwin 2010a; Cowie et al. 2008). The program currently reaches 90 percent of teachers, including school principals, who receive a laptop at no cost to the school. Because of the self-managed nature of New Zealand's schools, no requirements (e.g., participation in professional development), are attached to the provision of the laptops.

In addition to TELA and SNUP-3, several other programs are worth mentioning:

The Computer Access New Zealand Trust works with suppliers to give recycled computers to schools. A similar initiative, called the Computers in Homes project, distributes recycled computers to families.

The National ICT Helpdesk provides software and hardware support to schools between the hours of 8 a.m.–5 p.m., Mondays–Fridays.

The Ministry of Education provides basic software (antivirus, Microsoft Office, etc.) to schools free of charge. (New Zealand Ministry of Education Overview website)

In preparation for widespread fiber-based connectivity, a National Education Network is being piloted with 200 schools to explore how 100 Mpbs high-speed networks might facilitate the integration of ICT services such as videoconferencing and content delivery (Baldwin 2010b).

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

At the time of writing, there were no compulsory ICT standards that affected New Zealand's national secondary school qualifications tests, known as the National Certificates of Educational Achievement (NCEAs). Beginning in 2011, there will be standards for secondary school students (ages 13–18) in "digital technologies"—a broad term that encompasses skills in computer science and programming, digital media, digital society (i.e., a historical understanding of the role of ICT in our lives), electronics and sound and audio. These standards are currently under development.

Priorities and Programs in This Area

The Virtual Learning Network (VLN) is a program created to support schools interested in using virtual learning environments, including videoconferencing systems and online portals. After finding that groups of schools in mainly rural locations were banding together to share teachers via videoconferencing networks, the Ministry created a unified program to help more schools similarly augment their resources. Virtual Learning Networks have now spread to urban areas to meet shortages in language teachers. The Ministry expects that as the fiber-based initiative increases in scope, greater numbers of schools will seek to use online learning environments (Baldwin 2010b).

Digistore is an online repository for curriculum resources for students ages 6–16. Currently, only students, teachers and staff in schools have access to the content, but the Ministry is considering giving access to pre-service teacher training institutions. Many of the materials on the Digitstore portal were created by The Learning Federation, a collaboration between New Zealand and Australia to create and disseminate digital content for education (Learning Federation website).

In addition to these programs, the Ministry adopted selected technologies to deliver materials for the Correspondence School that serves students in isolated areas. Traditionally, this school conducted courses via mailings of materials, but it is now possible to receive and submit assignments via email. Moreover, subject-appropriate content and materials are made available in digital form (e.g., CDs, DVDs, MP3 recorder, interactive CD-ROMs, craft materials, etc.).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

New Zealand does not have ICT standards for teachers currently in place.

Priorities and Programs in This Area

ICT PD is one of New Zealand's longest standing (1999–present) and most successful programs in educational ICT. Clusters of schools apply for ICT-focused professional development grants that last about three years with a maximum funding amount of USD 76,000 per cluster. The total annual budget for ICT PD is USD 7.4 million. In their application, the schools propose how they will spend their grant money and specify what goals they seek to reach with the grant. They also commit to self-fund a percent of the costs. A National Support Services Facilitator helps schools to select and design the professional development they receive (through a third party provider) and ensures that schools follow-up with their plan. If problems are detected, the government may "intervene" with additional support services. The focus of the professional development is heavily on integration, rather than technical skills, and often includes a mix of face-to-face and distance learning activities (Baldwin 2010b). The Ministry reports an intention to migrate ICT PD from a "school-based cluster model" to a "support model" that relies more on the Ministry's regional offices. The migration is expected to begin in 2011 and be completed by 2013.

From 1999 to present, 64 percent of teachers participated in the program. The Ministry also provides support for ICT integration into the curriculum via the existing regionally based advisors, who liaise with schools on behalf of the Ministry, supporting activity design and helping schools establish learning communities.

Finally, the Ministry supported e-Learning Teacher Fellowships from 2003 until 2009. Through this program, teachers (maximum of seven teachers in a year) went on year-long sabbaticals from classroom teaching in order to engage in research on e-learning in classrooms in accordance with a specified theme. For example, the 2009 theme for the projects was literacy, and e-fellows explored an aspect of their e-learning practice, sharing their findings with other teachers in their community. Due to a reprioritization of resources, the Ministry turned the program over to CORE Education, a research and development nonprofit organization, in 2010. It continues as a philanthropic activity and remains small in scale with fewer than 10 teachers on sabbatical each year (Baldwin 2010b).

Te Kete Ipurangi (TKI) is an online educational Web portal that provides access to online communities and educational materials for teachers and other educators. It is intended to be used as a gateway to the Web for the broader education community and to disseminate Ministry information. The portal was updated recently to include interactive features. Some examples include: the "software for learning" community page, where teachers discuss how they use various software applications to improve their teaching; the assessment community, which provides resources and tools for assessing student knowledge, searchable by subject; and the professional learning community, which allows teachers to participate in discussion forums, chats and online conferences on their teaching practices. Other portal communities focus on gifted and talented learners, Maori education and specific subjects in education.

Continuous Improvement Efforts

Review officers from the Educational Review Office conduct evaluations of schools every three years. Reports from these evaluations are publicly accessible through the TKI educational Web portal (described in Use of ICT to Increase Teacher Capacity section above).

Investing in Data Systems

The Ministry is considering supporting schools in their use of electronic grading and attendance systems. Some schools have already chosen to invest third-party systems, but a national system to track students as they move from school to school would help the Ministry monitor and improve attendance in school (Baldwin 2010b).

National ICT Program and Policy Evaluation Efforts

There is no data collection for accountability purposes. Several of the programs mentioned above are evaluated regularly to monitor the program's progress. Reports of these evaluation activities are available on the "E-learning Publications" page of the Education Counts website.

For example, research based on classroom observations, focus groups and questionnaires has provided encouraging evidence that the TELA Laptop Scheme is benefiting teachers. According to Cowie et al. (2008), primary outcomes included:

Increasing confidence and expertise with ICT in many teachers.

Increasing use of laptops to strengthen collegial relationships.

Efficiencies gained in lesson planning, preparation, administration and reporting.

Growing use of laptops for classroom practice and student learning activities.

An evaluation of the ICT PD professional development program conducted by Sahin and Ham (2010) concluded that the program has resulted in the following outcomes:

High satisfaction among most participating teachers; most believed the program had a "significant" impact on their development.

Improved ICT skills.

Increased confidence using ICT for teaching purposes; 81 percent reported that their practices had changed to some extent.

These results echo previous studies on other cohorts of ICT PD participants.

National ICT in Education Indicator Collections

Data was not available at the time of collection.

Plans to Participate in International Data Collections

New Zealand will participate in the Trends in International Mathematics and Science Study (TIMSS) 2010 and 2014, the Progress in International Reading Literacy Study (PIRLS) 2010 and the Program for International Student Assessment (PISA) 2014.

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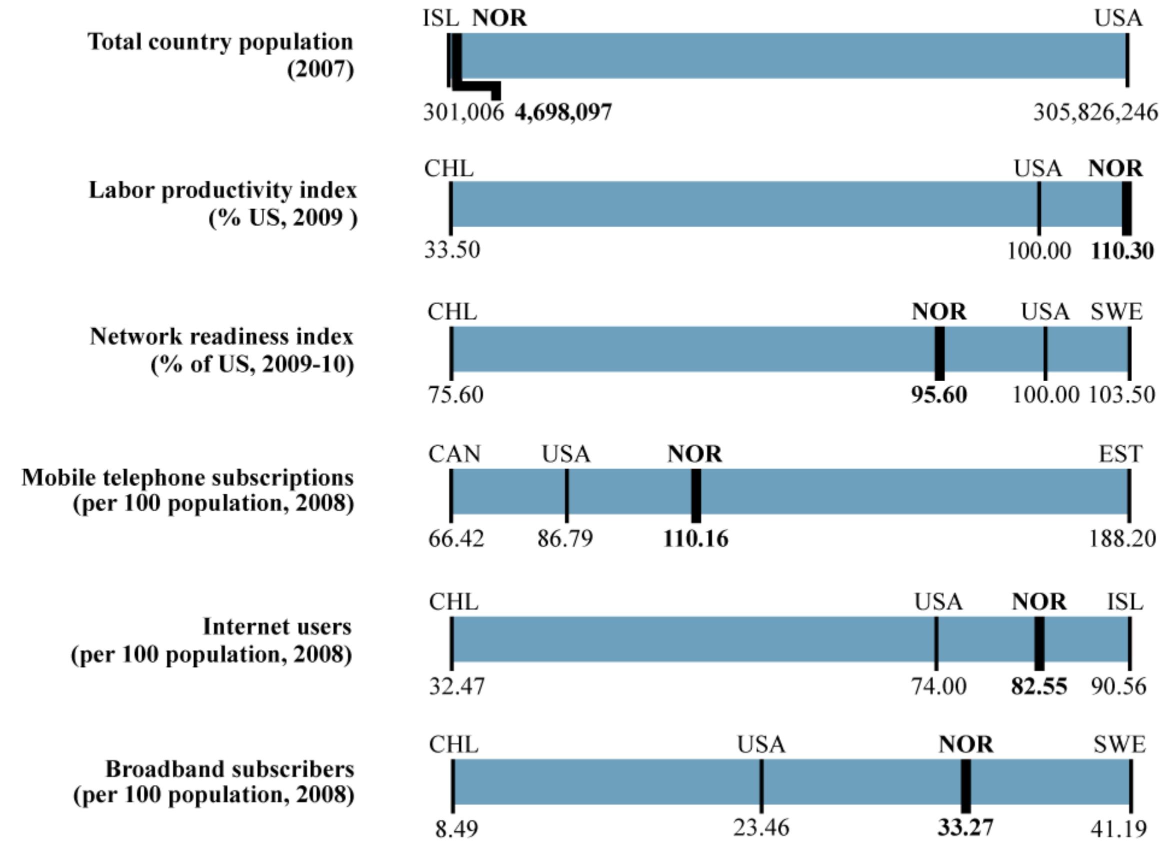
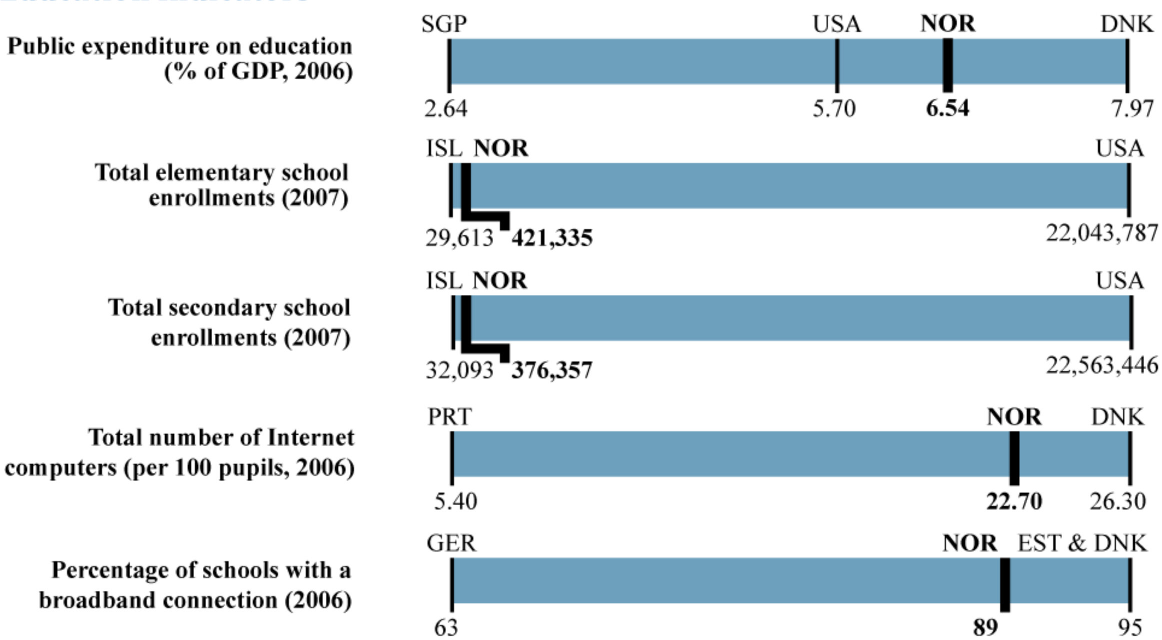
Norway ICT in Education Profile

Country Statistics at a Glance

National Indicators



Education Indicators



ICT In Education Highlights

- Norway's new national curriculum identifies digital skills as one of the five fundamental skills students need to acquire and embed them in all subjects at key grade stages.
- In 2010, three agencies were merged into a new center called the Center for ICT in Education. The Center is expected to play an important role in research, networking and development of various services and policy-making.
- The Ministry and regional education authorities have focused on providing free digital learning resources through online Web portals such as the National Digital Learning Arena (for upper-secondary students), Skolenettet (for primary and secondary education) and Utdanning.no (for the entire education sector).
- In 2009, ITU Monitor (ICT in education data collection) piloted a digital literacy test for teachers and students.
- The Ministry has invested in the online data-collection system to support its effort to improve the quality of basic education. Student achievement data and school-learning environment data are the two main data elements collected electronically through the system.

Structure and Nature of the Education System

Authorities Primarily Responsible

There are three levels in the Norwegian education system: primary or grades 1–7 (ages 6–12), lower secondary or grades 8–10 (ages 13–15), and upper secondary or grades 11–13 (ages 16–18). Most Norwegian schools for grades 1–13 are public and are funded and administered by the Ministry of Education and Research (Erstad and Quale 2009).

Norway's education system has traditionally been unitary and centralized, with the Ministry being primarily responsible for administering the education system and developing national education policy, including the national curriculum and national exams. The Directorate for Education and Training, a subsidiary agency of the Ministry, is responsible for primary and secondary education. The Ministry also oversees a new, semi-autonomous agency, the Center for ICT in Education. The Center was established in January 2010 through the merger of three small ICT related agencies (Soby and Egeberg 2010).[32] The Center is expected to play an important role in research, networking and development of various services and policy-making, as well as to increase the visibility and administrative efficiency of ICT in education. The Center has 45 employees and an operating budget of USD 14 million, which is simply a reallocation of funding from the former agencies and the Ministry. In other words, funding in research and development for ICT in education has not increased (Johannessen 2010).

[32] The former organizations that merged into the Center for ICT in Education are the Network for IT Research and Competence in Education (ITU), the national education portal *Utdanning.no* and a government company UNINETT ABC.

Political and Economic Context

Although there are changes in ICT in education at the national level (e.g., the establishment of the new Center), Norway is also undergoing a shift of decision-making power to the regional and local levels due to recent educational reforms such as the Knowledge Promotion reform (described in the next section) because of regional disparities (OECD 2009b). A practical implication of this decentralization effort, for example, is that local school authorities can adapt the national curricula to local conditions and develop their own strategies for ICT implementation (OECD 2009b, 4).

National Plan for ICT in Education

The new national curriculum, the Knowledge Promotion, is currently the most important ICT policy for schools because it is seen as a legal directive defining learning goals for all subject areas for key grade stages (Johannessen 2010; Soby and Egeberg 2010). As a competency-based curriculum, the new curriculum defines digital skills as the ability to make use of information and communication technology, and regards it as one of the five basic skills necessary for students to succeed in the knowledge society. The other four basic skills identified in the curriculum include the abilities to read, write, perform basic mathematical operations and express oneself orally. One of the major changes in the new national curriculum from its predecessors is that it articulates the specific use of ICT in different subject areas, often with explicit learning goals for digital skills (some examples of these are provided in Improving Student Learning through Technology-Enhanced Instruction section).

Norway had a stand-alone national strategy for ICT in education, the Program for Digital Literacy 2004–08. However, after facing challenges in its implementation, the Ministry realized that ICT should be embedded and integrated into the national curriculum rather than treating it as a separate entity with a stand-alone strategy. The Ministry made similar efforts to reduce the number of national strategies of this nature because the pressure of too many strategies tends to be counter-productive and difficult to coordinate (Johannessen 2010).

Private Sector Involvement

There are no targeted partnerships between the Ministry and the industry. Instead, the Ministry generally maintains good relations with various organizations that can inform and support the Ministry's policies and programs. Such organizations include ICT Norway, an interest group for the ICT industry, and Abelia, a nonprofit, nonparty political trade and employers' association that is part of the Norwegian Confederation for Trade and Industry (Abelia, *Næringslivets Hovedorganisasjon*). Similarly, the Ministry generally maintains a good dialogue with the major vendors of learning management systems (LMSs) (Johannessen 2010).

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

The main responsibility for school ICT infrastructure lies with regional and local authorities. According to a survey conducted by the Ministry whose results were released in 2005 (Directorate for Primary and Secondary Education 2005 cited in Balanskat and Kefala (2006), all Norwegian schools have access to the Internet, most have school homepages, and many have school Intranets. Additionally, the computer-to-student ratio is approximately one to eight for primary and lower-secondary education (ages 6–15) and one to two and a half for upper-secondary and vocational education (ages 16–19).[33] Almost all upper-secondary and vocational schools have broadband connections, but only 37 percent of primary and lower-secondary schools have high-speed connections (2 Mbps or faster). In remote areas, the survey study found that broadband connections continued to be a challenge.

At the national level, the Center is implementing Federated Identity Management (*Feide*), a program designed for managing identity and access to educational information with a single username and password. *Feide* began in 2006 with the initial goal of becoming available as an option through all primary and secondary schools (serving students of ages 6–18) in Norway by the end of 2010. Although the program had success in higher education and upper-secondary education (ages 16 and older), implementation faced challenges at the primary and lower-secondary levels (ages 6–15), with an adoption rate of 10–15 percent (Johannessen 2010). The Ministry personnel explained that the effort has been quite fragmented and that it is difficult to reach over 400 municipalities in the country. The annual budget for this program is USD 1.6 million (Johannessen and Strømsheim 2010).

LMS penetration has reached 100 percent in both primary and secondary schools (Johannessen and Strømsheim 2010; Soby and Egeberg 2010). Fronter and It's Learning are by far the most popular platforms, while Microsoft's Learning Gateway and PedIt are used by some schools. Transferring information and resources in a simple, safe manner as well as security issues are seen as major challenges with all LMSs (Soby and Egeberg 2010). Although the use of learning platforms in school has been subject to continuous debate, a recent study looking at relationships between the teacher and student use of ICT and student scores on a test of digital literacy found positive correlations between teachers' use of learning platforms and student scores on digital literacy (ITU 2009; additional details about the digital literacy test are provided in the next section).

[33] Computers in these computer-to-student ratio statistics have access to the Internet.

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

As described earlier, student ICT skills are considered as one of the five basic skills and are embedded in the national curriculum in all subject areas at different grade levels. The student ICT competency includes the abilities to use digital tools (e.g., word processing, the Internet, subject-specific tools) as well as to evaluate and manage information. The national curriculum makes some reference to legal and ethical issues related to ICT, such as intellectual property rights and source criticism. Although it is not very well defined, Internet safety issues are also included in the national curriculum (Soby and Egeberg 2010). More specifically, the national curriculum in the arts standards, for example, calls for fifth-grade students (ages 10–11) to plan and build models of houses and rooms using digital tools and simple craft techniques. Standards for 10th-grade students (ages 15–16) include evaluating messages, ethical issues, and visual quality of advertisement, film, websites, and computer games (Johannessen 2009).

Currently, there is no official national test for ICT skills, although there is an ongoing debate about adopting a digital literacy test locally developed in Oslo and Bergen—the two largest cities in Norway—at the national level (Soby and Egeberg 2010). In fact, in 2009, Oslo's digital literacy test was piloted at the national level as part of the national ICT in education data-collection effort (ITU 2009). Items included in the test were all multiple-choice questions focused on two forms of ICT competency: basic ICT skills and problem-solving with ICT. Identifying the correct file type (e.g., picture) from the extension of a file name (e.g., .pps) is an example of the former, while calculating a mean with a spreadsheet is an example of the latter. The test also included several questions on social and ethical issues, communication and use of multiple sources (more details are provided in the National ICT in Education Indicator Collection section below). Additionally, some basic ICT skills such as using spreadsheets and the Internet are assessed in the final exams in regular subject areas that students take after 10th grade (ages 16 and older) (Soby and Egeberg 2010).

Priorities and Programs in This Area

As part of the strategy to implement the Knowledge Promotion curriculum reform, the Ministry focused on upgrading digital learning resources and making them widely available for students and teachers through education portals. The Ministry also provided funding to school authorities to purchase commercially available digital resources.

At the national level, there are three educational Web portals: 1) the National Digital Learning Arena for upper-secondary education (ages 16–18); 2) Skolenettet for primary and secondary education; and 3) Utdanning.no for the entire education sector. The National Digital Learning Arena was created out of Ministry's USD 7.6 million initiative (implemented from 2006–08) to develop digital learning resources for upper-secondary education. Started as an inter-regional initiative in 2007, the National Digital Learning Arena supports and coordinates the efforts of county councils to provide access to high-quality digital learning resources in some of the core subject areas (Johannessen and Strømsheim 2010; OECD 2009a). The portal provides both commercially available and locally developed learning materials, all reviewed by university experts, for free of charge using creative commons licenses (Johannessen 2010; Soby and Egeberg 2010). Currently, all Norway's regional authorities except for Oslo participate in this effort. The Ministry's funding (USD 4.0 million) was used to develop the technical platform and learning resources, which included the purchase of commercially available content. Unfortunately, the Arena has caused controversy and conflict with the publishers' association in Norway (Johannessen 2010).

The other two national portals, Skolenettet and Utdanning.no, both collect, index, and make available digital content for teachers and students (Soby and Egeberg 2010). The former is for primary and secondary education and is the website of the Directorate for Education and Training—the group within the Ministry responsible for primary and secondary education. As such, Skolenettet contains information, guidance and resources related to the national curriculum for teachers, school leaders and parents (OECD 2009b, 6-9; Johannessen 2010). Utdanning.no on the other hand is intended for the entire education sector and is composed of a course description depository, a learning content metadata repository, and a learning content publishing framework (OECD 2009b). Utdanning.no provides mostly links to resources available elsewhere, including those in Skolenettet,http://skolenettet.no rather than actual resources developed in-house; therefore, it is sometimes considered as more of a "referatory." According to the Ministry, both of these educational portals have been met with limited success since portals are viewed as an outdated solution to providing access to resources and services (Johannessen 2010). Additionally, there was no incentive for teachers and schools to use the portals, especially to share the digital resources that they created by themselves (OECD 2009b). However, the portal Utdanning.no, now managed by the Center for ICT in Education, is incorporating Web-2.0 elements, such as user ratings and comments (OECD 2009b), and has experienced some growth in Web traffic (Johannessen 2010). Skolenettet is slated to close by the end of the 2010-2011 school year (Johannessen 2010).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

Norway's ICT standards for teachers are indirectly expressed in the new national curriculum. Because digital literacy is one of the five basic skills in the new national curriculum, it is compulsory for teachers to integrate ICT in their teaching in order to ensure that students reach the curricular competence goals requiring the use of digital tools (Johannessen and Strømsheim 2010). However, teachers are not assessed against these standards (Johannessen and Strømsheim 2010). Nor is there a separate assessment or accreditation scheme for teachers' ICT competence (Soby and Egeberg 2010) apart from an 11-item digital literacy test for teachers piloted in 2009 as part of Norway's biannual ICT in education data-collection effort called ITU Monitor (more details are provided in National ICT in Education Indicator Collection section below).

Priorities and Programs in his Area

Improving teachers' technical ICT skills is not a priority at the national level because it had been a priority previously and also because schools and individual teachers are responsible for those skills (Johannessen 2010). In fact, there is no nationally mandated in-service training on ICT for teachers (Soby and Egeberg 2010). Local authorities initiate and provide professional development for in-service teachers through universities and private companies. These providers offer training on the pedagogical use of ICT in the form of online learning, traditional face-to-face courses or a blend of both. However, the number of these courses and their nature greatly vary depending on local priorities and needs.

At the national level, there are a few noteworthy trends. Both in-service and pre-service programs have incorporated ICT integration as part of their focus. For example, in 2008, in-service teacher training courses shifted from short courses to longer courses for university or college credit (Johannessen 2010). These new courses focus on the integration of ICT skills into different subject areas along with other basic skills emphasized by the new national curriculum. As for initial teacher training, beginning in August 2010, the system changed from a single track for all teachers of grades 1–10 to two separate tracks: one for teachers of grades 1–7 (primary, ages 6–12) and another for teachers of grades 5–10 (ages 10–15). These two tracks have a greater focus on pedagogy and the basic skills in the subject curriculum, facilitating greater ICT integration with a pedagogical orientation (Johannessen 2010).

Secondly, the national portals of digital learning resources described above—the National Digital Learning Arena, Utdanning.no and Skolenettet—all provide venues for teacher professional development focusing on ICT. The National Digital Learning Arena, for example, offers activities that help teachers acquire both technical and pedagogical skills related to ICT and help them develop online materials and share them with others in the online environment (Johannessen 2010). Similarly, the other two national educational portals help teachers' informal learning of ICT skills by providing them with access to high-quality online instructional resources.

Lastly, the newly established Center for ICT in Education is expected to play a central role in developing incentives and resources for teachers and schools to integrate ICT in their work (Soby and Egeberg 2010).

Continuous Improvement Efforts

Investing in Data Systems

Norway has invested in the national quality assessment system focused on improving the quality of basic education. Established as part of the Knowledge Promotion curriculum reform (Soby and Egeberg 2010), this national data system relies largely on two types of data: student achievement data from annual national exams and learning environment data from surveys with students, teachers and parents. Both of these data sets are collected online annually (Johannessen and Strømsheim 2010). The national tests are computer-based and are given to fifth- and eighth-grade students in Norwegian, English and Mathematics (Soby and Egeberg 2010; Statistics Norway 2010). The student achievement data from these tests are used as a tool for teachers and schools to give feedback to individual students, rather than as a tool to monitor and evaluate school performance. There has been controversy over the use of student data for the latter purpose, and therefore the Ministry has elected not to use the data in such a way at this time (Johannessen 2010). An online annual student survey, the main instrument to collect data on school environments, covers topics including satisfaction with teachers, academic challenge, student democracy, physical learning environment, bullying at school, motivation and professional guidance (Quality Assessment System website).

The Ministry, particularly the Directorate for Education and Training, is responsible for the national quality assessment system, supervising and supporting schools to use data to become learning organizations (Soby and Egeberg 2010). The Directorate's main tasks include analyzing data, making the data and findings publicly available for regional and local education authorities through one of the national online portals, *Skoleporten*, and providing guidance, support, and supervision and administration (Johannessen and Strømsheim 2010; Soby and Egeberg 2010).

National ICT Program and Policy Evaluation Efforts

Norway participated in the E-Learning Nordic 2006 study of ICT use in Nordic countries (Denmark, Finland, Norway and Sweden). Data was collected via Internet-based surveys sent in 2005 to 224 Nordic schools, and follow-up visits to twelve of those schools. There were 8,000 survey respondents including teachers and students in grades 5, 8 and 11 (ages 11, 14 and 17, respectively), parents of these students and principals (separate survey questionnaires were developed for each respondent group). The school visits included interviews with teachers, students, school management, parents and municipal representatives (Kiesa et al. 2006, 98). The report, which addressed the perceived impact of ICT, found that ICT does have a positive impact on improving student learning in Nordic countries, but that the potential of ICT is not fully realized in many schools (Kiesa et al 2006). Although teachers tend to use ICT to support subject-specific content, the study found a positive impact of ICT in pedagogy on student engagement, differentiation, creativity and efficient use of time. Regarding LMSs, the report also noted that some schools have invested in LMSs to improve education and knowledge-sharing, but it seems that use of the systems has been rather limited.

National ICT in Education Indicator Collections

ICT in education indicators are collected by the Ministry biennially since 2003 through the ITU Monitor program. Quantitative surveys of ICT use are administered to teachers and students in 7th, 9th, and 12th grades (ages 12, 14, and 17, respectively). The program's primary objective is to identify the extent to which ICT is integrated with pedagogy and broadly assess the frequency and nature of its use in Norwegian schools (ITU 2009). This information is used to keep ICT in education as an important issue for policy-makers and schools since ICT use remains an issue despite it being officially embedded in the curriculum (Johannessen 2010).

Primary indicators reported in the ITU Monitor 2009 include student access to computers in school, frequency of student computer use in school and at home for homework, frequency of student computer use in different subjects (as an indicator of how well digital skills are integrated in subjects) and teacher use of computers in instruction (ITU 2009). Some of the key findings from the 2009 Monitor include that ICT is more frequently used in upper-secondary schools than in primary and lower-secondary schools, and that across all grade levels, computers are used most frequently for reading and writing in the Norwegian language.

In addition to the student and teacher surveys, in 2009, this Monitor Program also piloted a digital literacy test for teachers and students (Johannessen 2010). The tests included only multiple-choice questions and focused on assessing basic ICT and problem-solving with ICT (ITU 2009). The city of Oslo had previously piloted this test, and there was an expectation that there may be a demand for making this test a national test as other cities and schools expressed interest in adopting this test (Johannessen 2010). Unfortunately, the added testing burden on teachers and schools and the difficulty of testing digital skills in the context of regular subject areas led the Ministry to reconsider its plans to administer the test nationally.

More basic information about access and infrastructure, such as number of pupils per computer and connectivity, is collected through the Quality Assessment System (*Skoleporten*). In addition to these national data-collection efforts, the Ministry developed an online tool for schools to evaluate their progress with ICT. Modeled after the UK's self-review framework, ITU Mentor consists of a set of statements about ICT for school leaders and teachers to discuss and evaluate their achievement in the following six areas: leadership and management, planning, learning, assessment of ICT capacity, professional development and resources (Soby and Egeberg 2010).

Plans to Participate in International Data Collections

Norway plans to participate in the Program for International Student Assessment (PISA) 2012 and International Computer and Information Literacy Study (ICILS) 2013.

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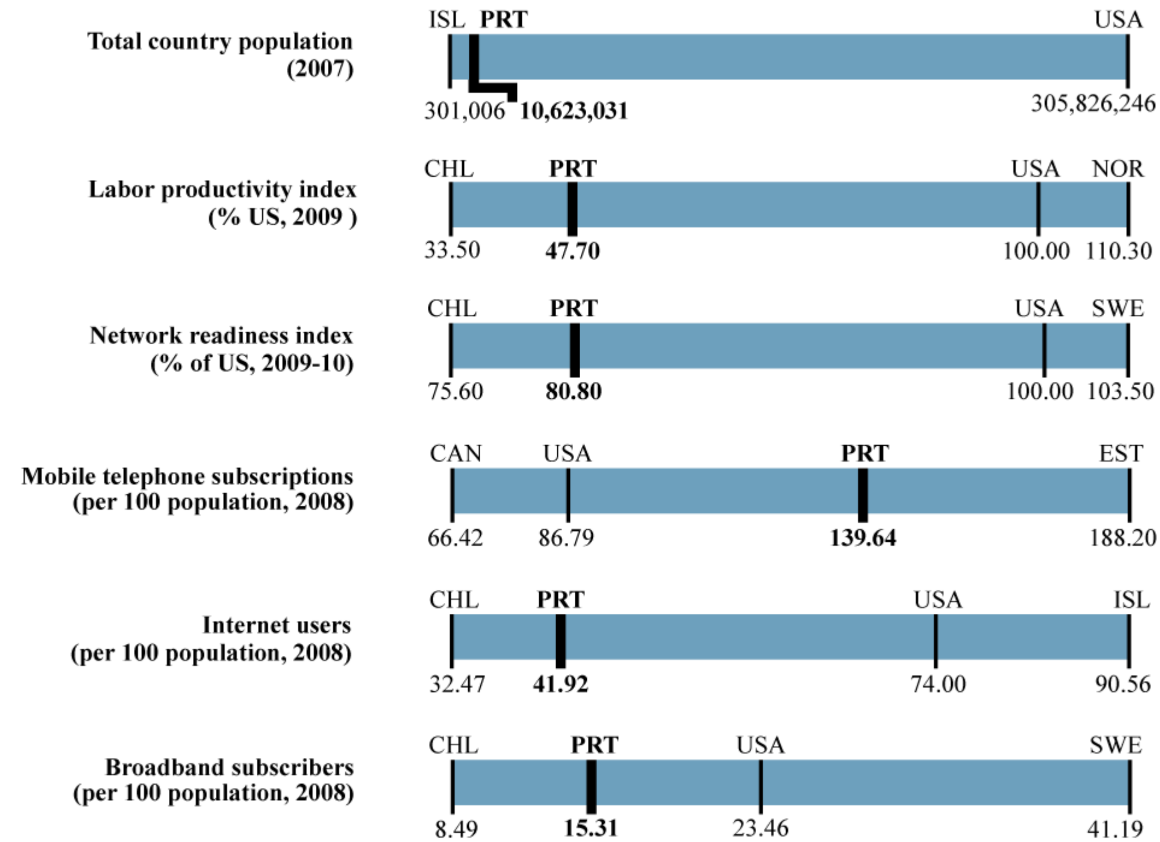
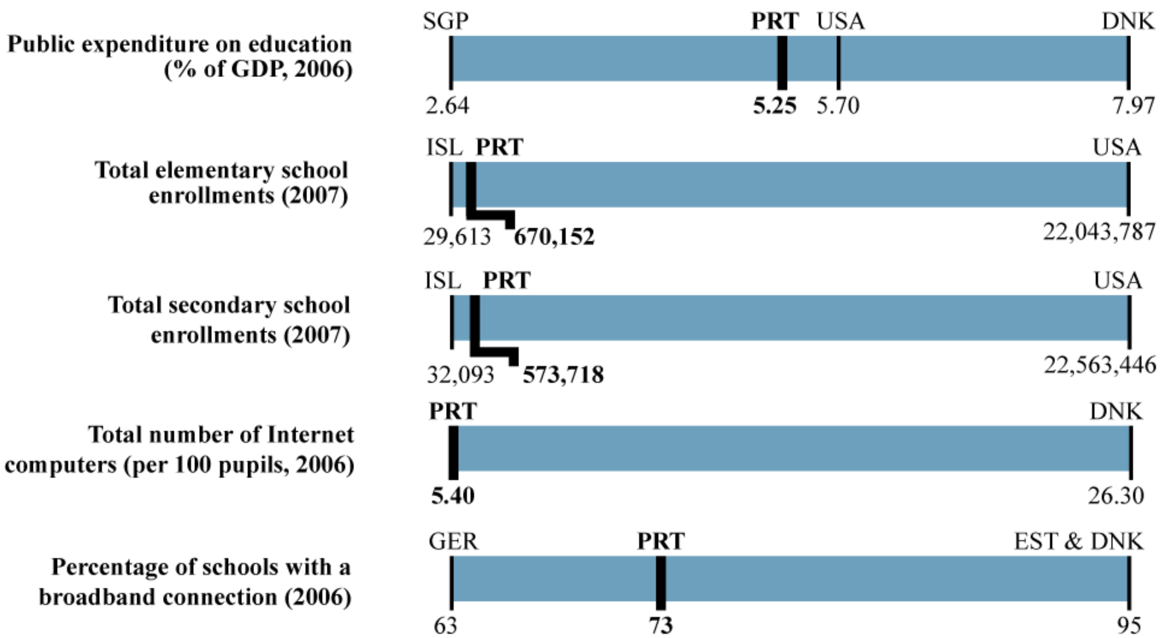
Portugal ICT in Education Profile

Country Statistics at a Glance

National Indicators



Education Indicators



Portugal ICT in Education Profile

ICT in Education Highlights

- Portugal published a comprehensive national ICT plan for education in 2007, which led to extensive ICT programs in infrastructure, teacher training and digital content.
- Since 2007, over 1.2 million laptops were distributed to teachers and students, representing one of the largest government laptop rollouts in the international community to date. The laptops are subsidized in large part by offset agreements with telecommunications companies.
- Under the current national plan, Portugal successfully lowered the student-to-computer ratio to two-to-one, installed video projectors in every classroom, put interactive whiteboards in one out of three classrooms and reached over 95 percent of schools with high-speed (at least 48 Mbps) Internet access.
- The national school Web portal for all of Portugal's schools is available to teachers and students, integrates a school management system, a learning management system (LMS), and provides access to digital learning resources.
- Portugal's centralized technical assistance program serves as a centralized hub for technical assistance. When fully operational, students and teachers will be able to receive assistance for problems ranging from downloading software updates to hardware installations and replacements.
- Through its ICT Competencies program, Portugal aims to certify 90 percent of teachers in ICT skills by 2010.

Structure and Nature of the Education System

Authorities Primarily Responsible

For the most part, the education system of Portugal is centralized at the national level and managed through two ministries: the Ministry of Education and the Ministry of Science, Technology and Higher Education. However, there are two autonomous regions in Portugal, Azores and Madeira, where education policies are adapted and enacted by regional governments.

The Ministry controls most major policy functions, including planning, resource allocation and inspection for K–12 education. Every three years, the Ministry requires schools to develop strategic plans, known as "educational projects" in Portugal, which are then approved by the Ministry in the same cycle; nevertheless, schools have autonomy in deciding how to implement the plans. Responsibility for school administration is divided among several local bodies:

- The School Assembly that includes representation from the local community approves the school's strategic plan as well as internal school procedures;
- The Executive Management is a single school leader or a board that manages the school;
- The Pedagogical Council sets the pedagogical strategy of the school; and

The Administrative Board makes financial and administrative decisions for the school.

The boards of education at the municipal level play a coordinating role, helping schools enact education policy, assisting in the development of school networks and promoting efficient management (European Commission 2007).

In the case of ICT in education, the Ministry's work is also supported by the Ministry of Communication, which has developed a series of infrastructure-related initiatives described below that are closely linked with those outlined by the national plan for ICT in education (Evaristo 2010b).

ICT in Education

National Plan for ICT in Education

Portugal's Technological Plan for Education was designed by the Ministry and approved in 2007 by a resolution of the Council of Ministers, which means that the entire government was officially responsible for its approval. The plan grew out of the Lisbon Strategy (a European Union [EU] plan) and Portugal's Strategic National Plan, both of which presented goals for "modernizing" education and integrating ICT into society. Portugal's Technological Plan for Education is a comprehensive national plan; it outlines specific objectives, projects, and indicators for success along four main dimensions:

Technology goals: Improving the computer-to-student ratio, improving Internet connectivity, restructuring school networks, and implementing an e-card system for all students.

Content goals: Implementing school portals, learning management systems (LMSs) and making digital learning resources available to teachers and students.

Training goals: Restructuring training in ICT for teachers, introducing ICT certification, using ICT for assessment and working with ICT companies to establish ICT internships and academies.

Investment and financing goals: Investing in digital inclusion funds, reviewing and incentivizing technological patronage and channeling EU funds into ICT in education. (Portuguese Ministry of Education 2007)

When the plan was drafted, these dimensions were supposed to be integrated in a unified manner under the supervision of the Ministry of Education and by subcommittees responsible for each program area. In practice, integration has been less than perfect. Delays and other logistical hurdles have made synchronizing rollout of programs a challenge. Progress indicators for each of the plan's programs are available on the PTE website (Portuguese Ministry of Education 2007). Importantly, however, even though Portugal has been especially hard hit by the European debt crisis, funds for the Technological Plan for Education are guaranteed (Evaristo 2010a).

Portugal's educational technology plan specifies a series of national programs related to educational technology, all of which are underway and fully described on the plan's website. Thus far, most initiatives have been related to infrastructure, though the plan is flexible enough to accommodate new programs within its structure in the future (Evaristo 2010a).

The plan is scheduled to expire in 2010, but the government is considering an update and extension through 2013 (Evaristo 2010b). Such an update would not modify current timelines; it would serve only to propose additional objectives and/or programs related to the expansion of web services for teachers, students and families (Evaristo 2010a).

Details of National Plan

Title: Technological Plan for Education: The Portuguese Framework for ICT in Education

Year of Publication: 2007

URL: http://www.pte.gov.pt/pte/EN/

Private Sector Involvement

Portugal is committed to involving private institutions in education through a combination of corporate sponsorships, offset agreements and government contracts for hardware and software. As part of the national ICT plan, the government has made it a priority to increase awareness among businesses and other organizations about the incentives and benefits of sponsoring education initiatives (Ministry of Education). Hardware companies such as Intel and telecommunications companies including Vodafone, Optimus and TMN have been heavily involved in Portugal's laptop distribution programs.

ICT companies also provide opportunities for workplace readiness via the ICT academies and ICT internships programs, organized by the Ministry as part of the national ICT plan. For ICT academies, Cisco, Microsoft, Apple, Oracle, Linux and Sun Microsystems are establishing 250 in-school training centers by the end of 2010 in order to promote workplace readiness in the IT sector. The Ministry is training teachers to staff these centers. For ICT internships, the ministry has established relationships with over 40 national and international technology companies to provide real-world training for several hundred students in vocational education (Portuguese Ministry of Education 2007).

Increasing ICT Infrastructure and Support

Priorities and programs in this area

As part of a benchmarking exercise while developing the national plan, the Ministry determined that it was lagging behind other European countries in terms of providing ICT access to students. As a result, updating infrastructure has been Portugal's main area of focus under its current educational technology plan. By the end of 2010, the ministry aims to equip all lower- and upper-secondary schools (ages 13–18) with high-speed Internet (48 Mbps) and enough computers to lower the student-computer ratio in all schools to two-to-one. Also by 2010, teachers should be using ICT in 25 percent of classes.

To this end, the Ministry has launched several programs focused on school infrastructure and support:

Technological Kit: This program aims to bring the student-to-computer ratio down to two-to-one, to add video projectors in every classroom and to put interactive whiteboards in every three classrooms by 2010. As of June 2010, all targets had been achieved.

Voice Over Internet Protocol (VOIP): This program aims to provide an integrated VOIP and videoconferencing solution for all schools. As of 2010, a competitive bidding process has been launched. International companies are allowed to bid in order to ensure that the government signs the most cost efficient contract.

Internet in the Classroom: Local Area Networks: This program aims to install local area networks with wireless access points in every school. To date 35 percent of schools have been reached.

High-Speed Broadband Internet: This program aims to install high-speed Internet access (at least 48 Mbps) in all lower- and upper-secondary schools by 2010; 93 percent of primary schools (ages 6–12) and 97 percent of lower- and upper-secondary schools (ages 13–18) have achieved this target. (Portuguese Ministry of Education 2007)

Although not exclusively school-infrastructure initiatives, Portugal's laptop distribution programs for primary school students (ages 6–12; 2010 budget: USD 67 million), for secondary school students (ages 13–18; budget unavailable) and for teachers in schools represent the government's most visible ICT effort.[34] Together, over 1.2 million laptops have been distributed since 2007, amounting to one of the largest government laptop rollouts in the international community to date (Portuguese Ministry of Education 2007). The goal of the programs is to generalize computer use among students from an early age in school and at home by offering laptops at affordable prices. The programs operate in parallel to other infrastructure initiatives, but are considered "transversal" programs because they also relate to the national plan's content and teacher training goals. Across all programs, the laptops are owned by students and teachers, and integration into the classroom is not required (Evaristo 2010b). The guiding philosophy is that teachers will use the devices as they see fit, and the program is not expected to change every classroom (Evaristo 2010c).

In particular, the laptop program for students ages 15–18 (*e.escola*), provides laptops to students at a cost to students of USD 210. Children from less affluent homes who already receive government support for schooling through a separate program are eligible to receive laptops at no cost. Through an offset agreement, telecommunications companies subsidize the laptops and receive a discount on their telecommunication license fees. As part of the program, students also purchase a 3-year contract for 3G Internet access (2–3Mpbs, at USD 7 per month), giving business to the companies.

[34] Another program provides laptops for adults enrolled in the "New Opportunities" program.

The laptop program is for student ages 6–12 (*e.escolinha*) was also funded in this way until 2009. The Ministry now finances it because the Internet contract agreement was not viewed as necessary for primary school students (Evaristo 2010a). The laptop available for purchase under this program is the Magellen PC, an Intel-designed laptop made specifically for students and preloaded with Ministry-approved software. Families may purchase the laptops for USD 70, USD 28 or at no cost, depending on their level of need. Unfortunately, the logistics of providing laptops to students at the beginning of the school year have been difficult; in many cases, students did not receive their computers on time (Evaristo 2010a).

To address the need for specialized technical support created by this influx of infrastructure, the ministry established a centralized and integrated system for information technology (IT) support and maintenance (CATE) for teachers, students, and school staff. The program is still under development and will serve to coordinate technical support from multiple providers. The ministry hopes that through a combination of web, phone, and face-to-face support, the program will be able to assist schools with technical needs ranging from downloading software updates to hardware installation and replacement. Before developing the model, the ministry conducted a needs assessment and models for technical support in other countries.

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

There are no general ICT standards for education, although there are stand-alone ICT subjects in 9th and 10th grades (ages 14–15), in which students' skills are assessed internally. There are also ICT-specific subjects in vocational schools (Evaristo 2010a).

Priorities and Programs in This Area

Portugal's school laptop programs aim to enable new forms of student learning. For example, the Magellan PC used in the laptop program for students age 6–12 comes preloaded with Mythware's e-Learning Class software. Teachers can use the program to "project" content onto every child's laptop, take control of individual students' computers (including "blocking" all use of the laptop), create virtual groups, enable group chats, assign student "leaders" to guide learning of other group members and record student activity on their computers for assessment purposes. Teachers and students can also share resources and materials.

All students and teachers, regardless of their hardware, can also make use of the school portal (http://www.portaldasescolas.pt/), which aims to provide an online environment for collaboration, sharing of educational materials, distance learning and communication between teachers, students and parents. There are more than 1,000 digital materials available for use, and in 2010, the Ministry initiated a competitive bidding process for access to commercial digital educational resources (Portuguese Ministry of Education 2007). In the near future, access to an archive of national newspapers and magazines, content produced by schools, and educational videos will be available. There are also plans to integrate with the EU's Learning Resource Exchange (http://www.melt-project.eu/).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

The ICT certification program in Portugal's educational technology plan outlines competencies around digital skills and ICT integration into various aspects of teaching and learning (portfolios, learning management, etc). The Ministry announced its goal of certifying 90 percent of teachers by 2010.

Priorities and Programs in This Area

The ICT Competencies program proposed by the Ministry aims to develop teacher skills in ICT use and integration into the classroom. The program has two goals: (1) to create a system for ICT certification in Portugal; and (2) to certify 90 percent of the teachers in ICT by the end of 2010. Each of the three levels of ICT certification (digital skills, ICT integration and advanced ICT integration) may be earned by taking Ministry-approved courses offered by private organizations:

Digital skills (choice of one course, 15 hours per course): This course focuses on ICT skills such as accessing and using information, Internet security, creating presentations, working with data, etc.)

ICT integration (two required courses, two optional courses, 15 hours per course): These courses focus on teaching and learning with ICT, assessment with ICT, using whiteboards, using LMSs, etc.

Advanced ICT integration (Master's or doctorate degree): To achieve this level of certification, teachers must earn a degree in an ICT-related subject from an accredited institution.

Teacher training under the ICT Competencies program occurs in parallel to other professional development efforts, including three laptop-specific ICT training sessions of two hours each organized by school coordinators (Evaristo 2010a).

Teachers with already-developed ICT skills may also earn their certification by demonstrating their competencies to the director of their local teacher-training center. For example, a teacher who is able to demonstrate an ability to innovate using ICT, reflect on and investigate their practice and share with other teachers is eligible to earn an advanced ICT integration certification (GEPE 2008). At the time of writing, the certification system had been approved and the first-level course on digital skills had been designed and implemented in several settings.

Continuous Improvement Efforts

Investing in Data Systems

The Ministry is currently developing a national data system for centralized access to data on every teacher and student. The system will allow the Ministry to more efficiently monitor the progress of its students.

National ICT Program and Policy Evaluation Efforts

The Ministry has commissioned research on the national plan and its associated programs, and a series of studies are underway. Results from the research were not publicly available at the time of collection. Prior to implementation, the Ministry published assessments for several programs to outline project components and to describe relevant research that informed program planning. The research is publicly available in Portuguese on the national plan document library.

Many of the programs under the national plan outline specific indicators for measuring progress. For example, the Technological Kit program specifies the number of computers, interactive whiteboards and projectors that should be installed in classrooms by the end of 2010. The ministry of Education monitors achievement of these objectives and posts status updates for each program on the national plan's website.

National ICT in Education Indicator Collections

Data was not available at time of collection.

Plans to Participate in International Data Collections

Portugal participates in the Program for International Student Assessment (PISA).

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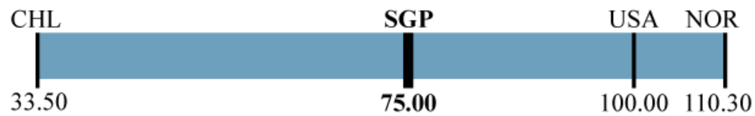
Country Statistics at a Glance

National Indicators

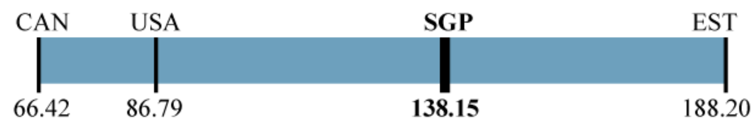
Total country population (2007)

Labor productivity index (% US, 2009)



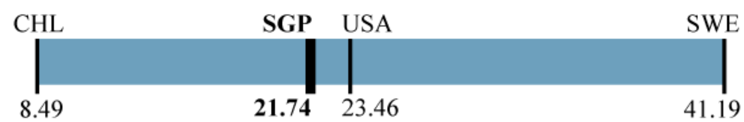
Network readiness index (% of US, 2009-10)

Mobile telephone subscriptions (per 100 population, 2008)



Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

Public expenditure on education (% of GDP, 2008)

Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)

Data not available.

Percentage of schools with a broadband connection (2006)

Data not available.

ICT in Education Highlights

- Having attained its infrastructure targets, Singapore turns its attention to advancing student uses of ICT to promote self-directed and collaborated learning, to enhance teacher capability and implement longer-term sustainability of programs by delegating responsibility to the school level.
- The Cyber Wellness program integrates responsible uses of ICT into regular curricular lessons reinforced with supports from teachers and school leaders, independent researchers that track school and home usage, a national portal that includes access for parents and a student ambassador program to promote peer education.
- The ICT Mentorship program promotes a grassroots approach to scale and sustainability of exemplary pedagogical uses of ICT by leveraging existing capabilities of exemplary teachers in schools.

Structure and Nature of the Education System

Authorities Primarily Responsible

The government of Singapore, through the Ministry of Education, is the primary driver of all education policy and administration. It provides deliberate definitions of the national curriculum, which include providing syllabi for subject areas as well as guidelines for textbook use and assessment. It also oversees 10 statutory boards: the council for private education;[35] the country's five polytechnic universities; the Institute for Technical Education; the Institute of Southeast Asian Studies, a center dedicated to conducting sociopolitical, security and economic research in the Southeast Asian region; the Singapore Science center that deals with informal learning; and the Singapore Examinations and Assessment Board, which administers national examinations such as the Primary School Leaving Examination (About Us website).

Teacher education is likewise centralized under the National Institute of Education at Nanyang Technological University, which provides all pre-service preparation and some in-service professional development (Cheah 2010b). The Ministry determines the number of teachers to be trained and provides public funding to cover teachers' full tuition, an amount decided by the Ministry. The National Institute of Education runs three programs: a four-year undergraduate program, a one-year postgraduate diploma and a two-year post-graduate diploma. Teachers are hired by the Ministry prior to enrollment, a system that guarantees them a salary while studying and a teaching assignment upon graduation. Subsequently, every teacher is entitled to 100 hours of in-service professional development for which the Ministry reimburses the cost. The National Institute of Education operates two types of in-service training: a certification for a Masters in Sciences, Masters in Teaching, Masters in Education and the like, for which the Ministry pays tuition as though supporting a degree candidate at the university; and specially-requested

[35] Private schools in Singapore receive limited funding from the Ministry, which has an advisory and supervisory role.

programs for which the Ministry selects the teachers who will enroll. The second type of training does not lead to a university degree. In cases where the National Institute of Education is unable to provide the training, the Ministry will turn to other providers.

Political and Economic Context

According to the Compulsory Education Act passed in 2000 in Singapore, education is compulsory for all children between the ages of 6–15 who must complete six years at a national primary school (Ministry of Education Singapore website).[36] Students have the option to enroll at state schools where education is free or attend private schools run by community organizations, religious bodies or civic or business groups. At the end of the six years, all students take the required Primary School Leaving Examination, which results in their placement into differentiated educational tracks based on ability and interest, including: special, express, normal (academic) and normal (technical). At the secondary level, students complete higher-level examinations that define pre-universities or postsecondary institutions to which they may apply.

Although authority over many aspects of education rests centrally with the Ministry, the monitoring of instructional programs is delegated to the individual schools. The Ministry supervises neither school administration nor implementation of programs and instead leaves such questions to school leadership.

National Plan for ICT in Education

Singapore's national plan for ICT in education (master plan) is developed solely by the Ministry and covers students ages 6–15 only. Updated every five to six years, each master plan progressively lays the foundation upon which all the ICT in education programs are designed in order to target particular needs.

The first master plan went into effect in 1997 and focused on building the infrastructure both in terms of technology—i.e., hardware, software and connectivity—and human resources to ensure that teachers achieve the basic competency required for using ICT. The second master plan, which went into effect in 2002, was aimed at capacity-building within schools, and pushed for cutting edge uses of ICT such as robotics and 3-D immersive environments. The Ministry sought to create institutions of excellence as well as test beds for research and development in order to encourage experimentation and identify models for successful ICT integration. The second master plan saw a decrease in expenditure from the previous plan, which required large capital investments to purchase the required ICT infrastructure. The third and current master plan covers the period 2009–14. Building on accomplishments of the past, the Ministry plans to scale practices beyond pilot schools to affect the entire system. This plan sets in place the structures and policies that will bring fresh ideas and develop new theories with a focus on well-grounded support.

[36] Passage of the Compulsory Education Act made parents' failure to enroll their children in primary school a criminal act.

The outcome goal of the current plan is for students to "develop competencies for self-directed and collaborative learning through the effective use of ICT [and to] become discerning and responsible ICT users" with a focus on anytime-anywhere learning (ICT Connection website). The three key enablers are: school leadership for providing direction, communicating that vision and creating a conducive environment with systematic support; teacher capacity to guide students and provide structures that allow for such experiences; and infrastructure, including Internet connectivity, within the school and at the Ministry level with opportunities for extension to the home for every student.

The Ministry is implementing a variety of integrated programs that focus on ICT integration in teaching and learning and that address the need for systemic support. In some cases, programs that were initiated as part of the former master plan continue through the current master plan. Implementation strategies, each of which is enacted through a variety of programs, were drafted along with five key strands (ICT Connection website):

1. ICT in curriculum, pedagogy and assessment: This includes the development of a core set of subject-specific ICT-enriched learning experiences that will eventually be incorporated formally into the syllabus; baseline ICT standards for students; and ICT Connection, a platform for schools to dialogue and for the Ministry to "capture and distill exemplary practices of good curricular instruction."
2. Cyber Wellness: This strand includes programs to embed content on ethical and responsible ICT use in civics, moral education and other appropriate subjects; commissioning research on students' behavioral patterns; and providing professional development for teachers and school leaders in order to effectively implement such programs.
3. Professional Development: Following the idea that teachers must experience the learning environment they are expected to deliver to their students, the Ministry is shifting towards "differentiated professional development that is practice-based and models the target instructional behavior." Furthermore, attention is given to the roles that other (nonteaching) staff can play to further support for ICT integration.
4. Research and Development: This strand focuses on protoyping pedagogical principles and classroom practices, developing ICT-infused learning experiences, creating interactive digital media-based environments and implementing whole-school reform.
5. ICT Infrastructure: This covers efforts to install fiber-optic cables in all schools in 2011, to enable connection speeds of 100 Mbps; a shift to mobile devices for students to enable out-of-school connectivity; and interoperability standards for learning management systems (LMSs) used by schools.[37]

[37] For more information on ICT in education planning in Singapore, see Koh and Lee (2008).

Singapore ICT in Education Profile

Details of National Plan

Title: Third Master Plan for ICT in Education

Year of Publication: 2009

URL:
http://ictconnection.edumall.sg/cos/o.x?c=/ictconnection/pagetree&func=view&rid=665

Private Sector Involvement

The government consults with the private sector in its development of policies and programs to address particular needs identified by the Ministry and in support of its programs. It does not systematically engage with private institutions. Rather, these arrangements are project-dependent and developed in accordance with mutual goals and agreements. For example, the Ministry has a memorandum of understanding with Microsoft to provide resources, financial or in-kind, to engage in projects such as Cyber Wellness Education or professional learning circles.

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

Singapore achieved its infrastructure targets during the first master plan, which ended in 2002 (Cheah 2010b). Ongoing efforts occur at a smaller scale and focus on enhancing the existing infrastructure, such as current initiatives to equip schools with fiber-optic cables to improve connection speed and to integrate mobile devices in order to extend learning beyond traditional classroom boundaries and facilitate anytime-anywhere learning, a key outcome of the third master plan.

Improving Student Learning Through Technology-Enhanced Instruction

National ICT in Education Standards for Students

"Singapore as a system has done quite well in traditional exams, so we are not looking to [improve] those scores. We are looking to increase [students'] understanding and 21st century competencies, deepening the learning of subjects with ICT used as a mediator to develop a more self-directed learner," reports Dr. Horn Mun Cheah, the Director of Educational Technology of the Ministry (Cheah 2010b). Although Singapore is still in the developmental stages regarding measuring 21st-century competencies, it has defined its Baseline ICT Standards (2009), the set of minimum ICT skill competencies defined developmentally for students ages 6–16. The Standards cover skill areas mapped against commonly used learning tools that have extensive utility in a technology-driven working environment: basic computer operations, Internet (searching), word processing, multimedia, spreadsheets, communication tools, and data-collection tools. They also emphasize ethical, legal and safe use, which is supported by the

Ministry's Cyber Wellness program, one of the key priority programs under the current plan. The Standards were benchmarked against international ICT standards as well as curriculum and existing practices in schools. The standards are purposely generic so that they can be integrated into core subject areas and project work.

Priorities and Programs in This Area

As one of the five implementation strands under the current master plan, the Ministry has taken a multilevel approach to addressing issues related to Cyber Wellness. Specified in the Baseline ICT Standards (Ministry of Education Singapore 2010) and articulated in the school curriculum, Cyber Wellness Education aims to create (1) a comfortable and proficient user of cyber-environments, (2) a discerning user able to verify content and sources and who avoids being bullied or succumbing to "computer addiction" and (3) an ethical user that is compliant with the law and good moral conduct. Teachers within the school are designated as Cyber Wellness coordinators who, together with school leaders, develop lessons that integrate topics specified in the Cyber Wellness matrix into regular lessons, particularly in Civics and Moral Education (social studies). Moreover, Cyber Wellness Education includes a Student Ambassador Program where selected students become role models in the school, receiving specialized training and conducting peer education activities in the school. Ambassadors participate in organized conferences to promote community-building across schools while also serving as a venue for recognizing their efforts. "By involving the students directly in the planning and carrying out [of] cyber wellness activities, this will heighten their own awareness of online safety concerns, as well as spread the adoption of positive cyber habits within the student community" (Cheah 2010a). Independent researchers run the Cyber Wellness Research Program for tracking the usage and exposure of students at school and at home on practices such as gaming addition. The Ministry will also develop an online portal for teachers, students and parents that provides them with easy contacts to counselors (like information help lines) in addition to relevant information and resources.

The Research and Development on Interactive Digital Media (IDM) in Education[38] program is a national-level research program supported by the National Research Foundation as part of a larger effort by the government "to grow Singapore into the interactive digital media capital building Singapore's brand, much like the Singapore education brand"[39] (Government of Singapore website). With funding from the National Research Foundation in the amount of USD 3.4 million, researchers at institutions of higher learning, e.g., universities, work towards (1) the development of innovative content and prototype tools and devices for an IDM-based learning environment, (2) understanding the interactive digital media-literacy required in learners, and (3) studying the social and psychological impact of interactive digital media on students.

[38] Interactive digital media is broadly defined as "any digitized media, such as voice, video, music, text, images, graphics and animation, delivered via various electronic platforms, that allow teachers and students varying degrees of freedom to actively interact with these media both as consumers and producers, for the purpose of learning" (Koh et al 2009, p. 617).

[39] Intelligent Nation 2015 (iN2015) is Singapore's 10-year master plan, the "blueprint to navigate Singapore's exhilarating transition into a global city, universally recognised as an enviable synthesis of technology, infrastructure, enterprise and manpower." It is a multi-agency effort of the public and private sectors under the leadership of the Infocommunications Development Authority of Singapore.

Related to efforts in the Research and Development on Interactive Digital Media in Education program's theme on Learning of the Future, the Future School Program has funded a small sample of schools that serve as test beds for the development and integration of cutting-edge technologies in the classroom, experimenting with particular pedagogical practices such as problem-based learning, as well as for supporting efficient school administration. Schools work with a designated research team and receive support from industry partners, where appropriate. The six schools selected as part of Phase I demonstrated the capacity for ICT integration/adoption or school leadership and, as a result, received generous funding that includes at least four additional teachers and additional technical support. The program expects to grow to 15 schools—about 5 percent of all schools in Singapore—by 2015 (Koh et al. 2009).

Furthermore, each school shares information with students and parents via the school portal, which parents can access free of charge. Here they learn about the activities in class, assignments, and other (online) opportunities to extend classroom experiences. Parents can also communicate with the school via email/info exchange, submit required forms and read announcements about activities. The Ministry makes available a portal for all schools, but a school may choose its own system as long as it conforms to technical standards.

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

The Ministry is developing its ICT professional development framework that defines roles, responsibilities and competencies for all school personnel implementing the use of ICT in schools as part of the current master plan. Its purpose is to guide school planning for the successful implementation of programs rather than serve as means of assessment or accountability, which might be counterproductive and cause undue anxiety amongst teachers (Cheah 2010b). There are no plans to test teachers' ICT competencies. Teachers are expected to have at least the skills that have been specified for students in the Baseline ICT Standards (Ministry of Education Singapore 2010), if not more, as part of their pre-service education and ongoing professional development.

Priorities and Programs in This Area

There are no programs that target the use of ICT for delivering professional development. Instead, teachers have access to Edumall 2.0, an Internet-based platform that hosts digital content produced or procured by Ministry headquarters division (Edumall 2.0 website).

The comprehensive ICT Mentorship program is one of the Ministry's "ground-up" efforts to identify teacher champions that both model and push for meaningful pedagogical uses of ICT in their respective disciplines. ICT mentors undergo a rigorous training program to develop not only their pedagogies but also their coaching competencies to assist in training their peers in their schools and create and nurture learning communities. ICT mentors are expected to train at least two other teachers in their schools each year while also assisting with the integration of ICT into the curriculum for the school in general. Although not limited to ICT interactions, ICT mentors can use the Internet-based platform Edumall 2.0 for asynchronous discussions on relevant topics categorized by subject area. ICT mentors will be trained in phases over four years with the aim of having four ICT mentors per school by 2012, or roughly 5–8 percent of the teacher population in schools.

Continuous Improvement Efforts

Although education in Singapore is highly centralized, the Ministry delegates responsibility for monitoring school performance to schools, with the expectation that they conduct self-evaluations in accordance with competencies identified by the Ministry, e.g., hours of teacher training, as well as teacher and school leader experience and tenure. Scores from the evaluation are considered an important factor in assessing school leader performance. Approximately every 5 years, a team verifies findings of the self-evaluations.

Investing in Data Systems

Furthermore, the Ministry uses School Cockpit, a Web-based school administration system containing student data such as grades, abilities and scores on national exams. Teachers can use this portal to carry out their administrative tasks. Access is restricted to teachers and school leaders only.

National ICT Program and Policy Evaluation Efforts

The Ministry started a longitudinal study in 2009 to track the implementation of the current master plan at the school level in order to understand progress to date and identify areas to fine tune along the way (NIE website). The study aims to capture information about teachers' and students' effect on the reforms being implemented. Methods include survey questionnaires for school leaders, teachers and students focusing on ICT leadership, use of ICT and extent of self-directed and collaborative learning in addition to classroom observations and focus group discussions with teachers and students. The first phase is currently underway. It focuses on validating the instruments and then collecting baseline information to inform longer term tracking of schools' progress. Sampling will be done at the national level. Private institutions conduct classroom observations and case studies and gather self-reports of students, teachers and school leaders.

National ICT in Education Indicator Collections

The Ministry aims to have all students meet its Baseline ICT Standards by 2013. The Ministry plans for testing using a task-based, adaptive assessment with a sample of 20 percent of schools in Singapore, beginning in 2010 for primary schools and in 2011 for secondary schools. Additionally, schools are expected to monitor their own students' progress, without any formal reporting responsibilities to the Ministry, as part of the goal to delegate primary responsibility to school leadership.

Plans to Participate in International Data Collections

There are plans to continue participation in the Program for International Student Assessment (PISA), the Trends in International Mathematics and Science Study (TIMSS) and the Progress in International Reading Literacy Study (PIRLS) within the next five years.

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South Korea ICT in Education Profile

Country Statistics at a Glance

National Indicators

Total country population (2007)

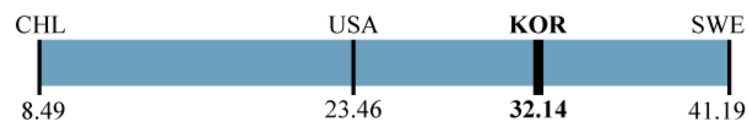
Labor productivity index (% US, 2009)

Network readiness index (% of US, 2009-10)

Mobile telephone subscriptions (per 100 population, 2008)

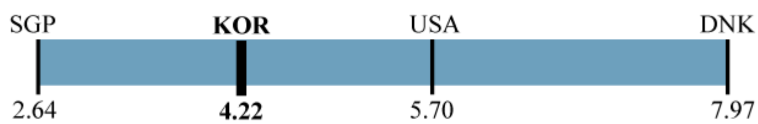
Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

Public expenditure on education (% of GDP, 2006)



Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)

Data not available.

Percentage of schools with a broadband connection (2006)

Data not available.

South Korea ICT in Education Profile

ICT in Education Highlights

Edunet, the ICT in education hub run by the Korea Education and Research Information Service (KERIS), was founded South Korea in 1999 with a mission encompassing infrastructure improvements, the development of digital learning resources and professional development.

All Korean schools are networked to the National Education Information System. Teachers and administrators use this school information system to communicate with parents. The Ministry and KERIS collect data from the system on an ongoing basis for continuous improvement purposes.

Korea reported piloting digital textbooks in primary schools. The Linux-based content is used in a one-to-one environment in which each student has a tablet computer such as an iPad. National roll out of digital textbooks for all primary and secondary students (ages 6–18) is slated for 2013.

Structure and Nature of the Education System

Authorities Primarily Responsible

The national government is primarily responsible for the educational system in South Korea (Kim 2010b). The Ministry of Education, Science and Technology (MEST, formerly known as the Ministry of Education and Human Resource Development) develops and regularly revises the national curriculum and develops and approves the materials for teaching it. Public school starts at approximately age six and ends around age 18.

The Korea Information and Research Information Service, an office of the Ministry, is responsible for implementing ICT in education practices that support governmental policy. Although this role is somewhat flexible, as policy priorities change with each new government, Korea Education and Research Information Service consistently supports the Ministry's broader goal of becoming an education superpower through the effective use of ICTs (MEST and KERIS 2008). For example, the current administration, in place since 2008, defined increasing local autonomy as one of its priorities. To support this goal, Korea Education and Research Information Service developed a monitoring system and made it accessible to parents and other stakeholders (MEST and KERIS 2008). Municipal and provincial offices for education complement the activities of Ministry of Education and Korea Education and Research Information Service by offering some in-service teacher training and by bearing responsibility for programs for gifted and special needs students (Oh 2009).

Political and Economic Context

South Korea is widely recognized as a global leader in ICT in education. In 2007, South Korean excellence in this field earned the country a United Nations Education, Scientific and Cultural Organization (UNESCO) prize as well as a Learning Impact Platinum Award from the IMS Global Learning Consortium (KERIS website). National educational policy in South Korea currently favors building a knowledge-based society by developing the nation's human-resource base. Although education has traditionally been and continues to be strongly centralized—with the Ministry creating the national curriculum and developing the materials for teaching it, sometimes even publishing those materials itself—the present government seeks to develop people's individual potential through a more diversified approach to learning. The three main points in this shift are increasing local autonomy so that the curriculum can be adapted to regional contexts; individualizing learning at the high school level; and diversifying the criteria for admission to university, which had previously depended solely on a standardized entrance exam (Kim 2010a, 2010b; Oh 2009; MEST and KERIS 2008).

ICT serves as both a catalyst and an ongoing support in the change from a centralized, uniform model of educational delivery to a more decentralized, context-based approach. Individualized, anytime-anywhere content and access can be more readily implemented thanks to South Korea's exceptional ICT infrastructure. In general, e-learning is intended to make widely available educational resources of the quality formerly available only to the elite, who would typically invest in private tutoring to supplement their children's education (KERIS website; Kim 2010b; Oh 2009). A corollary goal of e-learning policies is therefore to bolster people's trust in public education and lessen the perceived advantages of private tutoring. (KERIS Mission Statement website; Oh 2009).

Korea Education and Research Information Service's ICT in education work is carried out by Edunet, a hub founded by KERIS with support from other South Korean national education organizations. Edunet was founded in 1996, and today has an annual budget of USD 2.25 million. Its four-part mission is aligned with the government's top priorities of individualizing education while providing equal access:

- Improving infrastructure;
- Developing standards and models for digital learning resources, and producing materials aligned with those standards and making resources available to teachers, students and parents;
- Providing centralized services and support to help teachers integrate ICT into their pedagogy; and
- Supporting an online community for teachers, known as Edu-café.

National Plan for ICT in Education

The current national educational technology plan was developed jointly by the Ministry of Education, the Ministry of Knowledge Economy, and Korea Education and Research Information Service. MEST is solely responsible for approving it (Kim 2010b). The current plan builds on 15 years of work related to the two previous plans. "Adapting ICT into an Education Master Plan" first went into effect in 1996 with a tandem approach: hardware and infrastructure initiatives were carried out alongside the development of Edunet, an educational information service containing resources and support for teaching with ICT. Between 1997 and 2000, the government focused on enhancing teachers' use of ICTs by giving computers to all primary and secondary teachers (Oh 2009). The next wave, "Comprehensive Plan for the e-Learning in

Education Support System," took place in 2004–10. With hardware, infrastructure and access for teachers to digital learning resources and support already in place, this plan outlined goals for building South Korean competiveness through human resource development. The plan aimed to fulfill every citizen's right to an e-learning education as outlined in the Constitution (Oh 2009). Objectives included the creation of e-learning communities by strengthening ties between home, school and community, and improving equality of access to educational resources.

The current plan, which covers 2010–14, aims to create a decentralized "ecosystem" of ICT-based education and research to support a creative, productive workforce. This means establishing a nationwide system for collecting and archiving research-related information to be made available in ways that break down barriers between research sectors. The research archiving system will allow research institutions to share supercomputing facilities on which they can store and manipulate massive amounts of data. The development of this system calls for improving cybersecurity and revisiting related intellectual property laws (e.g., copyright). The plan also promotes building international ties for South Korean research, as well as a greater appreciation of science and technology among all South Koreans. MEST intends to evaluate and revise the new plan every year and emphasizes seeking input from a wide range of stakeholders—not only researchers and educators but also ordinary citizens (MEST 2010).[40]

Details of National Plan

Title: Ground Plan for Adapting the Nation's Education, Science and Technology to the Information Age

Year of Publication: [not published; drafted 2010]

URL: [not published]

Private Sector Involvement

MEST and KERIS have a range of existing public-private partnerships for research and development, especially in the areas of ICT for teaching and learning and of infrastructure and support (Kim 2010a). South Korea's top-notch ICT infrastructure attracts attention from companies such as IBM and Intel interested in testing new technologies. To do this, the companies donate equipment. KERIS views this as a win-win arrangement since the equipment helps South Korea maintain its reputation as an ICT leader, while the companies gain a chance to increase their market share with products that prove successful in South Korea. KERIS views its current partnerships as successful and generally maintains that such coordination is necessary. In short, the government can make policies but needs the private sector to realize them, particularly in terms of technology (Kim 2010b).

[40] The national educational technology plan in effect 2010–14 is not published, but KERIS provided a copy to IETE researchers.

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

Edunet partners with local education authorities and schools to support the ongoing extension and improvement of infrastructure. Edunet can also serve as an integrated service desk, supporting teaching and learning projects, since it is linked into the systems of individual schools (Edunet website). South Korea is generally a leader in centralized services. All schools are already networked in a school information system known as the National Education Information System. School libraries also benefit from centralized services, through the Digital Library Support System (KERIS website). To meet the new national plan's objective of making shared super-computing facilities available to all South Korean research entities, the country is now investing in improving capacity for cloud-computing (MEST 2010).

It is worth noting that the National Education Information System, which has an annual budget of USD 2.2 million, operates on the Linux platform, as do the digital textbooks now under development. KERIS maintains that the National Educational Information System and the textbook collection are the two largest open-source resources in the world. The textbooks will run on a single device, such as a netbook or tablet (Kim 2010a, 2010b; MEST 2008). South Korea is pursuing a one-to-one computer-to-student ratio—privileging lighter, mobile devices—and plans to achieve that by 2013, in time for national use of digital textbooks by all students ages 6–18 (Seo 2010).

Improving Student Learning Through technology-Enhanced Instruction

National ICT in Education Standards for Students

Goals for student achievement in ICT in education are articulated in guidelines, but students are not assessed according to the guidelines (Kim 2010a). Relative to students in other countries, South Korean students—approximately six million of whom use the Edunet resources—are considered to be well advanced in their use of technology for education (Kim 2010b).

Priorities and Programs in This Area

KERIS considers South Korean students to be intrinsically interested in and highly proficient with computers. Thanks in part to outstanding ICT infrastructure, they become highly skilled at home and do not need to be taught technical skills at school (Kim 2010b). It is important to note that exposure to ICTs at school begins as early as preschool. Preschools have high-speed Internet connections that allow them to take advantage of a growing number of online resources designed specifically for early childhood education (Oh 2009).

Students regularly use the resources available through Edunet and the Cyber Home Learning System (CHLS). Although Edunet's resources focus on classes and the school curriculum, CHLS is geared towards supplemental learning at the students' own pace, offering online tutors and other individualized tools through an anytime-anywhere digital Web portal. Launched in 2005, CHLS has an annual budget of USD 8.76 million. The online tutors, who are in-service teachers from around the country, respond rapidly to questions from students in grades 1–12 (ages 6–18). Math and English are the subjects in which students most often seek help online (Kim 2010b).

CHLS is part of the governmental effort to improve public faith in the education system and reduce the perceived advantage of private tutoring for those who can afford it (CHLS website). KERIS acknowledges that despite governmental efforts, attitudes change very slowly, and progress has been limited so far. Reliance on private tutoring remains high among wealthier South Koreans. Nonetheless, telecommunications have supported progress towards educational equity, particularly for students in rural areas and otherwise isolated places (Kim 2010b).

Digital textbooks for primary students (ages 6–12) are now being piloted, with a goal of nationwide use by 2013 and the subsequent development of digital textbooks for students in other age brackets. The textbooks, which combine traditional content with interactive and multimedia components, will be made available on a single device, such as an Apple iPad (Kim 2010a; MEST 2008). The textbooks will be used in a one-to-one environment, in which each student has his or her own device. KERIS views the one-to-one environment and its digital textbook content as keys to making South Korean education more student-centered, making students who have traditionally been “good listeners” into “active performers.” Components of this transformation will be more group projects, in which students will learn how to discuss, collaborate, and reach agreements, and gain greater opportunity for hands-on, experiential learning, in which students collect their own data and generate solutions to real-world problems (Seo 2010).

In the near future, MEST and KERIS will continue working towards improving equality of access and reducing isolation. South Korea is a small country, KERIS notes, so developing its full human-capital potential means making resources for lifelong learning equally available to all citizens (Kim 2010b).

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

There are no ICT in education standards for teachers in South Korea. There are guidelines, and teachers are expected to reach a certain level of competency, although they are not assessed with regards to the expectations (Kim 2010a, 2010b).

Priorities and Programs in This Area

MEST and KERIS have been encouraging teachers to use ICT to streamline their work and enhance their pedagogy since the late 1990s, when laptops were given to every teacher as part of the first national educational technology plan. Today, teachers use the National Education Information System—the nationally networked school information system—for administrative purposes and to communicate with parents. Through Edunet, they can locate high-quality digital learning resources and guidance for using them, or participate in online communities with other teachers. Teachers can also take advantage of professional development programs.

Edunet, KERIS's ICT in education hub, develops and disseminates standards and models, and makes high-quality digital learning resources aligned with those models available to teachers, students, and parents in a searchable library (Edunet). Edunet also contains a community-of-practice space for teachers called Edu-Café. Divided into subspaces by subject matter and level, the site includes social networking features such as chat spaces and allows users to modify and repost contents and move them around among cafés. Parents and students can also participate in Edu-Café (Kim 2010b).

In terms of professional development, South Korea has an in-service training program for all school personnel, with 180-hour (30-day) courses available for teachers. Courses address topics such as the digitization of resources and curriculum development, as well as more general aspects of pedagogy. KERIS also offers in-service training on every aspect of improving pedagogical use of ICTs and has small scholarships for teachers who excel in this area (Oh 2009).

Continuous Improvement Efforts

Investing in Data Systems

The fact that all schools are linked to the National Education Information System facilitates data collection. The National Education Information System's central headquarters and regional offices both analyze data and disseminate information. Teachers and parents can both enter data into the system.

MEST also conducts annual, national collections of school-level data through the System. MEST further selects samples of student-level data collected through the same means. Results of the analysis are used to guide policy and to develop strategies for designing and deploying support (Kim 2010a). In addition, usage data is collected continuously on Edunet and the Cyber Home Learning System. KERIS tracks the number of log-ins, how long users spend on the site and how they use the resources. KERIS also maps where active users are located as a means of determining where students who are not yet benefiting from the services may still be isolated. Analysis of the data collected is used to inform policy and for budgeting purposes.

KERIS also uses data systems to share information with students and parents, through Edunet, in order to inform administrators and local educational authorities about the effectiveness of instructional practices, and as a means for training teachers and administrators how to use data to improve instruction.

National ICT Program and Policy Evaluation Efforts

In addition to the ongoing data collection and analysis processes already discussed, the national plan is evaluated and revised each year so that actions can be adjusted to targets. More specifically, the digital textbook program is now being tested at the primary-school level (ages 6–12), prior to full rollout with older students slated for 2013.

Plans to Participate in International Data Collections

South Korea plans to participate in the Program for International Student Assessment (PISA).

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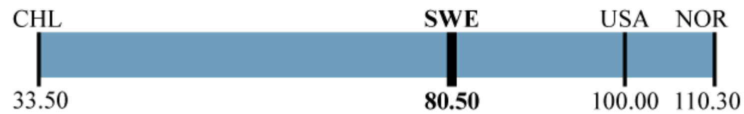
Sweden ICT in Education Profile

Country Statistics at a Glance

National Indicators

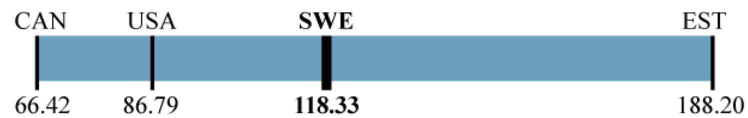
Total country population (2007)

Labor productivity index (% US, 2009)



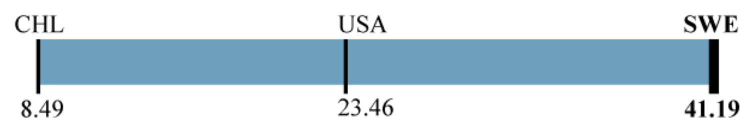
Network readiness index (% of US, 2009-10)

Mobile telephone subscriptions (per 100 population, 2008)



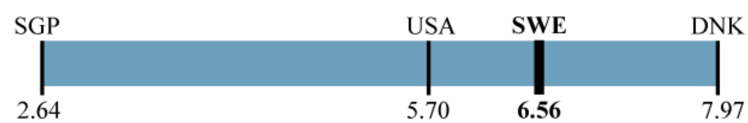
Internet users (per 100 population, 2008)

Broadband subscribers (per 100 population, 2008)



Education Indicators

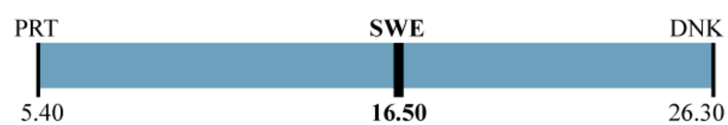
Public expenditure on education (% of GDP, 2006)



Total elementary school enrollments (2007)

Total secondary school enrollments (2007)

Total number of Internet computers (per 100 pupils, 2006)



Percentage of schools with a broadband connection (2006)

ICT in Education in Highlights

Sweden's education system emphasizes local control and teacher professionalism. Municipalities and schools have considerable discretion in how to allocate funds and shape classroom practices

The national Agency for Schools provides a rich set of online resources and tools for teachers and students that are based on the premise of grassroots initiative and local control of education. These tools provide professional development, access to searchable databases of teacher and student resources and materials and ongoing updates on the latest news and research in education around the world

The education system is highly decentralized, with the national Agency for Schools serving primarily a supportive role and relying on teachers, principals and local municipalities as the drivers of educational change.

Structure and Nature of the Education System

Authorities Primarily Responsible

The Swedish educational system emphasizes local control and the professionalism of its teaching corps. The system was officially decentralized in the early 1990s, following two decades of increasing localization. Since then local schools and municipalities have the primary responsibility for funding and running schools. The Education Ministry, which is part of the government, establishes general curricular frameworks, national objectives and guidelines for education. The Ministry also allocates funds, but it does not decide how its guidelines and goals are implemented. These functions are delegated to its various agencies.

The Agency for Schools is the agency primarily responsible for carrying out the Ministry's goals for primary and secondary education. The Agency, like all other agencies in Sweden, has a degree of political and legal independence from the Ministry. The Ministry, on orders from the government and the Parliament, decides on the allocation of funds to its various agencies and sets general guidelines and goals. The agencies have discretion over how to attain those goals. Ministry and government officials are prohibited by law from intervening in the agencies' work, which means that the agencies have considerable discretion in how they decide to meet the goals. The Ministry is also not allowed to interfere with or influence the methods and findings of the reports that it commissions. The Agency for Schools receives guidelines for its work in Mission Statements issued by the Ministry approximately every three years.

The Agency for Schools is the agency responsible for overseeing primary and secondary education. It serves a mostly supportive role by providing access to resources and collecting data on schools and student performance. Local municipalities and school districts have the authority to allocate funds and decide how to run their schools. Another agency, the Agency for School Inspection, conducts onsite inspections at schools to make sure that all practices are in compliance with the Education Act. The Agency for Schools "evaluates, follows up, and supervises the public school system" (Karlberg 2009). The Agency is responsible for encouraging professional development, disseminating research, supporting teachers and students and collecting data on schools (the Agency took over some of these tasks—and the personnel responsible for them—from another agency in 2008). In addition, the agency Swedish Institute for Special Needs oversees issues related to special needs students. With regard to primary education, the Agency for Schools produces the general curricular guidelines, which the government and Parliament approve before the Agency can use them as the basis for writing course plans that guide school districts. In secondary education, the Agency both creates and authorizes general curricular guidelines and course plans for all the subjects to be taught. All these serve as guiding documents for school districts, which ultimately decide what will be used in the classroom.

In summary, schools and municipalities have considerable authority in deciding their own curricula and practices. The Agency for Schools' role is to guide and support municipalities, districts and teachers. ICT-related data is collected through limited surveys of teachers and school leaders. Guidance and support are provided through online resources that teachers and school leaders participate in on a voluntary basis.

ICT in Education

National Plan for ICT in Education

Sweden does not have a national technology plan (Dykes 2009: Karlberg 2010a). "In a sense," according to Karlberg, "there has never been one" (Karlberg 2010b). The government has, however, issued some guiding documents. In the beginning of the 1990s, for example, the emergence of the Internet led to a government document about ICT use in schools, which primarily addressed the importance of access to computers and the Internet. Later in the 1990s, another government document led to initiatives like the European SchoolNet. The last effort to outline directions in ICT was a large government program called Information Technology (IT) in Schools. The program consisted of two parts: in-service training for teachers and funding to municipalities to improve infrastructure. IT in Schools lasted from 1999–2002 and was essentially the latest large-scale government program supporting ICT (Dykes 2009). This early enthusiasm was significantly dampened by the technology industries downturn of 2002, which resulted in widespread disenchantment with technology and turned IT into a political nonissue (Karlberg 2010a). This relative lack of interest continued to characterize the political debate in education for the rest of the decade, and it is only more recently that attitudes have begun to change and that the need for a national ICT strategy is being debated again (Karlberg 2010b).

The Agency for Schools receives a Mission Statement from the Ministry every three years, which contains goals and priorities for the Agency. It received its most recent Mission Statement in 2008. According to Karlberg (2010b), directives to support soft ICT infrastructure were not included in this Mission Statement, and he suggested that they might not have considered it an appropriate task for a national agency. On the other hand, no other organization has been tasked with working with ICT infrastructure in education. One important task included in an earlier Mission Statement was to find out how a follow-up system of providing frequent evaluations of ICT use and capacity could best improve ICT in education.

Given the decentralized nature of the Swedish school system, most schools develop their own individual ICT plans and rarely share their plans with other schools. These plans tend to address issues related to equipment, staff competence and ICT as a learning and information gathering tool. In secondary and adult education, ICT plans primarily deal with issues of equipment. Schools' ICT plans are usually updated every year in secondary and adult schools, but more rarely in elementary schools (Skolverket 2009).

Private Sector Involvement

Private partnerships are relatively rare in Sweden. Although there are some programs run by companies like Apple, Intel and Microsoft, these are usually partnerships with individual school districts and play a relatively small role overall (Karlberg 2010b). Private financing in Sweden is among the lowest in the Organisation for Economic Co-operation and Development (OECD) countries. Only 2.7 percent of school funding in 2001 came from private sources, compared to an average of 13.4 percent for all OECD countries (Hylén 2010). It should be noted, however, that the information on private funding of adult education is incomplete.

The Agency for Schools currently does not have programs to incentivize private-sector investments related to ICT and learning, increasing teacher capacity, data systems to support continuing improvement or access and availability of infrastructure. The Agency does, however, maintain active relationships with museums, organizations, publishers and other nonprofit and commercial actors to keep abreast of the field in terms of teaching and learning resources and technology; and to continually update its various Web sites with relevant material (Karlberg 2010c). A number of OECD reports note that Sweden stands out in its lack of formal frameworks for connections and partnerships between secondary education and employers. (A unique feature of the Swedish education system, however, is the right that employees have to take leave from work for the purpose for education or training purposes [Hylén, 2010]).

The context for Sweden's relative lack of large-scale involvement with the private sector is somewhat complex. Although on the one hand, the Agency and the Ministry consider it a high priority to cultivate relationships with and create pathways to the private sector, where many of its students will ultimately end up, there is a tradition of ensuring that students are protected from undue influence from actors with commercial interests. Strict procurement regulations provide additional obstacles to contracting with individual companies on a larger scale.

Charter Schools

More significant private-sector involvement is seen in the area of charter schools (*friskolor*), many of which are run by private companies. These schools get their funds through general school funding that "follows" the student, but the law prohibits schools from charging any additional tuition.

Sweden ICT in Education Profile

Increasing ICT Infrastructure and Support

Priorities and Programs in This Area

Sweden does not currently have any standards, targets or guidelines for student-to-computer ratios or Internet connectivity speeds. The Agency for Schools collects data on these, and the issue has been framed in more general terms. Schools are required to have at least one Internet-connected computer that is accessible to the students, and the Agency for School Inspection ensures that they all do. Overall, however, schools are considered to have good access to the Internet (Karlberg 2010c). Municipalities have received grants for increasing bandwidths in their schools but were not provided specific metrics on the goals (Karlberg 2010c).

Improving Student Learning through Technology-Enhanced Instruction

National ICT in Education Standards for Students

There are no national ICT in education standards in Sweden. The primary means of evaluating student achievement are students' grades. Although there are no strict ICT standards, the importance of ICT in education is reflected instead in the general goals and guidelines contained in various Ministry decrees. For example, the curriculum guidelines for elementary schools specify that all students should be able to use ICT in their learning (Skolverket 2009).

There are no guidelines or recommendations, however, about specific levels of ICT knowledge and skills other than general proficiency. Schools and school districts are thinking more about digital competence and 21st-century skills as recommended by the OECD and other organizations active in European educational standards but there are no efforts to drive that change from the Ministry or the Agency (Karlberg 2010c).

Most municipalities have access to some form of learning management system (LMS). Some are commercial and other open source, and they vary in quality. According to Karlberg (2010c), they have only been used to a limited extent, and anecdotal evidence suggests that teachers and school officials are often disappointed with the results they have gotten, often wondering if they were worth the money spent. A recent report by the Agency for Special Needs found that an alarming number of these systems did not feature accessibility for special needs students (Specialpedagogiska Skolmyndigheten 2009).

Priorities and Programs in This Area

The Agency for Schools emphasizes access to content and resources for students and teachers. There is no program for assessing student achievement in terms of ICT standards. However, as mentioned above, national tests are administered to diagnose student proficiency levels in core subjects. The Agency for Schools does not prioritize using ICT in meeting individual learning needs, inquiry, instructional resources, collaboration and extending the learning environment beyond the classroom.

In terms of data collection, there are other initiatives outside of the Agency, such as LearnIT, which was a large-scale research program funded by the Knowledge Foundation (Stiftelsen för kunskaps- och kompetensutveckling) at Gothenburg University. LearnIT supported research in the area of ICT in teaching and learning, but with a particular focus on higher education.

The Use of ICT to Increase Teacher Capacity

National ICT in Education Standards for Teachers

The Swedish education system is based on local control and reliance on the professionalism of teachers and principals. Consequently, the Agency for School's role is to provide support and networks for teachers and principals to leverage their own needs and interest in professional development and educational resources. The Agency makes powerful use of the Internet to build comprehensive databases and online tools for teachers.

There are, however, no ICT in education standards for teachers. Participation in the Agency for Schools' programs is voluntary, and the Agency for Schools relies on municipalities to voluntarily get on board with their programs and ask their teachers to participate actively (Karlberg 2010b). The Knowledge Foundation and the Agency for Schools initiated the IT in Schools project in the late 1990s to support ICT in schools. IT in Schools focused on the development of school infrastructure and strengthening teachers' ICT skills (Skolverket 2009). The program ended in 2002. Currently the Agency focuses on providing access to programs primarily through its websites.

Priorities and Programs in This Area

The Agency's most recent Mission Statement from the government, in December 2008, included a general task to support the use of ICT in schools and specifically mentioned secure use of ICT, national and international cooperation, use of ICT in school/parent/student communication and general dissemination of knowledge about the use of ICT in education (Karlberg 2010a). The Agency does not produce its own ICT materials. Instead, its programs have emphasized access and capacity-building. One organization worth mentioning in relation to content production is the Public Broadcasting Foundation (*Utbildningsradion*), which is a nonprofit foundation largely funded through the state. It produces educational radio and television programming, and the Agency is working with the Public Broadcasting Foundation to make their materials accessible to students and teachers online (Karlberg 2010b).

IT for Teachers

The most important program promoted by the Agency for Schools for teachers to develop ICT use and skills is IT for Teachers, which is a continuation of SchoolNet. IT for Teachers is a Web portal to all the Agency's resources. It targets teachers and school leaders and provides them with ways to connect with digital learning resources, as well as courses, research, ideas about how to use ICT in schools and reports. The site contains a number of resources that include Check the Source (Kolla Källan), where teachers and students are encouraged to use resources safely; The Spider (Spindeln), which is a school search engine that searches across national archives and draws together resources from over 30 participating organizations (Dykes 2009). IT for Teachers is essentially a means of bringing together a number of resources that have been developed separately.

Practical IT and Media Knowledge

Since 2006, the Agency has been promoting Practical IT and Media Knowledge (PIM), which is an online platform for providing in-service training for teachers. PIM is accessible through the main IT for Teachers site. It provides modules for teachers to learn more about how to effectively use the computer in the classroom for learning. After teachers go through the modules and are certified locally, they are trained to become disseminators of the technology. According to Karlberg, around 100 school districts—over half of all districts—are using PIM. So far, PIM is focused on more basic and general skills (like how to make a movie or record sounds), but there are plans to make it more subject-oriented (Karlberg 2010b).

Online Repositories of Digital Learning Resources / Curriculum

The Link Library is an edited site, part of IT for Teachers, which provides links to online educational resources for teachers, school librarians and students. The resources are organized by subject area. The editors are teachers and school librarians who work part-time. Seven editors serve at any given time and vet all content to be posted on the site. Another resource for teachers is the Course Hub, which is a repository for digital learning resources dedicated specifically to adult education.

Community of Practice

One of the most successful sites for facilitating a community of practice in Europe is Lektion.se. The site was not developed by the Agency for Schools, but by former teachers. The site has more registered users than there are teachers in the country, and features shared lesson plans, activities and other resources. It also provides discussion forums and other ways for teachers to collaborate and share materials. It's considered to be a good example of the bottom-up approach that characterizes Swedish education.

Technology Incentives

The Agency for Schools does not have programs that directly incentivize schools to use more technology. They do, however, offer grants for the implementation of innovative programs in subject areas that often involve various uses of technology (Karlberg 2010c). Much of the push toward more ICT use is an outcome of local schools themselves taking those initiatives. For example, there is currently a drive toward one-to-one computing in schools. This is not funded or initiated by the Ministry but is nevertheless emerging on a larger scale (Karlberg 2010c).

Continuous Improvements Efforts

Investing in Data Systems

The Mission Statement issued to the Agency for Schools in 2008 specified that data should be collected on ICT use and skills in schools, but there is no separate funding appropriated for this purpose since it is expected to take place within existing budgets (Karlberg 2010a). (In addition to its general fund, the Ministry provides the Agency for Schools with additional "development funds" that are to be spent on specified activities. Its ICT special funds range from USD 1.4–2.1 million per year). There is no established system for using data to improve school, district and program performance (Karlberg 2010a), due to the decentralized nature of the system. Rather, the Agency organizes materials, resources and data and provides ready access to these resources online.

There are three main databases through which data is provided. One is called SIRIS that provides information for schools and municipalities in order for them to make improvements in education and childcare. The site was created in 2001. Some examples of content in the database include municipalities own quality reports; students' leaving certificates from the ends of the nine-year compulsory school and the three-year upper-secondary school; results from nationwide standardized tests; results from national education inspectors' quality investigations; and demographic and financial information on schools (SIRIS website). Another database, SALSA, provides achievement information for school districts as well as demographic and financial information on schools and students (SALSA website).

The Education Ministry continuously tracked the use of ICT in schools throughout the 1990s, with the last report in its series of reports published in 2001 (Skolverket 2009). According to one study, most programs have had relatively little impact on the development of IT in schools, likely due to the fact their budgets are relatively small in comparison to overall school and district budgets. The gradual change that does take place, the study finds, happens as a result of general changes in society (Eriksson-Zetterquist, Hansson, Löfström, Selander, & Ohlsson, 2006).

National ICT in Education Indicator Collections

The Agency for Schools conducts a study every three years on ICT in education. The study has primarily focused on pedagogical and administrative uses of ICT, ICT competency and ethics in the use of ICT. The Agency also collects data on the conditions for use of ICT, which includes data on ICT infrastructure such as access to computers, educational software and the Internet, but also other digital resources like digital cameras and Smart Boards. The Agency also maps schools' individual ICT plans. The data is collected primarily through surveys of teachers and administrators. The most recent follow-up report issued by the Agency for Schools (Skolverket 2009) conducted two surveys and an interview study to collect data on computer use among students. One class in each of the 155 different schools was surveyed among students age 10–12. In addition 2,600 students age 13–19 were surveyed.

The data showed that most students use computers in school, but that the range of use is limited. For example, more than nine out of ten 13- to 15-year-old students rarely or never use the computer for math. Even in science and technology classes students rarely use computers. Swedish and Social Studies are the subjects with the most computer use, and even in these classes only three out of ten report that they use it frequently in those classes. When students do use computers, they primarily search for information or type texts. Computer use is less frequent among students of younger ages. Students of all ages do report, however, that they have learned about safety and critical thinking in the area of Internet use. The survey also looked at how many computers schools have and found that there is one computer per six students in regular elementary schools and 4.5 in elementary charter schools. For students ages 16–19 the corresponding numbers are 2.5 and 1.6. The findings were reported to the Ministry and the government and made available on the Agency for Schools' websites.

Plans to Participate in International Data Collections

According to Karlberg, there is an interest from the Agency for Schools in comparing "policies, programs and investments with results in terms of changed pedagogical practices, achievements in subjects and achievement in digital competence (i.e., 21st-century skills)" (Karlberg 2010a). The Agency plans on participating in the following data-collection programs: the Program for International Student Assessment (PISA) 2012, the Trends in International Mathematics and Science Study (TIMSS) 2011 (years four and eight), Progress in International Reading Literacy Study (PIRLS) 2011 (year four) and ECLS.

In addition, there were plans to discuss Sweden's participation in the Organisation for Economic Co-operation and Development's (OECD) Teaching and Learning International Survey (TALIS) and the International Association for the Evaluation of Educational Achievement's International Computer and Information Literacy Study(IEA/ICILS) in the spring of 2010.

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Sweden ICT in Education Profile

Appendix A. Study Methodology

This report on international use of ICT in education (*International Experiences with Technology in Education*) was sponsored by the U.S. Department of Education (the Department). As many nations invest resources in education using technology, it is helpful that lessons learned from these international experiences are shared to better understand the effective use of technology in education. The report looked to expand awareness of ICT activities around the world as well as inform future international data collection efforts on the use of ICT in education.

This report presents data from several sources, including an online search of existing research, surveys of international Ministries of Education, and follow-up phone interviews with Ministry staff. The full methodology is described in greater detail below, including identification of study priorities, preliminary online research, survey and interview protocols, data collection techniques, and data analysis as presented in this report.

Identification of Study Priorities

To help guide the selection of countries and the selection and development of indicators for the IETE project, the project team worked with the Department to develop key areas of interest for the study. The areas of interest identified were:

- Improving Student Learning Through Technology-Enhanced Instruction: The focus of this area of interest was on policies, programs or outcomes related to school or classroom use of technology to improve student access to high-quality instruction and to address individual differences in students' ability to learn subject matter content.

Increasing Teacher Capacity Through the Use of ICTs: The focus of this area of interest was on policies, programs, and outcomes related to the use of technology to facilitate the professional development of teachers.

Using Data Systems to Support Continuous Improvement: The focus of this area of interest was on policies, programs, and outcomes related to the use of technology to support accountability, evaluation, and "continuous improvement" systems.

Based on the identified areas of interest and the study's original charter to survey international collections of ICT in education indicators, the study addressed the following research questions:

- What international educational technology data are being collected by international and national organizations? What are the limitations of these data?
- How are technologies being used to improve student access to high-quality instruction?
- How are technologies being used to increase teacher quality?
- To the extent that governments maintain national education data systems for continuous improvement, evaluation and accountability purposes, what indicators are being used to track student progress and inform policy and program decisions?

To address these questions, the project team collected and analyzed data from two primary sources: (1) a web-based search to identify recent international data collections related to the use of ICT in education and (2) a survey and interview with international government officials.

Selection of Countries

The process to select countries for participation in the study involved input from both the Department and members of the study's technical working group (TWG), a panel of experts with experience internationally in the field of ICT in education. The Department and the TWG decided that the countries selected should be trading partners in the global economy and have significant existing technology infrastructure to support the implementation of ICT in education. Geographical representation was not considered in the country selection process.

A total of 34 countries were identified as potential candidates for inclusion in the study. Based on the top 30 rankings on both the Network Readiness Index[41] and an index of labor productivity (2008 GDP per person employed).[42] Luxembourg was dropped because of its size. Twenty-three countries were ultimately selected for inclusion in the study based on two rankings identified above. In addition, the Technical Working Group recommended Chile and Portugal be included in the study because of innovative national practices that seemed relevant to activities in the United States. The project team was unable to include four countries in the final study due to unforeseen barriers and unavailable data. This yielded a total of 21 participating countries included in the final study.

Ministry of Education country contacts were identified with assistance from members of the TWG.

[41] Network Readiness Index (NRI). The NRI, developed by the International Technologies Group at Harvard University (http://cyber.law.harvard.edu/itg/) and currently administered by the World Economic Forum is a composite of three components: the environment for ICT offered by a given country or community, the readiness of the community's key stakeholders (individuals, businesses, and governments) to use ICT, and finally the usage of ICT amongst these stakeholders. Data is derived from publicly available sources and an executive opinion survey conducted by leading research institutes and business organizations within the countries under analysis. In total, data on 27 indicators, including utility patents, mobile phone use and bandwidth available, are combined with 41 survey indicators to give the overall network readiness index score.

[42] Labor Productivity Index (LPI). The LPI used is based on a country's 2008 GDP per person employed in 2008 U.S. dollars. The international data reported was taken from the Total Economy Database on Output and Labor Productivity maintained by The Conference Board (http://www.conference-board.org/economics/database.cfm#6).

Online Search for Multinational Data Collections

In order to benefit from and build upon prior international data collection efforts, the project focused on three key tasks: identification of available online sources of ICT in education indicators, coding ∫ the findings from the online research describing the specific information on indicators, decision-making processes, major initiatives as well as the extent of the availability of national indicators of education technology investments, access, penetration, and effectiveness along with the frequency at which the data was collected. Data for selected indicators was used to inform the development of the survey.

Exhibit A-1. List of reports and the corresponding major data collections reviewed

Title of Report	Major Data Collection referenced	Year/s of Collection
Are Students Ready For Technology-Rich World?	PISA	2003
Benchmarking Access And Use Of ICT In European Schools 2006	European commission eLearning Policy (ECEP)	2006, 2001
Completing The Foundation For Lifelong Learning: An OECD Survey Of Upper Secondary Schools.	ISUSS	2001
Education Policy Analysis 2004	PISA	2000, 2003
ICT Sub-Theme Final Paper: Using ICT For Teaching And Learning (2004)	APEC Survey	2003
ICT@Europe.Edu: Information And Communication Technology In European Education	Eurydice Report: Information and Communication Technology in European Education Systems	2001
Key Data On Information And Communication Technology In Schools In Europe. 2004 Edition	Eurydice	2002/03
	PIRLS	2001
Pedagogy And ICT Use In Schools Around The World: Findings From The IEA SITES 2006 Study	SITES	2006
PIRLS 2006 International Report	PIRLS	2003
TIMSS 2003 International Mathematics Report	TIMSS	2003
TIMSS 2003 International Science Report	TIMSS	2003

Development of Survey and Interview Protocols and Data Capture Template

The conceptual framework of the survey was based on relevant research experience, expertise in international ITC policy and programs, evaluation of education technology programs, online and survey research, and the preparation of accessible reports for broad audiences.

One of the objectives of this project was to identify barriers and gaps in global knowledge, in order to suggest areas for future research and opportunities for further international collaborations. Accordingly, the survey was designed to address the gaps found in existing research as well as to seek updated information related to the identified indicators. The survey also intended to collect data on the countries' ongoing and planned major technology initiatives and to ask country representatives for descriptions of challenges they faced associated with these initiatives.

Some countries included in the study have strong federalist-style governments where local education authorities have nearly complete autonomy over local educational policy and decision-making. For these countries, the project team instead focused on regional levels of education authority.

The project team developed a data capture template in order to have a standardized form on which to collect country data, to ensure consistent information reporting, and to aid in synthesis of survey responses. There were lead data collectors for each country, called "country managers," who were also primary project contacts for countries, and were responsible for data collection, and result reporting and writing. They were trained in the use of data capture templates and maintained regular contact with core project staff.

Survey Protocol, Process and Strategies for Inviting Country Participation and Follow-Up Strategies, Discussion of Strategies to Achieve Participation

Country managers emailed invitations to participate in the survey to each country contact. After country agreement, country managers emailed surveys to the country representative. Surveys were distributed and collected via e-mail, although respondents were given the option to request a printed copy sent via fax.

Surveys were provided in print-ready formats to give respondents the option to complete the information electronically or by handwriting their responses. Respondents had two weeks to complete the survey after it was sent out, after which, follow-up phone calls were made to verify responses and complete missing information. Translation services and telephone interpretation services were made available as necessary to help ease the survey completion process.

Upon receipt of the completed survey, the project team customized the interview protocol in order to get additional details specific to the country.

Interview Protocol and Process

Once a survey was returned, country managers reviewed the survey for completeness and generated an interview protocol to follow up and delve more deeply into activities identified in the survey. Country managers scheduled follow-up interviews with respondents. The purpose of the interview was two-fold: (1) to verify and clarify survey responses and (2) to collect additional descriptive information about country priorities, policies and programs related to ICT in education. Responses to survey questions served as high-priority topics for follow-up during interviews. The country managers asked respondents open ended questions regarding policy and program characteristics, including duration of initiatives, key stakeholders in planning and administration as well as funding mechanisms and amounts.

All interviews were conducted via telephone. Interviews were audio-recorded to serve as a back-up to the real-time data capture. When possible, interviews were conducted with two members of the project team present, to allow for more detailed notes and follow-up questions.

Synthesis Process

Once the majority of surveys and interviews were conducted, the project team synthesized survey and interview data. These data provided a more in-depth look at how investments in ICT in education are implemented, as well as the conditions and practices associated with emerging innovative policies, programs and funding mechanisms.

Open-ended responses were coded by qualitative analysts in order to generate descriptive country profiles that synthesized the data collected across the multiple sources – online research, surveys and interviews. Tables were created to show the priorities and topic areas addressed across the 21 countries along with major initiatives currently being implemented or planned in the 21 counties. In-depth analyses of individual countries' survey and interview responses were also synthesized, providing "country profiles," narratives regarding a country's activities related to the study priorities as well as other information collected from country respondents that describes a country's ICT in education activities.

Appendix B.
Relevant Indicators from Previous Multi-National Collections

Three sets of tables are provided below (Exhibit B-1, Exhibit B-2 and Exhibit B-3) which provide indicators collected from major multinational collections. Exhibit B-1 provides infrastructure-related indicators. Exhibit B-2 provides indicators related to technology-enhanced instruction, and Exhibit B-3 includes the one indicator identified that addresses the use of the Internet to build teacher capacity.

Exhibit B-1. ICT in Education Country Context Indicators

		Indicator	Source
		Access to Hardware	
1.		Percentage of schools where more than 5 PDAs were available.	SITES, 2006
2.		Percentage of schools where more than 5 graphical calculators were available.	SITES, 2006
3.		Percentage of schools where Smartboards were available.	SITES, 2006
		Access to Software	
4.		Percentage of schools where tutorial software was available.	SITES, 2006
5.		Percentage of schools where simulations were available.	SITES, 2006
6.		Percentage of schools where learning management systems were available.	SITES, 2006
		Access to the Internet	
7.		Total number of Internet computers per 100 pupils.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
8.		Availability of broadband connection in schools.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
9.		Percentage of schools having a local area network (LAN).	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
10.		Percentage of schools having an Intranet.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
		Access to Technical Support	
11.		Percentage of technology coordinators indicating that maintenance at the school is provided by the school's own staff.	SITES, 2006
12.		Percentage of technology coordinators indicating that maintenance at the school is provided by staff from other schools.	SITES, 2006

Exhibit B-1. ICT in Education Country Context Indicators (Continued)

		Indicator	Source
		Access to Technical Support (Continued)	
13.		Percentage of technology coordinators indicating that maintenance at the school is provided by an external hired company.	SITES, 2006
14.		Percentage of technology coordinators indicating that maintenance at the school is provided by an external company arranged by the ministry.	SITES, 2006
15.		Percentage of schools where a computer coordinator provides technical support.	SITES, 2006
16.		Percentage of schools where other ICT staff provide technical support.	SITES, 2006
17.		Percentage of schools where other admin and staff provide technical support.	SITES, 2006
18.		Percentage of schools where teachers provide technical support.	SITES, 2006
19.		Percentage of schools where students provide technical support.	SITES, 2006
20.		Percentage of schools where external volunteers provide technical support.	SITES, 2006
21.		Percentage of schools where external companies provide technical support.	SITES, 2006
22.		Percentage of schools where others provide technical support.	SITES, 2006
23.	+	Availability of technical support for teachers (based on a 3-point scale: 1=no support, 2=some support, 3=extensive support)	SITES, 2006
24.	+	Mathematics teachers' perceptions of the availability of support for teacher ICT-use, where support includes: teachers receive sufficient technical support; students have easy access to computers outside scheduled class time; and administrative work arising from ICT use in teaching is easy to do.	SITES, 2006
25.	+	Science teachers' perceptions of the availability of support for teacher ICT-use, where support includes: teachers receive sufficient technical support; students have easy access to computers outside scheduled class time; and administrative work arising from ICT use in teaching is easy to do.	SITES, 2006
		Access to Pedagogical Support	
26.	+	Availability of pedagogical support for teachers (based on a 4-point scale where 1 = not at all, 2 = a little, 3 = somewhat, and 4 = a lot)	SITES, 2006
		Student Access at Home	
27.		Percentage of students who access to a computer at home - None - One - Two - Three or more	PISA, 2006

Note: + = Quantitative data not available. These indicators do not appear in the benchmark data tables.

Exhibit B-2. Technology-Enhanced Instruction

		Indicator	Source
		Student Use of Hardware	
1		Percentage of students who use the computer at school by frequency - Almost every day - Once or twice a week - A few times a month - Once a month or less	PISA, 2006
2	*	Percentage of upper secondary students attending schools where students' assignments included operating a computer (e.g., saving files, printing) at least once a month.	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
		Student Use of Software	
3	*	Percentage of upper secondary students attending schools where students' assignments included writing documents with a word processor at least once a month.	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
4	*	Percentage of upper secondary students attending schools where students' assignments included making illustrations with graphical programmes at least once a month.	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
5	*	Percentage of upper secondary students attending schools where students' assignments included calculating with spreadsheet programmes at least once a month.	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
6	*	Percentage of upper secondary students attending schools where students' assignments included writing programmes at least once a month.	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
7	*	Percentage of upper secondary students attending schools where students' assignments included communicating via email with teachers and other students at least once a month.	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
8	*	Percentage of upper secondary students attending schools where students' assignments included using educational software (e.g. taking tests, exercises) at least once a month.	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
		Student Use of Internet	
9		Percentage of students who have used the Internet to collaborate with a group or team - Almost everyday - Once or twice a week - Never	PISA, 2006

Exhibit B-2. Technology-Enhanced Instruction, (Continued)

		Indicator	Source
		Student Use of Internet (Continued)	
10.	*	Percentage of upper secondary students attending schools where students' assignments included sending, searching for, and using electronic forms of information at least once a month.	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
		Teacher Use of Hardware	
11.		Frequency of mathematics teachers' use of mobile devices in the target class.	SITES, 2006
12.		Frequency of mathematics teachers' use of interactive whiteboards (e.g., Smartboard) in the target class.	SITES, 2006
13.		Frequency of science teachers' use of mobile devices in the target class.	SITES, 2006
14.		Frequency of science teachers' use of interactive whiteboards (e.g., Smartboard) in the target class.	SITES, 2006
		Teacher Use of Software	
15.		Frequency of mathematics teachers' use of multimedia production tools in the target class.	SITES, 2006
16.		Frequency of mathematics teachers' use of simulations, modeling or digital games in the target class.	SITES, 2006
17.		Frequency of mathematics teachers' use of communication software in the target class.	SITES, 2006
18.		Frequency of mathematics teachers' use of a learning management system in the target class.	SITES, 2006
19.		Frequency of science teachers' use of multimedia production tools in the target class.	SITES, 2006
20.		Frequency of science teachers' use of simulations, modeling or digital games in the target class.	SITES, 2006
21.		Frequency of science teachers' use of communication software in the target class.	SITES, 2006
22.		Frequency of science teachers' use of a learning management system in the target class.	SITES, 2006
		Teacher Use of Internet	
23.		Percentage of teachers who use material they have searched for on the Internet.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
24.		Percentage of teachers who use existing online material from established educational sources.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)

Note: These indicators do not appear in the benchmark data tables.* = Data collected prior to 2005.

Exhibit B-2. Technology-Enhanced Instruction, (Continued)

		Indicator	Source
		Policy on Use for Instruction	
25.		Existence of policies/ statements about the use of computers in the national curriculum for 4th grade science.	TIMSS, 2007
26.		Existence of policies/ statements about the use of computers in the national curriculum for 8th grade science.	TIMSS, 2007
27.		Existence of policies/ statements about the use of computers in the national curriculum for 4th grade mathematics.	TIMSS, 2007
28.		Existence of policies/ statements about the use of computers in the national curriculum for 8th grade mathematics.	TIMSS, 2007
		Use for Instruction	
29.		Percentage of teachers who use a computer in their lessons by percentage of lessons - 5% or less - 6 to 10% - 11 to 24% - 25% to 50% - More than 50%	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
30.		Percentage of teachers who use material that is available on the school's computer network or database.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
31.		Percentage of teachers who use electronic offline material (e.g., CD ROMS).	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
32.		Percentage of schools agreeing to the statement: "computer science is taught as a separate subject".	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
33.		Percentage of schools agreeing to the statement: "computers and the Internet are integrated into the teaching of most subjects".	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)

Exhibit B-2. Technology-Enhanced Instruction, (Continued)

		INDICATOR	SOURCE
		Use for Instruction (Continued)	
34.		Percentage of schools agreeing to the statement: "computers and the Internet are integrated into the teaching of most subjects".	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
35.		Percentage of schools agreeing to the statement: "computers and the Internet are used for coping with students with special needs".	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
36.		Percentage of 4th grade students whose science teachers reported using the computers for about half of the lessons or more to do scientific procedures or experiments.	TIMSS, 2007
37.		Percentage of 8th grade students whose science teachers reported using the computers for about half of the lessons or more to do scientific procedures or experiments.	TIMSS, 2007
38.		Percentage of 4th grade students whose mathematics teachers reported using the computers for about half of the lessons or more to discover principles and concepts.	TIMSS, 2007
		Teacher Use for Assessment	
39.	+	Mean percentages of mathematics teachers using ICT for traditionally important assessment methods	SITES, 2006
40.	+	Mean percentages of mathematics teachers using ICT for assessments involving reflection/ collaboration	SITES, 2006
41.	+	Mean percentages of mathematics teachers using ICT for assessments involving learning products	SITES, 2006
42.	+	Mean percentages of science teachers using ICT for traditionally important assessment methods	SITES, 2006
43.	+	Mean percentages of science teachers using ICT for assessments involving reflection/ collaboration	SITES, 2006
44.	+	Mean percentages of science teachers using ICT for assessments involving learning products	SITES, 2006

Note:+ = Quantitative data not available. These indicators do not appear in the benchmark data tables.

Exhibit B-2. Technology-Enhanced Instruction, (Continued)

		INDICATOR	SOURCE
		Barriers to Use in Instruction	
45.		Percentage of teachers stating the lack of computers as a reason for not using computers in class	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
46.		Percentage of teachers stating the lack of adequate content/material as a reason for not using computers in class.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
47.		Percentage of teachers stating the lack of content in national language as a reason for not using computers in class.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
48.		Percentage of teachers stating the lack of adequate skills of teachers as a reason for not using computers in class.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
49.		Percentage of teachers stating no or unclear benefits of computer use as a reason for not using computers in class.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
50.		Percentage of science, mathematics & computer science teachers stating the lack of computers as a reason for not using computers in class.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
51.		Percentage of science, mathematics & computer science teachers stating the lack of adequate content/material as a reason for not using computers in class.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
52.		Percentage of science, mathematics & computer science teachers stating the lack of content in national language as a reason for not using computers in class. Science, Mathematics, Computer Science only.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
53.		Percentage of science, mathematics & computer science teachers stating the lack of adequate skills of teachers as a reason for not using computers in class. Science, Mathematics, Computer Science only.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)

Exhibit B-2. Technology-Enhanced Instruction, (Continued)

		Indicator	Source
		Barriers to Use in Instruction (Continued)	
54.		Percentage of science, mathematics & computer science teachers stating no or unclear benefits of computer use as a reason for not using computers in class. Science, Mathematics, Computer Science only.	eLearning Policy: Head Teacher and Classroom Teacher Survey , 2006 (European Commission; ECEP)
		Impact on Students	
55.		Percentage of mathematics teachers who perceived increases in students' ability to learn at their own pace.	SITES, 2006
56.		Percentage of mathematics teachers who perceived increases in students' ability to self-direct their learning.	SITES, 2006
57.		Percentage of science teachers who perceived increases in students' ability to learn at their own pace.	SITES, 2006
58.		Percentage of science teachers who perceived increases in students' ability to self-direct their learning.	SITES, 2006
59.	+	Mathematics teachers' perceptions of the impact of ICT-use on student collaboration	SITES, 2006
60.	+	Science teachers' perceptions of the impact of ICT-use on student collaboration	SITES, 2006
61.	+	Mathematics teachers' perceptions of the impact of ICT-use on students' inquiry skills	SITES, 2006
62.	+	Science teachers' perceptions of the impact of ICT-use on students' inquiry skills	SITES, 2006
		Impact on Teachers	
63.		Percentage of mathematics teachers who perceived that their use of ICT increased the quality of coaching they provide.	SITES, 2006
64.		Percentage of mathematics teachers who perceived that their use of ICT increased their time available to help individual students.	SITES, 2006
65.		Percentage of mathematics teachers who perceived that their use of ICT increased the time needed for (lesson) preparation.	SITES, 2006
66.		Percentage of mathematics teachers who perceived that their use of ICT increased the quality of their instruction.	SITES, 2006

Note:+ = Quantitative data not available. These indicators do not appear in the benchmark data tables.

Exhibit B-2. Technology-Enhanced Instruction, (Continued)

		Indicator	Source
		Barriers to Use in Instruction (Continued)	
67.		Percentage of mathematics teachers who perceived that their use of ICT increased the quality of classroom discussions.	SITES, 2006
68.		Percentage of mathematics teachers who perceived that their use of ICT increased collaboration among students.	SITES, 2006
69.		Percentage of mathematics teachers who perceived that their use of ICT increased the availability of new learning content.	SITES, 2006
70.		Percentage of mathematics teachers who perceived that their use of ICT increased the variety of learning resources/ materials.	SITES, 2006
71.		Percentage of mathematics teachers who perceived that their use of ICT increased the variety of learning activities.	SITES, 2006
72.		Percentage of mathematics teachers who perceived that their use of ICT increased their ability to adapt to individual needs of students.	SITES, 2006
73.		Percentage of mathematics teachers who perceived that their use of ICT increased the amount of effort needed to motivate students.	SITES, 2006
74.		Percentage of mathematics teachers who perceived that their use of ICT increased their insight into the progress of student performance.	SITES, 2006
75.		Percentage of science teachers who perceived that their use of ICT increased the quality of coaching they provide.	SITES, 2006
76.		Percentage of science teachers who perceived that their use of ICT increased their time available to help individual students.	SITES, 2006
77.		Percentage of science teachers who perceived that their use of ICT increased the time needed for (lesson) preparation.	SITES, 2006
78.		Percentage of science teachers who perceived that their use of ICT increased the quality of their instruction.	SITES, 2006
79.		Percentage of science teachers who perceived that their use of ICT increased the quality of classroom discussions.	SITES, 2006
80.		Percentage of science teachers who perceived that their use of ICT increased collaboration among students.	SITES, 2006

Exhibit B-2. Technology-Enhanced Instruction, (Continued)

		Indicator	Source
		Barriers to Use in Instruction (Continued)	
81.		Percentage of science teachers who perceived that their use of ICT increased the availability of new learning content.	SITES, 2006
82.		Percentage of science teachers who perceived that their use of ICT increased the variety of learning resources/ materials.	SITES, 2006
83.		Percentage of science teachers who perceived that their use of ICT increased the variety of learning activities.	SITES, 2006
84.		Percentage of science teachers who perceived that their use of ICT increased their ability to adapt to individual needs of students.	SITES, 2006
85.		Percentage of science teachers who perceived that their use of ICT increased the amount of effort needed to motivate students.	SITES, 2006
86.		Percentage of science teachers who perceived that their use of ICT increased their insight into the progress of student performance.	SITES, 2006
		Teachers' ICT Competence	
87.	+	Mathematics teachers' self-reported pedagogical ICT-competence	SITES, 2006
88.	+	Science teachers' self-reported pedagogical ICT-competence	SITES, 2006
89.	+	Mathematics teachers' self-reported technical ICT-competence	SITES, 2006
90.	+	Science teachers' self-reported technical ICT-competence	SITES, 2006
		Professional Development Requirements	
91.		Percentage of schools requiring the acquisition of knowledge and skills in using new ways of assessment.	SITES, 2006
92.		Percentage of schools requiring the acquisition of knowledge and skills in using computers for monitoring student progress.	SITES, 2006
93.		Percentage of schools requiring the acquisition of knowledge and skills in being knowledgeable about the pedagogical issues of integrating ICT into teaching and learning.	SITES, 2006

Note:+ = Quantitative data not available. These indicators do not appear in the benchmark data tables.

Exhibit B-2. Technology-Enhanced Instruction, (Continued)

		Indicator	Source
		Professional Development on Integrating ICT in Instruction	
94.	*	Teachers' participation in technical professional development activities: - Attended - Would want to attend - Would not attend	SITES, 2006
95.	*	Teachers' participation in pedagogical professional development activities - Attended - Would want to attend - Would not attend	SITES, 2006
		Funding for Professional Development	
96.		Availability of government subsidy of professional development for teachers in: (a) "ICT-skills"; (b) "use of ICT in subjects"; (c) "use of ICT in administration"; and (d) "use of ICT for new approaches in learning"	SITES, 2006
		Major ICT Initiatives	
97.	*#	Major initiatives to integrate ICT into instruction, including goals of the initiative, target groups, partners, and period of performance.	Eurydice Report: Information and Communication Technology in European Education Systems, 2001
98.	*#	Major initiatives to develop distance education, including goals of the initiative, target groups, partners, and period of performance.	Eurydice Report: Information and Communication Technology in European Education Systems, 2001
		Partnerships to Support ICT Initiatives	
99.	*	Percentage of upper secondary students attending schools where cooperation exists with other educational institutions to support ICT initiatives that provide joint educational experiences through ICT (e.g., communication and exchange of information, joint research projects)	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
100.	*	Percentage of upper secondary students attending schools where cooperation exists with private companies to support ICT initiatives that provide joint educational experiences through ICT (e.g., communication and exchange of information, joint research projects	OECD International Survey of Upper Secondary Schools (ISUSS), 2001

Note: These indicators do not appear in the benchmark data tables. * = Data collected prior to 2005. # = Qualitative descriptive data.

Exhibit B-2. Technology-Enhanced Instruction, (Continued)

		Indicator	Source
		Partnerships to Support ICT Initiatives (Continued)	
101.	*	Percentage of upper secondary students attending schools where cooperation exists with other organizations to support ICT initiatives that provide joint educational experiences through ICT (e.g., communication and exchange of information, joint research projects)	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
102.	*	Percentage of upper secondary students attending schools that do not cooperate with organizations to support ICT initiatives that provide joint educational experiences through ICT (e.g., communication and exchange of information, joint research projects)	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
103.	*	Percentage of upper secondary students attending schools where cooperation exists with other educational institutions to support ICT initiatives on the delivery of instruction (e.g., online courses)	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
104.	*	Percentage of upper secondary students attending schools where cooperation exists with private companies to support ICT initiatives on the delivery of instruction (e.g., online courses)	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
105.	*	Percentage of upper secondary students attending schools where cooperation exists with other organizations to support ICT initiatives on the delivery of instruction (e.g., online courses)	OECD International Survey of Upper Secondary Schools (ISUSS), 2001
106.	*	Percentage of upper secondary students attending schools that do not cooperate with organizations to support ICT initiatives on the delivery of instruction (e.g., online courses)	OECD International Survey of Upper Secondary Schools (ISUSS), 2001

Note: These indicators do not appear in the benchmark data tables. * = Data collected prior to 2005.

Exhibit B-3. Increasing Teacher Capacity through Technology

	Indicator	Source
	Strategies for delivering Professional Development using ICT	
*#	Strategies for achieving aims: Utilize the Internet to both provide opportunities for teacher training and allow access to educational materials	Eurydice Report: Information and Communication Technology in European Education Systems, 2001

Note: These indicators do not appear in the benchmark data tables. * = Data collected prior to 2005. # = Qualitative descriptive data.

Appendix C. Approved Ministerial Contacts

The following list of contacts agreed to participate in the IETE data collection, including gathering responses to the IETE survey and participating in a follow up interview. Without the participation of these individuals, the IETE study would not have been possible.

Exhibit C-1. Contact Information for Ministry of Education Representatives

Country	Contact	
Australia	Evan Arthur Group Manager, National Schools and Youth Partnerships Department of Education, Employment and Workplace Relations evan.arthur@deewr.gov.au Tel: +61 2 6240 5187 Fax: +61 2 6275 3204	
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Exhibit C-1.
Contact Information for Ministry of Education Representatives, (Continued)

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Exhibit C-1.
Contact Information for Ministry of Education Representatives, (Continued)

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