Target 7: Adapt all primary and secondary school curricula to meet the challenges of the information society, taking into account national circumstances[1]

Introduction

The challenges faced by traditional education systems are amplified by the rapidly changing skills demanded in an increasingly globalized labour market. Insights into the direction in which information societies and technological advances are moving reveal a changing vision and a shift away from traditional practices. The impact of technological change on education calls for a critical examination of national policies, past and present. ICTs can play an important role in redefining education to respond to contemporary information society needs. Thus, there is a need to review education, from the earliest levels of schooling to the tertiary level, and to reorient and improve existing curricula so as to capitalize on technological change. This policy response will help prepare a pool of competent and globally competitive workers.

The action lines in the WSIS Geneva Plan of Action express a clear need for capacity building and skills development in order to reap the full benefits of the information society. Teachers who are methodically trained in the fields of ICT literacy and computing are best positioned to deliver curricula that build on the development of basic computer skills in preparation for advanced studies and the labour market. As stated in WSIS Action Line C4, capacity building through e-learning initiatives will be an important precondition for the development of skills in the information society:

> "*Everyone should have the necessary skills to benefit fully from the information society. Therefore capacity building and ICT literacy are essential. ICTs can contribute to achieving universal education worldwide, through delivery of education and training of teachers, and offering improved conditions for lifelong learning, encompassing people that are outside the formal education process, and improving professional skills.*"[2]

The key points within Action Line C4 pertaining to teacher training and ICT-adapted curricula are as follows:

- *Develop domestic policies to ensure that ICTs are fully integrated in education and training at all levels, including in curriculum development, teacher training, institutional administration and management, and in support of the concept of lifelong learning (§ 11a)*

- *Develop pilot projects to demonstrate the impact of ICT-based alternative educational delivery systems, notably for achieving Education for All goals, including basic literacy targets (§ 11f)*

- *Work on removing the gender barriers to ICT education and training and promoting equal training opportunities in ICT-related fields for women and girls. Early intervention programmes in science and technology should target young girls with the aim of increasing the number of women in ICT careers. Promote the exchange of best practices on the integration of gender perspectives in ICT education (§ 11g)*

- *Design specific training programmes in the use of ICT in order to meet the educational needs of information professionals, such as archivists, librarians, museum professionals, scientists, teachers, journalists, postal workers and other relevant professional groups. Training of information professionals should focus not only on new methods and techniques for the development and provision of information and communication services, but also on relevant management skills to ensure the best use of technologies. Training of teachers should focus on the technical aspects of ICTs, on development of content, and on the potential possibilities and challenges of ICTs (§ 11k).*

In addition to the WSIS Geneva Plan of Action, two other international movements calling for equal education opportunities are the *Millennium Development Goals* (MDG)[3] and the *Education for All* (EFA) goals. The EFA movement was officially launched by the international community, including representatives from 155 countries, in 1990 in Jomtien, Thailand.[4] Ten years later, in Dakar, Senegal in 2000, with many countries still far from achieving their commitments, the international community reaffirmed its support to providing Education for All, identifying six goals to be achieved by 2015. The EFA goals[5] aim to increase participation, equity and quality in schooling and lifelong learning for all, in addition to diversifying the skills supply to match the demands of the information society. While it is highly important that all of the goals be achieved, there are two EFA goals that are closely linked to the WSIS action lines, namely Goal 3 and Goal 6, which aim to enhance the quality of education and the development of essential life skills. The idea that ICT-assisted instruction can help enhance the quality of education and expand learning opportunities is one of the

Box 7.1: The six Education for All (EFA) goals

Goal 1: Expanding and improving comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children

Goal 2: Ensuring that by 2015 all children, particularly girls, children in difficult circumstances and those belonging to ethnic minorities, have access to, and complete, free and compulsory primary education of good quality

Goal 3: Ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life-skills programmes

Goal 4: Achieving a 50 per cent improvement in levels of adult literacy by 2015, especially for women, and equitable access to basic and continuing education for all adults

Goal 5: Eliminating gender disparities in primary and secondary education by 2005, and achieving gender equality in education by 2015, with a focus on ensuring girls' full and equal access to and achievement in basic education of good quality

Goal 6: Improving all aspects of the quality of education and ensuring excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills

Source: UNESCO.

Box 7.2: Estonia's tiger leap from prerequisites to action[7]

In 1993, the Estonian Information Network of Education and Science (EENet)[8] was established by the Ministry of Education and Culture to improve Internet connectivity and computer training for teachers. Inspired by the early success of EENet's initiative during the early nineties, the idea of distributing Internet-connected computers throughout Estonian high schools was first envisioned and articulated by a journalist in an 1995 newspaper article. Considering Estonia's size and development trends at the time, the country was quick to embrace the idea of introducing this new paradigm and enhancing the quality of education, to join the "developed world" in a single "tiger leap." The metaphor of a tiger leap became popular and was supported by all interest groups within society, including the President of the Republic, who announced the launch of the venture in a television speech in early 1996.[9] The *Tiger Leap Foundation* was established at the end of 1996.

The main focus of the project was on the acquisition of ICT hardware, the development of data communication networks and the creation of educational software. Another important policy element was teacher education, as well as fostering a virtual environment devoted to the Estonian language, culture and heritage.[10, 11] Actual work in connecting schools to data communication networks started after the project evaluation, at the end of 1997.

By 2006, the Tiger Leap programme had succeeded in ensuring that Estonia's schools were equipped with modern ICTs (including broadband access in the vast majority of schools) and had all integrated the use of ICTs in the curriculum. The focus of the 2006-2009 plan was on the creation of e-learning content and continued improvement of curriculum quality through the use of ICTs.

stepping stones towards achieving the education-related targets in the WSIS Plan of Action and the EFA goals (for a complete list of the EFA goals, see Box 7.1).

In view of the challenges faced in meeting the WSIS, MDG[6] and EFA targets, it seems unrealistic to assume that conventional delivery mechanisms will be capable of ensuring the affordable and sustainable provision of quality and equal education opportunities for all by 2015. Indeed, the biggest challenge for many education systems is to be able to offer training or learning opportunities to traditionally underserved or marginalized groups. This includes girls and women who face barriers to schooling; rural populations that are too dispersed to populate regular schools cost-effectively with reasonable class sizes; children from families in extreme poverty; and special needs groups or persons with disabilities who have no access to learning centres.

While the lack of ICT infrastructure remains a major constraint for many developing countries, some have gone beyond connecting schools. Exemplary actions are being taken by governments in terms of policy initiatives that address the multi-faceted challenges of adapting curricula in primary and secondary schools to meet the demands of an ever-changing society (see, for example Estonia, Box 7.2)

Measuring Target 7 — Proposed indicators

Monitoring curricula at the international level in relation to Target 7 can be understood in two ways. On the one hand, monitoring will track the *outputs* of ICT-adapted curricula. Almost all existing data on outputs in education are derived from sample-based international comparative assessments which rely on direct measurement of ICT use in schools and curricula by students and teachers (see Box 7.3). On the other hand, and of prime importance for Target 7, monitoring must also focus on measuring the *inputs* required in order to gear curricula to the needs of the information society. An evaluation over time of the requisite human and physical capital resources is essential, as these constitute the foundation for curricula that meet the changing needs of society.

A set of core ICT in education indicators that measure aspects of e-readiness and access to ICT in education systems was submitted by the *Partnership on Measuring ICT for Development* to the United Nations Statistical Commission (UNSC) at its 40th session in February 2009 [Partnership, 2010]. As a response to the need to expand the initial core list, UIS has established the international Working Group for ICT Statistics in Education (WISE). The purpose of the working group is to bring together statisticians (national focal points) from ministries of education (or national statistical offices) from 25 countries around the world to pilot the international *Questionnaire on Statistics of ICT in*

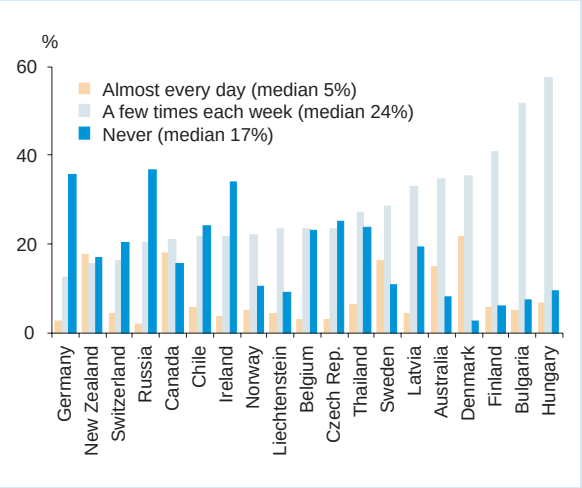
Box 7.3: The use of ICT in curricula — A review of selected comparative assessments

The International Association for the Evaluation of Educational Achievement (IEA) has performed international comparative assessments which focus on measuring student achievement in mathematics, science and reading, and include modules on ICT use by students and teachers as part of the curriculum. Examples of these studies include the Progress in International Reading Literacy (PIRLS)[12] and the Trends in International Mathematics and Science Study (TIMSS).[13] One of the first sample-based assessments aiming exclusively at measuring the use of ICT in education was the Second Information Technology in Education Studies (SITES). Initiated in 1997, SITES is a research programme focused on comparative assessment of ICT use in education across many countries.[14] In addition to cross-national data collection, qualitative case studies of innovative pedagogical practices were also undertaken.[15] SITES 2006 is the third project in the series.[16] Another important study is the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA). The programme, which is a standardized international assessment targeting the performance of 15-year old students, includes a specific module that examines ICT use by students [OECD, 2006].

The growing prevalence and integration of technology for education over time shows that steps have been taken to bridge the digital divide in education. In Charts 1 and 2 of Box 7.3, a comparison between the years 2000 and 2006 reveals an overall increase in the frequency of use of computers at school for 15 year-old students. The median proportion of students that use computers every day for the same countries has risen modestly from five per cent to nine per cent, while the median value for the proportion of students that use computers once or twice a week[17] reached a relatively high level in 2006 (46 per cent). Comparison of the figures for students who have never used a computer at school in 2000 (17 per cent) and 2006 (5 per cent) points to the growing proliferation and use of computers at schools in many countries.

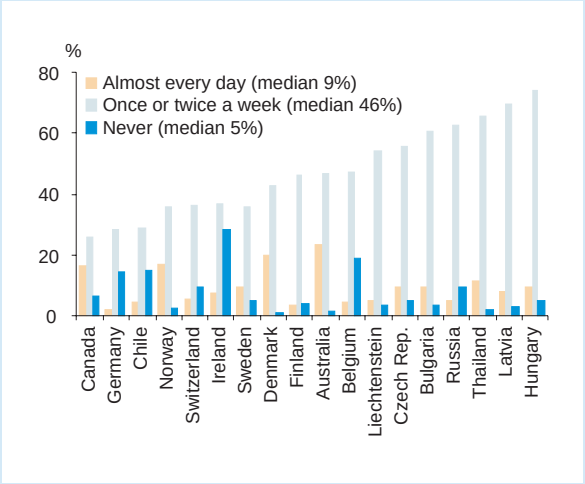
To date, international comparative student assessments remain the predominant source of information for policy questions regarding ICT use in education. These assessments are essential for identifying variables for the purposes of monitoring trends in the integration of ICTs in education.

Chart 1 Box 7.3: Frequency of computer use at school, 2000



Source: OECD PISA database

Chart 2 Box 7.3: Frequency of computer use at school, 2006



Source: OECD PISA database

Education. The following four indicators[18] suggested to monitor Target 7 in the following sections (Box 7.4) are the result of this initiative [UNESCO-UIS, 2009a]:

1. Proportion of ICT-qualified teachers in primary and secondary schools (for ISCED levels 1-3)

2. Proportion of teachers trained to teach subjects using ICT (for ISCED levels 1-3)

3. Proportion of schools with computer-assisted instruction (for ISCED levels 1-3)

4. Proportion of schools with Internet-assisted instruction (for ISCED levels 1-3)

Box 7.4: How is ICT-assisted instruction defined?

ICT-assisted instruction refers to teaching methods or models of instruction delivery that employ ICT in supporting, enhancing and enabling course-content delivery. It includes any, all or combinations of the following: radio-, television-, computer- and Internet-assisted instruction

What are ICT-related fields?

ICT-related fields include all programmes that comprise any of the following four fields of education and training [UNESCO-UIS, 2009a] [Eurostat, 1999]:

Audiovisual techniques and media production is the study of techniques and the acquisition of skills to produce books, newspapers, radio/television programmes, films/videos, recorded music and graphic reproduction with ICT. It includes programmes in methods of colour reproduction, photography and computer graphics, as well as the layout for pictures, words and decorations in the production of books, magazines, posters, advertisements, etc.

Computer science is the study of the design and development of computer systems and computing environments. It includes the study of the design, maintenance and integration of software applications.

Computer use is the study of using computers and computer software and applications for different purposes. These programmes are generally of short duration.

Electronics and automation (engineering and engineering trades) is the study of planning, designing, developing, maintaining and monitoring electronic equipment, machinery and systems. It includes designing computers and equipment for communication.

Source: [UNESCO-UIS, 2009a].

These indicators will measure the inputs or determinants required for the effective delivery of ICT-adapted curricula. Inputs in this instance refer specifically to trained teachers as well as the required conditions for the delivery of ICT-assisted instruction. They serve as the foundation for the integration of ICTs in education systems. The indicators that monitor these inputs are statistically comparable at a cross-national level, and aim to track progress towards Target 7 and the corresponding action lines identified above. At the international level, the collection and dissemination of these indicators are under the responsibility of UIS.

The stock of available human capital for teaching is seen as the hallmark for the effective delivery of any curriculum, in particular one that involves ICT-assisted instruction (for a definition of this indicator, see Box 7.4). One useful measure in monitoring the stock of human capital is thus the *proportion of ICT-qualified teachers* (or teachers trained to teach basic computer skills) in primary and secondary schools. Such a measure sheds light on the extent to which primary and secondary school teachers have the required ICT training to teach basic computer skills (or computing) classes. This indicator is part of the core list of ICT indicators identified by the *Partnership on Measuring ICT for Development* (*Partnership* indicator ED8).

A high percentage of ICT-qualified teachers among the overall teaching staff in primary and secondary schools suggests that a country aims to provide learners with basic ICT skills and to meet emerging and evolving skills requirements in the information society. This does not automatically mean, however, that basic computer skills (or computing) classes are actually offered to learners by all teaching staff who have received formal training to teach basic computer skills (e.g. in cases where certain other prerequisites — such as computer labs, basic computer skills course syllabus, etc. — are not available in schools). Besides its use for international comparison, this indicator can also be calculated and analysed at national and subnational levels (by ISCED level and grade, geographical region, urban/rural area, and public/private school) in order to design tailored policies and help implement training actions and deploy adequate numbers of ICT-trained teachers in schools.

The proportion of ICT-qualified teachers is a measure of human capital stock based on a nationally defined qualification in the core disciplines of ICT or a qualification to teach basic computer skills. The *proportion of primary and secondary school teachers trained to teach subject(s) using ICT* refers to those teachers who have received a nationally defined minimum of formal training to teach one or more subjects at the relevant level(s) using ICT to support their teaching.

A high percentage for the latter indicator can be interpreted as an appropriate measure of e-readiness. It means that teachers have been sufficiently trained to use ICTs to teach subject(s) in primary and secondary schools. When calculated by ISCED level, geographical region, urban/rural area and individual educational institution, and analysed in conjunction with other indicators, this indicator can highlight discrepancies, so that appropriate policy steps can be taken to assign trained teachers more effectively and to provide training to teachers.

Developing an informed assessment of curricula to meet the changing needs of the information society entails multiple dimensions. While targeted policies for the recommended use of ICTs in curricula and for human capital formation of teachers are vital to this assessment, other dimensions are required in order to monitor progress towards achieving the WSIS targets. In tandem with these aspects, therefore, indicators that measure the actual number or *proportion of primary and secondary schools that offer computer-assisted instruction and/or Internet-assisted instruction* provides policy-makers with a sense of the intensity or magnitude of ICT use at the school level. Internet-assisted instruction refers to an interactive learning method using the Internet to deliver instructional materials on a computer or through other devices, in accordance with learners' pedagogical needs. This mode of instruction helps to develop autonomy in research activities as well as information literacy skills. Computer-assisted instruction, which does not necessitate a cable or telephone line and is therefore more accessible, focuses more on the use of educational software and related tools in curricula, which can also increase information literacy skills.

Status of Target 7

While the results of existing surveys provide important insights into the status of school curricula, it is important to note that data for each of the four indicators proposed for measuring Target 7 are limited to about 20-25 economies.[19] Annex 7.1 provides an overview of all available data to track Target 7.

Existing figures for the *proportion of ICT-qualified teachers*[20] range from zero (in Bolivia and Nauru) to six per cent of the entire teaching force for a (limited and rather heterogeneous) selection of countries representing different regions and income levels. Data are available for two developed countries from Europe (Estonia and Lithuania). While Estonia has one per cent of ICT-qualified teachers, four per cent of teachers in Lithuania have ICT qualifications (Chart 7.1). The economies with the largest proportion of ICT-qualified teachers in all schools are Bahrain, Jordan and the Palestinian Authority. In Jordan, a country that has made ICTs a priority (see Box 7.5) the necessary qualification to teach basic computer skills in the public education system has been formalized (and is held by six per cent of teachers in public schools). All teachers that teach the subject have a formal qualification in computer science.

Nevertheless, this indicator only depicts the skilled teaching force available to deliver basic ICT skills (or computing) classes based on nationally defined standards. This does not necessarily mean that each of the teachers recorded as qualified actually teaches a basic ICT skills (or computing) course. Furthermore, in schools where there is no ICT equipment or inadequate ICT equipment, course delivery may not be effective even though the schools have teachers qualified to teach ICT. Given these limitations and the limited number of countries where data are available, it is difficult to identify an ideal percentage of ICT-qualified teachers. Much will depend, therefore, on how a country's ICT-qualified teachers are employed; but the input indicators provide a good insight into teachers' qualifications, training and potential, allow policy-makers to set targets, measure progress and make international comparisons.

Having ascertained the stock of ICT-qualified teachers that have the nationally defined qualification to teach basic computer skills, it is interesting to investigate the proportion of teachers who actually teach basic computer skills. An obvious hypothesis is that there would be a one-to-one relationship between the two groups. Indeed, Chart 7.2 shows that there is evidence in many countries of a more or less linear relationship, indicating a perfect match. Economies such as Jordan, the Palestinian Authority and Tunisia display perfect proportionality (i.e. a one-to-one ratio) between the two groups of teachers. Egypt shows a very high proportion of ICT-qualified teachers (24.5 per cent) as against only a small proportion of teachers actually teaching basic computer skills (1.9 per cent). This extremely high

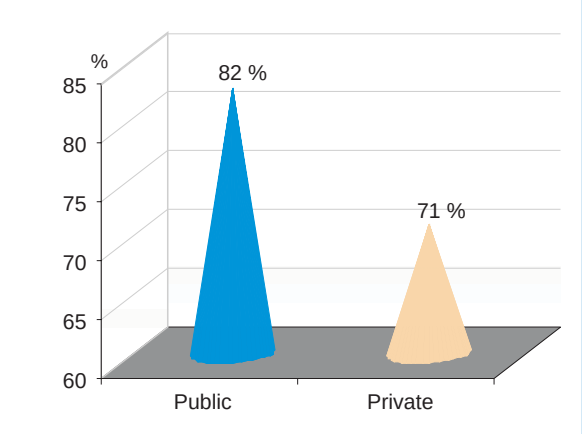
Box 7.5: Integrating ICTs in the curricula — A priority in Jordan[21]

Recognizing the importance and potential impact of the ICT sector for economic development, Jordan has made extensive efforts to achieve a high level of ICT readiness. The country has committed significant investments to reform the current education system in order to allow individuals to participate in the knowledge-based economy. Initiatives have focused on establishing and modernizing the infrastructure required to support ICT-assisted instruction. This includes the provision of Internet connectivity and computer labs that are equipped with relevant hardware and software. By 2009, 72 per cent of learners were entitled to use Internet laboratories at school as a pedagogical aid. Along with the development of electronic content, teacher-training initiatives were also deployed to complement teaching and learning processes with the use of ICTs.

By 2009, 80 per cent of schools in Jordan had Internet-assisted instruction (IAI) — 71 per cent of private schools and 82 per cent of public schools. Computer-assisted instruction (CAI) is practiced in 86 per cent of schools — 95 per cent of private schools and 83 per cent of public schools (see Charts 1 and 2 of Box 7.5).

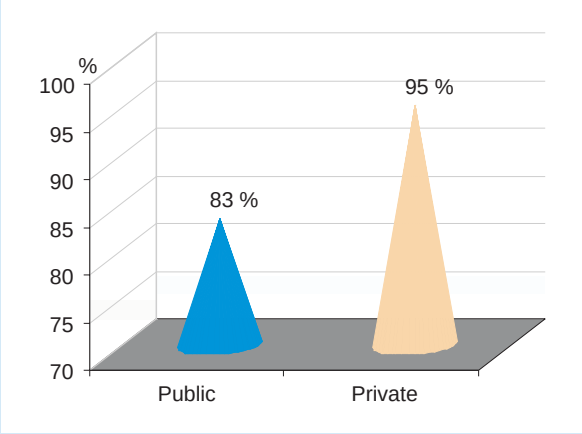
Substantial advances have also been made in terms of teacher training. By 2009, all teachers who teach subjects involving computer literacy have a bachelor's degree in computer science. Overall, ICT-qualified teachers make up six per cent of the teaching force, and the proportion of teachers trained to teach subject(s) using ICT facilities is 62 per cent. The proportion of female teachers trained is 37 per cent, compared to 26 per cent for men (Chart 3 Box 7.5). The ratio of learners-to-"teachers using ICT to teach" is 26:1 (31:1 in public schools and 16:1 in private schools).

Chart 1 Box 7.5: Proportion of schools with Internet-assisted instruction, Jordan, 2009



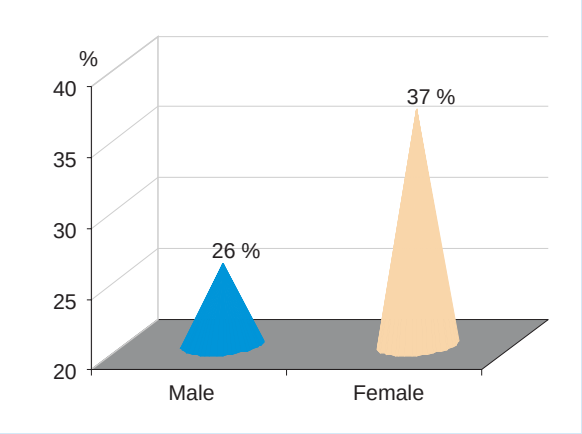
Source: Jordan Ministry of Education.

Chart 2 Box 7.5: Proportion of schools with computer-assisted instruction, Jordan, 2009



Source: Jordan Ministry of Education.

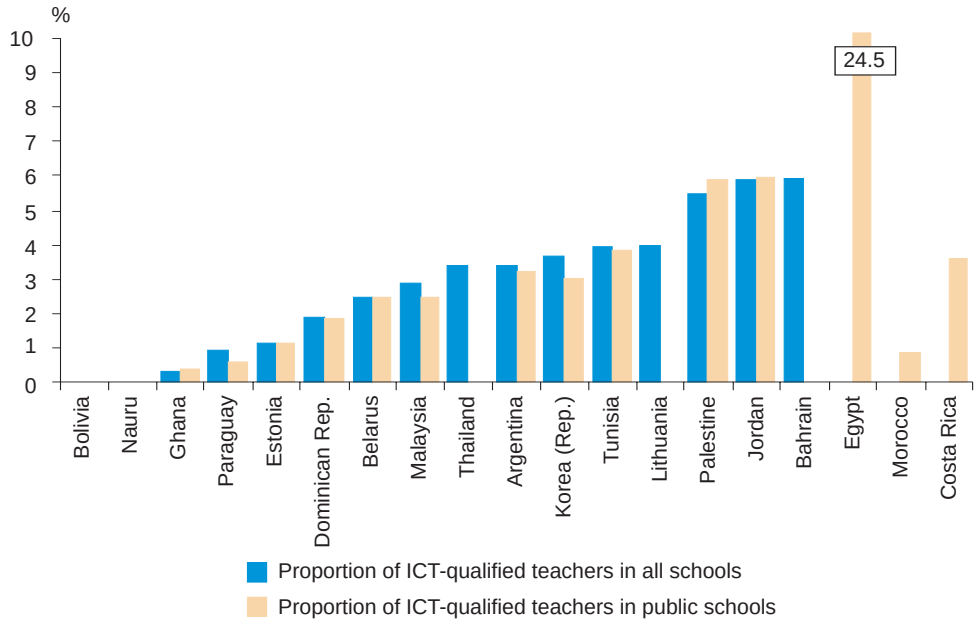
Chart 3 Box 7.5: Proportion of teachers trained to teach subjects using ICTs, Jordan, 2009



Source: Jordan Ministry of Education.

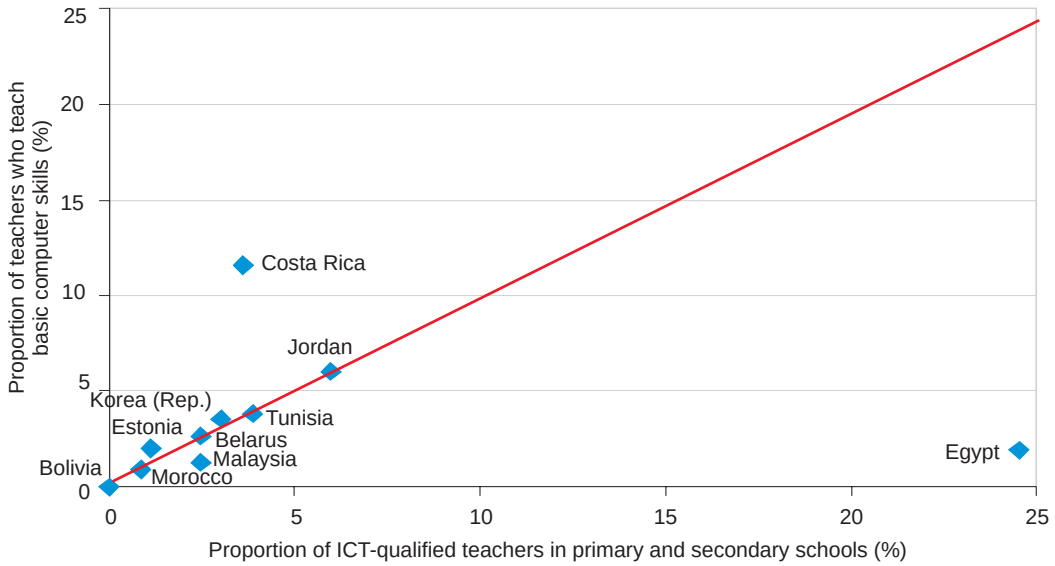
proportion of trained teachers in Egypt is attributed to a government policy by the Ministry of Education that sponsors teachers to take the International Computer Driving Licence.[22] This internationally recognized certification helps develop candidates' computer skills and increases their overall level of competency in using personal computers and common computer applications.[23] Costa Rica, on the other hand, displays a different type of gap between theory

Chart 7.1: Proportion of ICT-qualified teachers in primary and secondary schools, 2008-09*



Note: *Or latest year available.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education and ITU Survey on the WSIS Targets.

Chart 7.2: Proportion of teachers who teach basic computer skills compared to the proportion of ICT-qualified teachers (in public primary and secondary schools), 2008*



Note: *Or latest year available.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education (2009).

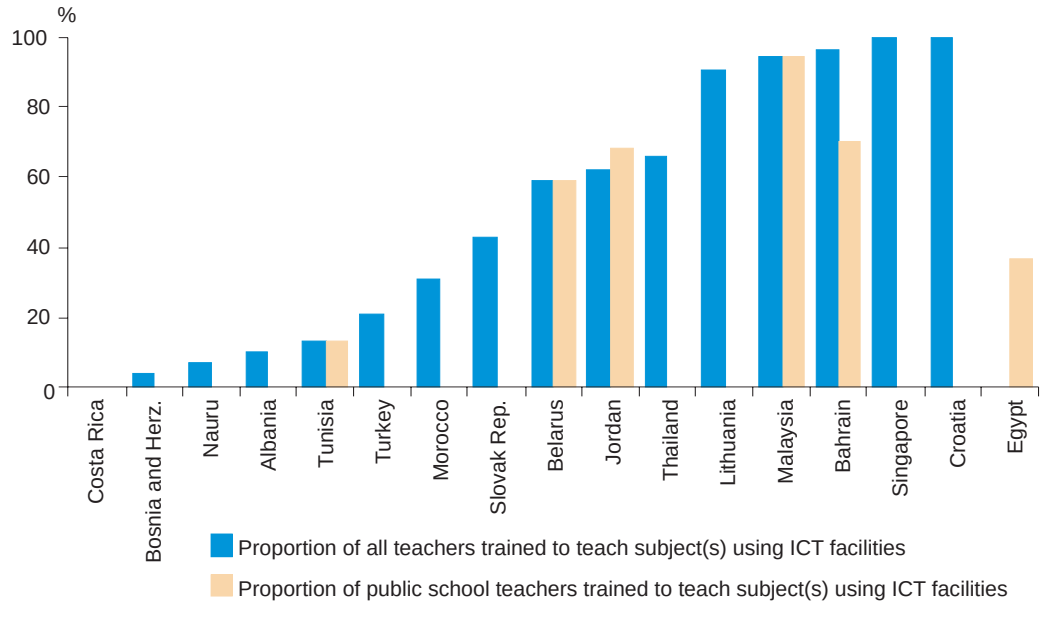
and practice: as many as 12 per cent of teachers teach basic computer skills, yet only four per cent are ICT-qualified. Conversely, figures suggest that Malaysia is not fully utilizing its pool of ICT-qualified teachers (2.5 per cent) to teach basic computer skills, since only 1.3 per cent are teaching ICT courses.

Nationally defined ICT qualifications to teach basic computer skills may differ from one country to another. While some countries may require a formal degree in an ICT-related field, others may have other forms of nationally defined certification to deliver courses in basic computer skills in their curricula.

There is significant variation in terms of the availability of teachers with formalized training in ICT-assisted instruction across the group of countries with available data. This is apparent in Chart 7.3, as the *proportion of teachers trained to teach subjects using ICT* in schools (i.e. ICT-assisted instruction) ranges from zero (in Costa Rica) to 100 per cent (in Singapore and Croatia). A high proportion of teachers are trained in the use of ICTs in both public and private schools in countries such as Jordan (62 per cent, 68 per cent), Bahrain (70 per cent, 97 per cent) Malaysia (94 per cent, 95 per cent) and Belarus (59 per cent for both). This usually reflects ongoing policies to fully integrate ICT into curricula and training programmes in these countries. For instance, under the Malaysian plan to fulfil "Vision 2020," a policy aimed at developing a critically thinking and technologically literate workforce, the Ministry of Education has successfully converted its schools into ICT-enabled "Smart Schools" through various phases beginning in 1999. The objective of the Smart Schools is to enhance the quality of education through the introduction of technology. Different multimedia technologies create the enabling infrastructure for new teaching and learning processes within the education network to link all Smart Schools.[24]

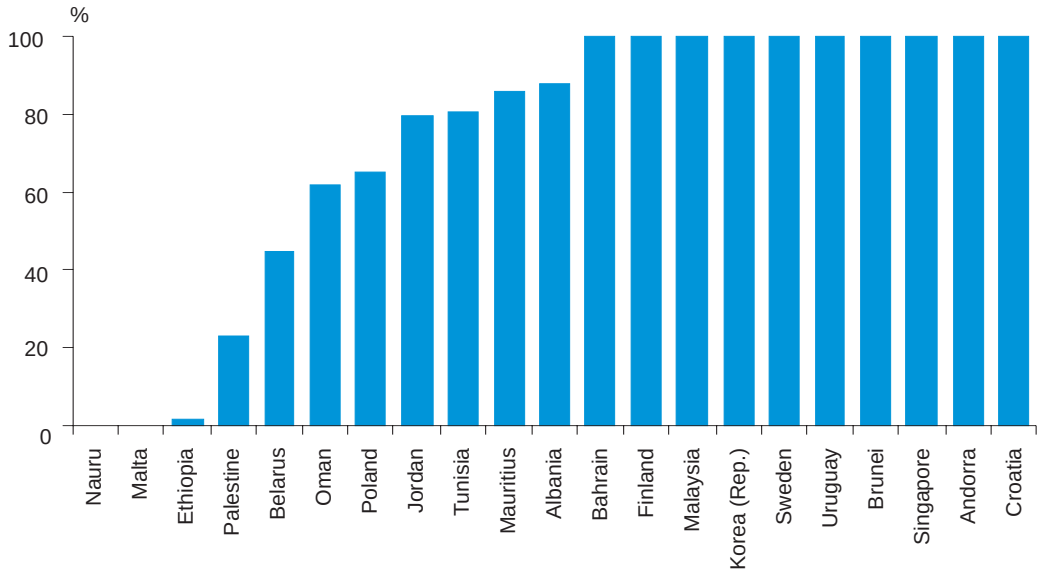
Many countries have moved beyond the initial e-readiness stage, to full penetration of Internet connectivity (see Chart 7.4), with all primary and secondary schools making use of the world wide web in their curricula (Bahrain, Finland, Malaysia, Republic of Korea, Sweden, Uruguay and the United States). In a number of developing countries, including Oman, Jordan, Tunisia and Mauritius, a relatively large proportion of schools (between 60 and 90 per cent) practise *Internet-assisted instruction*. Other countries such as Nauru, Malta, Guatemala and Ethiopia show either low or no presence of Internet-assisted instruction. Having said that, these countries may use alternative technolo-

Chart 7.3: Proportion of primary and secondary school teachers trained to teach subject(s) using ICTs, (for ISCED levels 1-3), 2008-09*



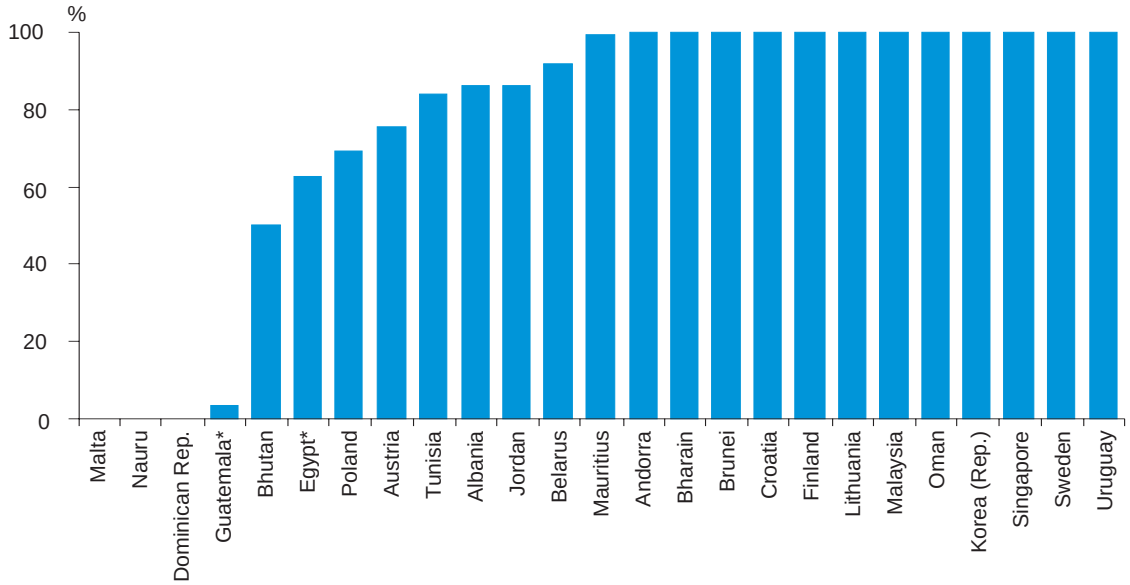
Note: *Or latest year available. Includes national estimates.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education and ITU Survey on the WSIS Targets.

Chart 7.4: Proportion of (public and private) schools with Internet-assisted instruction (for ISCED levels 1-3), 2008-09*



Note: *Or latest year available. Existing data are presented for total schools (public and private)
Source: UIS Pilot Questionnaire on Statistics of ICT in Education and ITU Survey on the WSIS Targets.

Chart 7.5: Proportion of schools with computer-assisted instruction (for ISCED levels 1-3), 2008-09**



Note: **Or latest year available. Existing data is presented for total schools (public and private), unless marked by an * which indicates only public schools.
Source: UIS Pilot Questionnaire on Statistics of ICT in Education and ITU Survey on the WSIS Targets.

gies such as radio-, and television-assisted instruction to complement course delivery, according to national circumstances.

Chart 7.5 shows that *computer-assisted instruction* is very prevalent in a number of countries. This type of instruction is more accessible, because it does not require a cable or telephone connection. It is founded on the use of educational software and related tools in the curricula. As many as eight countries from different regions and at different levels of development indicate that they have fully adopted this mode of instruction in their schools. A country's development status does not necessarily seem to determine the level of computer-assisted instruction, since both Austria and Poland — two developed, European countries — have lower levels (76 and 69 per cent) than a number of developing countries, including Tunisia, Jordan and Mauritius. A number of countries, including Malta, Nauru, the Dominican Republic and Guatemala, report no or little computer-assisted instruction in their schools. On the other hand, these countries may have a greater prevalence of other forms of ICT-assisted instruction such as television- and radio-assisted instruction.

Conclusions and recommendations

Under the right conditions, it is believed that ICTs can have a massive impact on the expansion of learning opportunities to greater and more diverse populations, beyond cultural barriers, and outside the confines of teaching institutions or geographical boundaries [Haddad and Draxler, 2002]. Indeed, technology can improve the teaching and learning process by reforming conventional delivery systems. As a tool, ICTs enhance the quality of learning and facilitate state-of-the-art skills formation.

Guaranteeing an adequate supply of trained teachers is of critical importance and remains a major challenge confronting many countries throughout both the developing and developed world. While only a limited number of countries collect data on the *proportion of ICT-qualified teachers*, there are large variations among countries. Some entirely lack trained staff and therefore remain unprepared to adapt their curricula to the information society. Similar discrepancies exist in terms of the *proportion of primary and secondary teachers trained to teach subjects using ICT* facilities, with the proportion ranging from zero in some countries to 100 per cent in others.

Without an adequate pool of skilled teachers, adapting curricula to meet the needs of the information society is arguably unattainable. It is widely understood that ICTs by themselves cannot provide the education that learners need in order to be productive citizens in society and to contribute to the economic, social and political life of their countries. Success in implementing and leveraging ICTs in education in the conventional classroom setting is heavily dependent on teachers. Moreover, without the necessary investments in infrastructure to support a curriculum that intends to encapsulate ICT in the learning process, the formation of practical ICT skills of both learners as well as teachers is hampered. By definition, schools that do not have the supporting ICT infrastructure and ICT-trained teachers are not in a position to deliver pedagogical initiatives such as computer- and Internet-assisted instruction.

In a general sense, adapting curricula means modifying the way content is presented and delivered. It means adjusting the curriculum to ensure that all ICT-mediated content is accessible to all students. Adapting the curriculum to integrate ICTs requires emphasis on design, development and implementation of instructional approaches that provide multiple means of representation and multiple means of student engagement. The inclusion of ICTs in curriculum design means that more flexibility is required in order to be able to adjust to learners.

For the limited sample of countries for which data are available on the different forms of *ICT-assisted instruction*, the variation across countries is striking. While a number countries show evidence of an ICT-adapted curriculum in all or a majority of their primary and secondary schools, only a small proportion of schools in many developing countries have the requisite inputs to effectively integrate ICT as part of the curriculum. Countries which have adopted full-scale implementation of computer- and Internet-assisted instruction in their schools also have a relatively higher proportion of trained teachers, whereas other countries show signs that they are still in the early stages of implementation. Looking at the gap observed, albeit across the limited number of countries with available data, countries which are in the earlier stages of e-readiness can propel their progress by seizing opportunities to determine what activities or conditions are necessary, learning from more advanced countries which have employed effective models and policies for integrating ICTs in their curricula.

Indeed, to adapt school curricula to meet the challenges of the information society, and hence meet WSIS Target 7, policies must go beyond mere capital investments in ICT-related infrastructure. It is imperative that initiatives also develop ICT-skills building among the teaching force, so that the knowledge can be passed down to students. Policies for developing ICT skills among teachers act as a catalyst for adapting new curricula that prepare student populations for knowledge-based economies. While many developing countries, in partnership with the international community, must continue to commit resources with a view to achieving Target 2 (Connect educational institutions to ICTs), policy-makers must at the same time address the multi-faceted challenges of adapting curricula in primary and secondary schools to meet the demands of an ever-changing society.

Notes

1 Substantial inputs to this chapter have been provided by Mr Claude Akpabie from the UNESCO Institute for Statistics (UIS), Ms Beatriz Valdez-Melgar (UIS), Dr Khalida Shatat from the Jordan Ministry of Education and Mr Joel Peetersoo from the Estonian Ministry of Education and Research. These inputs are greatly acknowledged.

2 See WSIS Geneva Plan of Action, § 11 at: http://www.itu.int/wsis/docs/geneva/official/poa.html#c4.

3 MDG Target 2 is to "achieve universal primary education." For more information on the target and its indicators, see: http://mdgs.un.org/unsd/mdg/Host.aspx?Content=Indicators/OfficialList.htm.

4 The movement was launched at the World Conference on Education for All in 1990 by UNESCO, UNDP, UNFPA, UNICEF and the World Bank and signed by delegates from 155 countries, as well as representatives from some 150 governmental and non-governmental organizations. For more information, see: http://www.unesco.org/en/efa/the-efa-movement/efa-goals/.

5 For an overview of the UNESCO Education for All Goals, see: http://portal.unesco.org/education/en/ev.php-URL_ID=50558&URL_DO=DO_TOPIC&URL_SECTION=201.html.

6 The latest MDG regional assessment (progress chart) highlights that a number of regions are not on track for achieving target 2 of the MDGs, see: http://mdgs.un.org/unsd/mdg/Resources/Static/Products/Progress2009/MDG_Report_2009_Progress_Chart_En.pdf.

7 The content of this box was contributed by Mr Joel Peetersoo, Analyst for Research and Development, Estonian Ministry of Education and Research. For more information on the "Tiger Leap," see: http://www.tiigrihype.ee/.

8 EENet. Akadeemilise andmeside areng Eestis, at: http://www.eenet.ee/EENet/40.html.

9 Jõesaar, A. & Muuli, K. (2005). Ilves kavandab Eestile tiigrihüpet uude sajandisse, at: http://www.eenet.ee/EENet/18.html.

10 Mattson, T. (1997). Tiiger ampsab tuleval aastal vaid 35,5 miljonit, at: http://www.postimees.ee/leht/96/09/24/kuum.htm and RISO (Estonia State Information System).

11 Aastaraamat (1996). Infotehnoloogia rakendamisest ja infosüsteemide arengust valitsusasutustes, at: http://www.riso.ee/et/pub/1996it/p3.html.

12 International Association for the Evaluation of Educational Achievements (IEA), PIRLS 2006, at: http://www.iea.nl/pirls20060.html.

13 International Association for the Evaluation of Educational Achievements (IEA), TIMSS 2007, at: http://www.iea.nl/timss2007.html.

14 International Association for the Evaluation of Educational Achievements (IEA) (1999). SITES M1, at: http://www.iea.nl/sites-m1.html?&no_cache=1&sword_list[]=m1.

15 International Association for the Evaluation of Educational Achievements (IEA), 2002, SITES M2, at: http://www.iea.nl/sites-m2.html?&no_cache=1&sword_list[]=m2.

16 International Association for the Evaluation of Educational Achievements (IEA), 2006,.SITES M3, at: http://www.iea.nl/sites20060.html?&no_cache=1&sword_list[]=m1.

17 The wording for category items in the 2000 and 2006 questionnaire modules differs. The item for weekly frequency in the 2000 questionnaire reads: "A few times each week" whereas the 2006 questionnaire item reads: "Once or twice a week."

18 ISCED refers to the *International Standard Classification of Education* and is used to define the levels and fields of education. ISCED levels 1, 2, and 3 refer to primary, lower secondary and (upper) secondary education. For more information, see [UNESCO 1997].

19 Data are based on the UIS Pilot Questionnaire on Statistics of ICT in Education (which is limited to a group of 25 economies, including the Palestinian Autonomous Territories (Palestinian Authority)), as well as on the ITU Survey on the WSIS Targets.

20 Teachers trained to teach basic computer skills (or computing) refer to teachers considered qualified according to national standards or norms to teach basic computer skills (or computing) courses. All teachers trained specifically in ICTs under pre-service or in-service schemes according to nationally defined qualification standards are counted as qualified. At higher ISCED levels, in particular, teachers trained to teach computing should have a nationally required academic credential in an ICT-related field of study, such as computer science.

21 The content of this box was contributed by Dr Khalida Shatat, Director of Studies and Technology Projects, Jordan Ministry of Education.

22 http://www.icdlegypt.gov.eg/FactsAndFigures.aspx.

23 http://www.icdlegypt.gov.eg/Inside.aspx.

24 UNESCO Bangkok (2006). Malaysia — ICT in Education: Regional and Country Overviews. UNESCO, at: http://www.unescobkk.org/education/ict/themes/policy/regional-country-overviews/malaysia/.

References

Eurostat (1999), Fields of Education and Training — Manual, Luxembourg: Eurostat.

Haddad, W.D. and A. Draxler (eds.) (2002), *Technologies for Education: Potentials, Parameters and Prospects*, Paris: UNESCO and the Academy for Educational Development (AED).

OECD (2006), Programme for International Student Assessment (PISA). Retrieved from: http://www.pisa.oecd.org/pages/0,3417,en_32252351_32236130_1_1_1_1_1,00.html.

Partnership on Measuring ICT for Development (2010), Core ICT Indicators, Geneva.

UNESCO (1997), International Standard Classification of Education, UNESCO, Paris, 1997.

UNESCO — UIS (2009a), *Pilot Questionnaire on Statistics of ICT in Education*.

WSIS (2003), Geneva Plan of Action, Geneva: ITU

Annex 7.1: ICTs in education (ISCED levels 1-3)**

Country	% of ICT-qualified teachers		% of teachers trained to teach subjects using ICT		% of schools with computer-assisted instruction		% of schools with Internet-assisted instruction	
Africa								
Ethiopia	...		...		...		2	2008
Ghana	0.3	2009	...		...		...	
Mauritius	...	...	...		99	2008	85	2008
Arab States								
Bahrain	6	2008	97	2008	100	2008	100	2008
Egypt	24.5*	2008	37*	2008	63*	2008	...	
Jordan	6	2009	62	2009	86	2009	80	2009
Morocco	1*	2008	31	2009	...		...	
Oman	...		...		100	2008	62	2008
Tunisia	4	2008	13	2008	84	2008	81	2008
Asia and the Pacific								
Bhutan	...		...		50	2008	...	
Brunei	...		...		100	No yr.	100	No yr.
Korea (Rep.)	4	2008			100	2008	100	2008
Malaysia	3	2008	95	2008	100	2008	100	2008
Nauru	0	2009	7	2009	0	2009	0	2009
Singapore	...		100	2009	100	2009	100	2009
Thailand	3	2008	66	2008	...		...	
CIS								
Belarus	2	2008	59	2008	91.8*	2008	45	2008
Europe								
Albania	...		10	2009	86	2009	88	2009
Andorra	...		...		100	2009	100	2009
Austria	...		...		76	2007	...	
Bosnia and Herzegovina	...		4	2008	...		...	
Croatia	...		100	2009	100	2009	100	2009
Estonia	1	2008	...		...		...	
Finland	...		...		100	2008	100	2008
Lithuania	4	2009	91	2009	100	2009	99	2009
Malta	...		...		0	2009	0	2009
Poland	...		...		69	2008	65	2008
Slovak Republic	...		43	2008	...		...	
Sweden	...		...		100	2008	100	2008
Turkey	...		21	2009	...		...	
The Americas								
Argentina	3	2007	...		...		...	
Bolivia	0	2008	...		...		...	
Costa Rica	4*	2008	0	2008	...		...	
Dominican Republic	2	2008	...		0	2008	...	
Guatemala	...		...		3*	2009	...	
Paraguay	1	2008	...		...		...	
Uruguay	...		...		100	2008	100	2008
Other Economies								
Palestinian Authority	5	2009	...		...		23	2009

Note: ** The reference year is indicated for each data point. Existing data are presented for total schools (public and private), unless marked by an *, which indicates only public schools. "...": data not available.

Source: UIS Pilot Questionnaire on Statistics of ICT in Education and ITU Survey on the WSIS Targets.