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INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN EDUCATION IN ASIA

A comparative analysis of ICT integration and e-readiness in schools across Asia

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Introduction

More than ever, the advent of the knowledge economy and global economic competition compel governments to prioritise educational quality, lifelong learning and the provision of educational opportunities for all. Policymakers widely accept that access to information and communication technology (ICT) in education can help individuals to compete in a global economy by creating a skilled work force and facilitating social mobility. They emphasise that ICT in education has a multiplier effect throughout the education system, by enhancing learning and providing students with new sets of skills; by reaching students with poor or no access (especially those in rural and remote regions); by facilitating and improving the training of teachers; and by minimising costs associated with the delivery of traditional instruction.

However, beyond the rhetoric and of equal importance to policymakers are basic questions related to the measurement of ICT in education, its usage and potential outcomes, including retention and learning achievement. There are those who contend that computers and other ICTs have properties or affordances that directly change the nature of teaching and learning (Kozma, 1991; 1994; Dede, 1996). For instance, it is believed that ICT can help to bring abstract concepts to life using images, sounds, movement, animations and simulations. Others meanwhile argue that ICTs are merely a delivery mechanism for teaching and learning, while it is the foundational pedagogy that matters (Clark, 1983; 1994). Regardless, a better understanding of ICT in education and how it is integrated across national education systems must be a priority for all countries.

1. Why do we measure ICT in education?

The UNESCO Institute for Statistics (UIS), which is the United Nation's repository for statistics on education, science and technology, and culture and communication, is mandated to administer international data collections on the availability, use and impact of ICT in education. Through the establishment of internationally-comparable and policy-relevant indicators, the UIS contributes significantly towards international benchmarking and monitoring of the integration of and access to ICT in education, which are fundamental for policymakers to select priorities and adopt and develop policies. For instance, policymakers may use UIS data to inform decisions related to: i) national capacity and/or infrastructure levels (e.g. electricity, Internet, broadband) for integrating new ICT tools in schools; ii) the types of ICT currently being neglected and/or emphasised in relation to concerns of usability and affordability (e.g. radio- versus computer-assisted instruction); iii) whether ICT-assisted strategies are evenly distributed nationwide; iv) whether girls and boys have equal access; v) the types of support mechanisms currently in place or the lack thereof; and vi) the relative level of teacher training provided in relation to the demands placed on them to teach and/or use ICT in the classroom.

Education policymakers have been formalising ICT policies as part of educational renewal and reform for almost four decades. At the international level, policy for integrating ICT for development was first formulated in the Millennium Development Goals (MDGs) Target 8.F, which states that "in cooperation with the private sector, make available the benefits of new technologies, especially information and communications" (United Nations, 2000; 2012). Moreover, while not mentioned explicitly in the Education for All goals, it is arguable that ICT plays a pivotal role in achieving these goals, including broadening access, eliminating exclusion, and improving quality (UNESCO, 2000) *(see **Box 1**)*.

Box 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% 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 in 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: The Dakar Framework for Action (UNESCO, 2000*)*

More than a decade later, the World Summit on the Information Society (WSIS), which convened in 2003 and 2005, resulted in a clear commitment by governments to foster the achievement of an inclusive information society. To this end, the WSIS Plan of Action identified ten targets to be achieved by 2015 – two of which are related to education. These include *Target 2: Connecting all primary and secondary schools to ICT*, which is a precondition to *Target 7: Adapting all primary and secondary school curricula to meet the challenges of the information society* (Partnership on Measuring ICT for Development, 2011) *(see **Box 2**).* The UIS plays a vital role in helping to benchmark country progress within the WSIS framework by collecting statistics and calculating internationally-comparable indicators related to ICT in education.

Box 2. WSIS targets on education and related indicators

Target 2. Connect all secondary schools and primary schools with ICT

1. Proportion of schools with a radio used for educational purposes
2. Proportion of schools with a television used for educational purposes
3. Learner-to-computer ratio
4. Proportion of schools with Internet access, by type of access

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

1. Proportion of ICT-qualified teachers in schools
2. Proportion of teachers trained to teach subjects using ICT
3. Proportion of schools with computer-assisted instruction (CAI)
4. Proportion of schools with Internet-assisted instruction (IAI)

Source: Partnership on Measuring ICT for Development, 2011

Yet, despite the growing demand for data on ICT in education, the best-known international sources of education statistics lack basic information about ICT policy in education. For developed countries, neither the Organisation for Economic Co-operation and Development (OECD) nor the European Commission have a comprehensive set of indicators that include all three components of inputs, processes and outcomes related to ICT – although they both are increasingly improving the dataset to include, for instance, assessments of student performance in digital skills. In fact, the OECD's Programme for International Student Assessment (PISA) dataset remains one of the most reliable sources of information on access, use and outcomes in this domain, despite its limitations in terms of geographical coverage, reliability and inadequacy regarding current classroom practices (OECD, 2010; 2011; Scheuermann, Pedró and European Commission, 2009).

For developing countries, the situation is even more challenging. The UIS has undertaken regional data collections in Latin America and the Caribbean (UIS, 2012) and in a few selected Arab States (UIS, 2013) that are intended to provide a comparative perspective of the integration and access to ICT in education, while the World Bank's System Assessment and Benchmarking for Education Results (SABER) initiative and the Inter-American Development Bank are currently focusing on a compilation of detailed information about technology policies in education, mostly from a qualitative perspective. Unfortunately, neither of these initiatives has yet produced a comprehensive global assessment.

2. Methodology: E-readiness as a framework for quantifying ICT in education

E-readiness (electronic readiness) is a measure of the degree to which a country is prepared to partake in electronic activities and, thus, benefit from ICT in education (Dada, 2006). E-readiness may be measured by a number of ICT in education indicators presented in the UIS *Guide to Measuring Information and Communication Technologies (ICT) in Education (DOI: http://dx.doi.org/10.15220/978-92-9189-078-1-en).*

In September 2012, the UIS co-organized with the Korean Education and Research Information Service (KERIS) a statistical capacity-building workshop for 30 Asian countries to train national statisticians in ministries of education and other relevant agencies to collect and report data on ICT in education using a newly-designed UIS data collection instrument. Subsequent to the workshop, questionnaires covering primary and secondary education *(see http://www.uis.unesco.org/UISQuestionnaires/Pages/Communication.aspx)* were mailed to 32 Asian countries. This report assesses ICT integration and e-readiness using administrative data from 28 out of 32 responding countries across Central, South and West, and East Asia. Except for Samoa, the Pacific region was largely omitted for the current data collection.

This report starts by examining the policy and curricular aspects of ICT in education as fundamental to building a culture of ICT use in education. This is followed by an analysis of basic infrastructure required to support ICT-assisted instruction, including electrical and telecommunication capacity, numbers of computers, computer laboratories, ICT support services and Internet. The report further discusses limited data on participation rates amongst enrolments in programmes offering ICT-assisted instruction by gender. Lastly, the report examines teacher preparedness, including relevant training for teaching basic computer skills (or computing) and on how to use ICT effectively in the classroom. Additionally, statistical tables are annexed to this report *(see the **Annex**),* which summarise all data.

3. ICT in Asia

Asia is not only the largest region by land mass; it is also the largest by population being home to approximately 60% of the world's population (UN Population Division, 2014). It extends from relatively small countries surrounding the Black and Caspian Seas in Central Asia, moving eastward to include the Indian subcontinent and still further spreading towards East Asia and the Pacific, including Indonesia and the Philippines. Given the absolute size, Asia – more than any other region – varies broadly in terms of history, culture, language and ethnicity.

Especially noteworthy for integrating and sustaining ICT across several domains, including education, Asia also exhibits significant economic disparity. Given high levels of investment in their national networks, some OECD Member States in Asia have matched or outperformed international standards in the field of ICT-assisted instruction (OECD, 2011), while in other countries upgrades to national networks, teledensity improvements, enhanced national connectivity, and the introduction of new Internet Provider (IP) delivery technologies are creating a more favourable environment for the uptake of ICT. Nevertheless, much progress remains to be made, and this is more true for some countries than others. In several least-developed countries (LDCs), Internet-based forms of teaching and learning and the essential infrastructure to support it are limited except for but a privileged few, driving countries to consider other forms of ICT.

Beyond sub-regional differences, the internal digital divide of developing countries has also increased significantly as urban centres quickly adopt ICT while it remains out of reach for rural and remote regions. Bearing these caveats in mind, ICT in education in Asia can be viewed from two very different perspectives. The first reflects a development discourse that stresses the role of ICT in eliminating the digital divide by reaching the unreached and providing support to those who cannot access essential infrastructure, trained teachers and other quality educational resources. The second perspective adheres to an e-learning paradigm and is a response to the emerging knowledge society where ways of teaching and learning are evolving at a rapid pace to foster learner-centric educational environments, which encourage collaboration, knowledge creation and knowledge sharing. While countries are admittedly at different stages of integrating ICT in education, ultimately both perspectives will be increasingly relevant for countries in Asia.

4. Integrating ICT in education through policy and other formal commitments

Policymakers are in a unique position to bring about change. This is illustrated in a study of 174 ICT-supported innovative classrooms in 28 countries (Kozma, 2003). In 127 cases, there was an explicit connection between the innovation and national policies that promoted the use of ICT (Jones, 2003). But while the introduction of ICT policy is necessary for change, it is not sufficient to result in its implementation or impact (Tyack and Cuban, 1995). Policies can, of course, fail to succeed and this happens when: i) they are viewed as mere symbolic gestures; ii) teachers actively resist policy-based change that they see as imposed from the outside without their input or participation (Tyack and Cuban, 1995); iii) they do not have explicit connections to instructional practice (e.g. focus on hardware rather than their relationship to pedagogy); iv) they do not provide teachers with an opportunity to learn the policies and their instructional implications; and v) there is a lack of programme and resource alignment to the policies' intentions (Cohen and Hill, 2001).

While some policies may fail, identifying those countries that have current active policies that address ICT in education and/or other types of formal commitments including plans, regulatory provisions or a regulatory institution (or body) is important for assessing countries' efforts to embark on educational reform through the implementation of ICT in education.

Responding to an understanding that ICT will be a fundamental requirement for work in the 21st century, the majority of countries providing data in Central Asia, East Asia and South and West Asia have a policy on ICT in education that sets out general principles, guidelines and strategy. In contrast, some countries have yet to develop policy specifically on ICT in education, including Bhutan, Lao People's Democratic Republic and Maldives, while in both Cambodia and Kazakhstan policy for ICT in education applies only for upper secondary education *(see Statistical Table 1*).

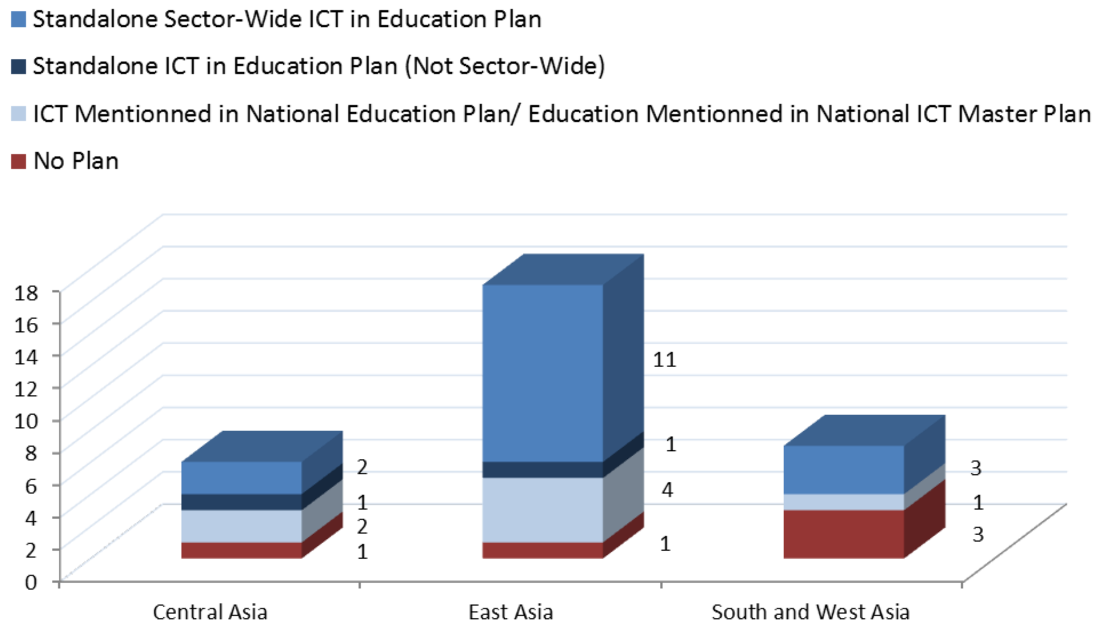
Within the framework of formal commitments, national plans to implement ICT objectives in education take on many forms including strategy papers, investment programmes, decrees and regulations that establish programmes with short- to medium-term targets (i.e. usually 5- to 10-year plans) aligned with longer-term goals and objectives. Moreover, countries vary in terms of how explicitly they formalise their plans. For example, formal, stand-alone plans on ICT in education, which may or may not be sector-wide, could be perceived as relatively transparent compared to National ICT Master Plans that include components on education or National Education Plans that include an ICT component.

According to **Figure 1**, the majority of responding countries from East Asia have a stand-alone, sector-wide ICT in education plan and this includes developed and developing economies: Macao Special Administrative Region of China, Hong Kong Special Administrative Region of China, Japan, Malaysia, New Zealand, the Philippines, the Republic of Korea and Singapore, while in Cambodia a stand-alone plan addressing only upper secondary education exists. Meanwhile for Indonesia, Myanmar, Thailand and Samoa, ICT is either mentioned in current education plans or education is mentioned in current national Master ICT Plans to cover several social spheres, including health, government and commerce, among others. At the present time, Lao People's Democratic Republic has no plan on ICT in education.

In South and West Asia, Bangladesh, Nepal and Sri Lanka have national stand-alone, sector-wide ICT in education plans. In fact, in Bangladesh and Nepal, these plans were published as recently as 2013 (Bangladesh, 2013; Nepal, 2013). In contrast, the Islamic Republic of Iran opted to include ICT in education within its national Master ICT Plan, while Bhutan, with the support of the UNESCO New Delhi office, has recently prepared a draft plan. Maldives does not currently have a plan. Lastly, given its federal nature, India does not have a national plan for ICT in education as it is the responsibility of individual states to develop plans to carry out policy set at the federal level. More specifically, states have the responsibility to define norms, standards, guidelines and frameworks to implement the policy in an effective manner, and to facilitate and monitor policy implementation (India, 2012).

In Central Asia, Azerbaijan and Georgia (under the "Deer Leap" project) have stand-alone, sector-wide ICT in education plans, while Kyrgyzstan and Mongolia mention ICT in education in their national education plans. Kazakhstan has a stand-alone ICT in education plan; however, it only addresses upper secondary education. Lastly, Armenia does not currently have a national plan.

Figure 1. National plans to implement ICT in education, by type, 2012



Source: UNESCO Institute for Statistics database; UNESCO Bangkok, 2011, and Statistical Table 1.

Most countries that have a policy and/or plan for ICT in education will also have a national regulatory institution or body to implement and monitor its integration. This is, however, not the case in Australia, Japan, Kyrgyzstan, New Zealand, Samoa and Singapore. In Bangladesh, a regulatory institution only exists to monitor primary education.

Laws for the integration of ICT in education also exist for a number of countries, including Armenia, Azerbaijan, Indonesia, the Islamic Republic of Iran, Kazakhstan, Malaysia and Myanmar *(see Statistical Table 1*).

5. ICT in national education curricula

ICT is ubiquitous in Asia in high-income and/or developed countries, while in many developing countries its integration and use – especially more advanced forms of ICT and broadband connectivity – often lag behind other social and economic spheres, including general communications, employment and commerce. As a consequence, children and youth in these countries frequently learn more about how to use ICT informally outside of the school system than in the classroom.

Nonetheless, as the integration of ICT in education rises and evolves with evermore sophisticated tools, and participation and transition rates to higher levels of education increase, children and adults will increasingly need to develop digital literacy, not only for life skills but also to support their education throughout the secondary, post-secondary and tertiary levels. The early integration of ICT into primary and secondary curricula through formal recommendations is therefore vital and moreover acts as an important lever for ensuring the introduction and implementation of ICT into educational institutions and classrooms.

Especially where ICTs are absent in households, learning basic computer skills or computing is important for lifelong learning. **Table 1** presents both developed and developing countries that have specific curricular objectives or a course on basic computer skills (or computing). More than one-half of the countries in the current data collection have integrated objectives or courses on basic computer skills or computing at primary, lower secondary and upper secondary levels of education, in some cases despite capacity to meet national curricula. For example, the available resources in developed countries such as Singapore, Japan and New Zealand are adequate to meet objectives, while Bangladesh faces challenges to universalise access to basic computer skills or computing in schools.

In countries that do not have objectives or courses on basic computer skills (or computing) at all levels, emphasis is placed on secondary education. For instance in Armenia, Bhutan, Lao People's Democratic Republic and the Philippines, basic computer skills and computing are emphasised beginning in lower secondary education, while in Cambodia, Myanmar, Nepal and Sri Lanka this occurs in upper secondary education. In Kyrgyzstan, a course in basic computer skills or computing occurs specifically at the lower secondary level (ADB, 2012).

Table 1. National curricula with specific objectives or a course on basic computer skills or computing by level, 2012

	Primary	Lower secondary	Upper secondary		Primary	Lower secondary	Upper secondary
				Bangladesh	√	√	√
Kyrgyzstan	x	√	x	China	√	√	√
Kazakhstan	…	…	√	China, Hong Kong	√	√	√
Cambodia	x	x	√	China, Macao	√	√	√
Myanmar	x	x	√	Georgia	√	√	√
Nepal	x	x	√	Indonesia	√	√	√
Sri Lanka	x	x	√	Iran, Islamic Rep.	√	√	√
Armenia	x	√	√	Japan	√	√	√
Bhutan	x	√	√	Malaysia	√	√	√
Lao PDR	x	√	√	Maldives	√	√	√
Philippines	x	√	√	Mongolia	√	√	√
Samoa	…	√	√	New Zealand	√	√	√
Australia	√	√	√	Singapore	√	√	√
Azerbaijan	√	√	√	Thailand	√	√	√

Notes: √ = Yes; x = No; … missing.
Source: UNESCO Institute for Statistics database and Statistical Table 2

In addition to the instruction of basic computer skills or computing, ICT is used to teach other subjects to enhance or expand student learning opportunities. National curriculum may be explicit about ICT being used at certain levels of education, number of hours per week (*see **Box 3***), or about the form of ICT, while other countries may have a more generalised and comprehensive set of recommendations for ICT-assisted instruction to be implemented across the entire curriculum at all levels of education.

Despite some countries having more capacity to provide ICT in education than others, formal recommendations to integrate ICT in all subjects and at all levels exist in Armenia, Hong Kong Special Administrative Region of China, Macao Special Administrative Region of China, Japan, Kazakhstan, Malaysia, the Philippines, Singapore, Sri Lanka and Thailand. In the case of Kazakhstan, this is related to their ambitious programme of using e-learning packages in local languages in all subjects in all schools, and having 100% connectivity to eliminate the domestic digital divide. In comparison, there are no formal recommendations for integrating ICT across curricula in Bhutan, Kyrgyzstan, Lao People's Democratic Republic and Nepal; however, the latter does offer a computer science course as an optional subject in secondary school (Nepal, 2012) (*see Statistical Table 2).*

Other developed and developing countries have set recommendations for the integration of ICT in education in all subjects and at all levels, but not necessarily at each grade. This group of countries includes: Australia, Azerbaijan, Georgia, and the Islamic Republic of Iran, where a new course on business and technology is offered to Grade 6 students since 2013 (Islamic Republic of Iran, 2012). Meanwhile, Bangladesh emphasises ICT in mathematics and natural sciences but not in second languages. In Cambodia, formal recommendations are even more uncommon only existing for natural sciences at the upper secondary level; similarly in Mongolia, recommendations for using ICT are currently formalised only for mathematics in secondary education *(Statistical Table 2).*

Box 3. Instructional hours using ICT according to national standards and curriculum

Stemming from national policies and plans to integrate ICT in education, countries may establish formal recommendations that specify level of education, specific grades and the academic subject matter in which ICT should be used. In addition, countries may also set an intended number of instructional hours in which ICT is to complement learning. While countries may have challenges in meeting their own objectives, setting instructional hours acts as a lever to promote the use of ICT in the classroom.

Table 2. Instructional hours using ICT by level, 2012

	Primary	Lower secondary	Upper secondary
Cambodia	.	.	1 ~ 5
Bhutan	.	< 1	< 1
Philippines	.	1 ~ 5	...
Kyrgyzstan	-	1 ~ 5	-
Mongolia	< 1	< 1	1 ~ 5
Myanmar	< 1	< 1	1 ~ 5
Bangladesh	1 ~ 5	...	...
Iran	1 ~ 5	< 1	1 ~ 5
Indonesia	...	1 ~ 5	1 ~ 5
Azerbaijan	1 ~ 5	1 ~ 5	1 ~ 5
Georgia	1 ~ 5	1 ~ 5	1 ~ 5
Kazakhstan	1 ~ 5	1 ~ 5	1 ~ 5
Sri Lanka	1 ~ 5	1 ~ 5	1 ~ 5
Thailand	1 ~ 5	6 ~ 10	11 ~ 20
Malaysia	11 ~ 20	11 ~ 20	11 ~ 20
Armenia	...	> 21	> 21

Based on data collected by the Korea Education and Research Information Service (KERIS), most countries in Asia set approximately 1 to 5 hours per week for the use of ICT in education. However, the extent to which countries can meet these targets depends on several factors, including the availability of ICT in schools and teacher training to support its use. For example, standard instructional hours for using ICT in education are not applicable at the primary level in Bhutan and Cambodia where policy is currently lacking and is reflected by poor school-level ICT infrastructure. In Cambodia, where ICT is only used for natural sciences at the upper secondary level, between 1 to 5 hours per week have been established for learning with ICT. In contrast, Malaysia sets a standard that ICT be used approximately 11 to 20 hours per week at both primary and secondary levels of education.

Notes: . not applicable
… missing
- quantity nil

Data for Cambodia refer to Grades 11 and 12. Bhutan has no formal ICT programmes in primary school. Data for Kyrgyzstan refer to Grades 7 to 9. Data for Armenia refer to Grades 6 to 10.

Source: KERIS, 2013

6. Infrastructure to support the integration of ICT in educational institutions

Electricity and telecommunication facilities

To support teaching and learning, as well as improve overall education management, a variety of ICT-assisted instructional approaches may be implemented, ranging from the use of radio or television to computers, Internet and newly-emerging mobile devices. While newer battery-operated ICTs are emerging, in addition to mobile devices that may be recharged off-site, the majority of ICTs including television, computers and the Internet continue to require a more stable energy source. To summarise, the integration of ICT into schools requires electricity (e.g. grid/mains connection, wind, water, solar or fuel-powered generator, etc.) that is regularly and readily available.

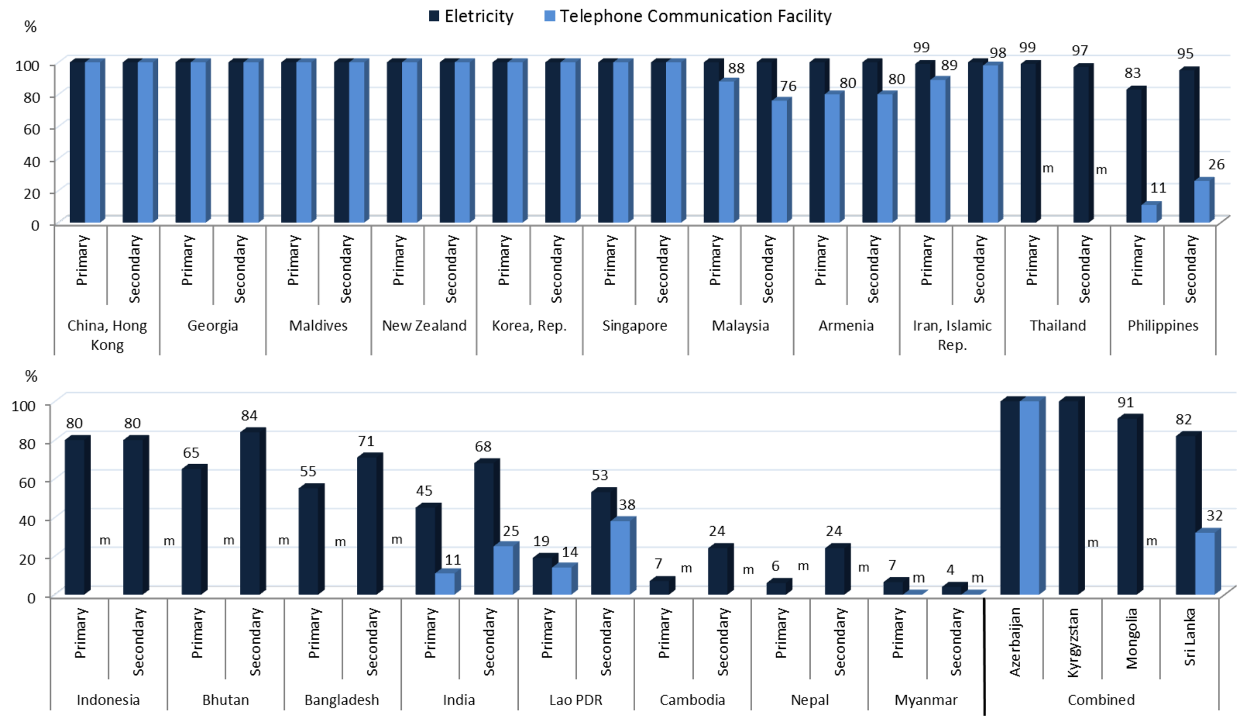
In most developing countries, the key determining factor for electricity is location. Rural, remote and mountainous regions are frequently neglected in building up national infrastructure, resulting in a lack of power supply to support ICT in education. For example, implementing ICT in education in Pakistan is a significant challenge given that just 31% of rural primary schools are connected compared to 53% in urban centres (Pakistan, 2010; Pakistan, 2012). Moreover, even if schools are connected to an electrical grid, in many countries power surges and brownouts are common in both rural and urban areas further impeding the reliable usage of ICT.

Telecommunication facilities are another basic element which help to build the educational and administrative capacity of schools. Defined as a fixed telephone line, cable connection, mobile phone or other sustainable communication technology that connects a school's terminal equipment to the public switched telephone network, or other telecommunication network, and which is intended for pedagogical or administrative purposes, telecommunication facilities can be used for communication between teachers with students, parents, various service providers to the schools, local education authorities, and other administrative organizations. Telecommunication facilities may also provide the requisite infrastructure to provide various types of Internet connectivity. Fixed telephone lines can provide both narrowband and broadband Internet, while mobile telephones can provide varying levels of broadband connectivity through 3G or 4G technology. Generally, faster than mobile broadband Internet, wired connections (including ASDL, cable, fixed wireless, fibre optic cable, satellite, etc.) allow for upload and download broadband speeds that are faster.

In order to gauge national capacity to support the integration of ICT in education, measuring the share of educational institutions with electricity and a telephone communication facility provides basic information for policymakers to assess current gaps in infrastructure, as well as help inform decisions about which ICT tools would be appropriate for short- and longer-term planning.

According to **Figure 2**, electricity is universally available in primary and secondary schools in developed countries and in many middle-income countries, demonstrating that basic electrical infrastructure is generally in place to integrate ICT in the classroom. This is the case in Armenia, Azerbaijan, Georgia and Kyrgyzstan in Central Asia; Hong Kong Special Administrative Region of China, Malaysia, New Zealand, the Republic of Korea and Singapore in East Asia; and in Maldives in South and West Asia. Given the availability of electricity in these countries, a lack of ICT in education cannot be attributed to the absence of a power supply but rather to a lack of policy imperative, an excessive regulatory environment, or gaps within schools' operational budgets.

Figure 2. Proportion of educational institutions with basic electrical and telecommunications infrastructure by level of education, 2012



Notes: m = missing. Data for Cambodia cover pre-primary, primary and secondary education. For Indonesia, the Philippines and the Republic of Korea, data for secondary education only include the lower secondary level. Data for the Republic of Korea refer to 2009. Data for Malaysia, Singapore and New Zealand refer to 2011. Data for Cambodia, the Philippines and the Republic of Korea cover the public sector only. Data for India do not cover secondary-level independent schools.
Source: UNESCO Institute for Statistics database and Statistical Tables 3 and 4

In contrast, electricity is a significant obstacle to integration of ICT in education in India and a number of least-developed countries. In Nepal and Lao People's Democratic Republic, 6% and 19% of primary schools have electricity compared to 24% and 53% of secondary schools, respectively. Electricity is also rare in educational institutions in Cambodia, where 7% of all public schools are connected to a reliable power source to support the integration of ICT in the classroom. In India and Bangladesh, approximately one-half of primary schools (45% and 55%) and two-thirds of secondary schools (68% and 71%) have electricity; however, given their status as high-population countries (E-9)[1], significant challenges remain so that ICT can be integrated across the educational systems of the South and West Asia region *(see Statistical Tables 3 and 4).*

[1] With slightly more than one-half of the world's population, the nine highly-populated developing countries (E9) together represent tremendous challenges that weigh heavily on global education trends. E9 countries include: Bangladesh, Brazil, China, Egypt, India, Indonesia, Mexico, Nigeria and Pakistan.

Telephone communication facilities are more or less universal wherever electricity is widespread. However, in Malaysia and Armenia, which have electricity in all schools, telephone communication facilities are just available in 88% and 80% of primary schools and 76% and 80% of secondary schools, respectively. In countries where electricity remains a challenge, telephone communication facilities are also typically less than universal. For example, telephone communication devices are present in 14% and 11% of primary-level and 38% and 25% of secondary-level schools in Lao People's Democratic Republic and India, respectively. Telecommunication devices are also uncommon in some schools with relatively high levels of electricity, for example in Sri Lanka and the Philippines. While privately-owned mobile telephones are excluded from the current definition, mobile units are increasingly used by teachers in developing countries for both pedagogical and administrative purposes. As such, current statistics do not fully encompass the entire range of available capacity for telecommunications *(see Statistical Tables 3 and 4).*

Building computer infrastructure: Learner-to-computer ratios (LCRs)

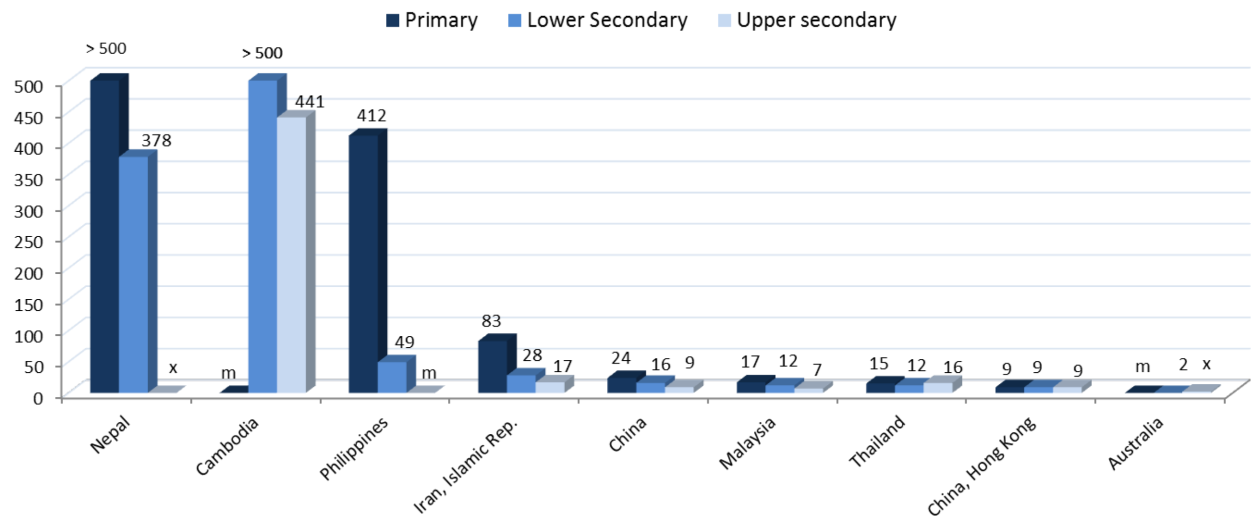
In order to provide advanced forms of ICT-assisted instruction, including computer-assisted instruction (CAI) and Internet-assisted instruction (IAI), sufficient computer resources and Internet connectivity must be established, keeping pace with demand based on enrolment. The *learner-to-computer ratio (LCR)* refers to the mean number of learners sharing a single computer available for pedagogical use in national, aggregate education systems.

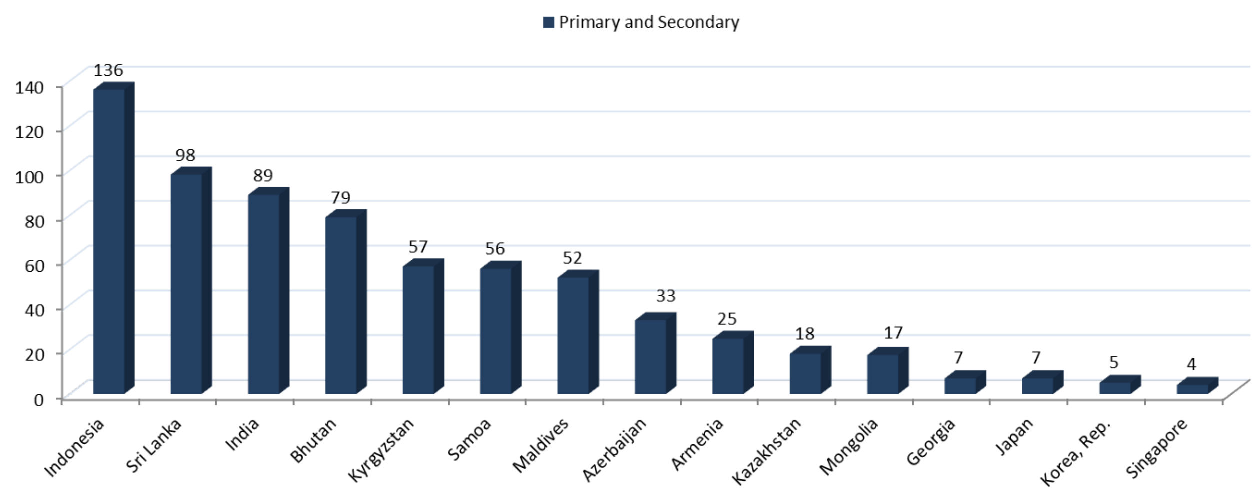
While, the LCR sheds light on current infrastructure to support the integration of ICT-assisted instruction, national-level LCRs mask sub-national differences within a single country, which may referred to as the internal digital divide. LCR values are frequently low in urban centres indicating greater access, but high in rural and remote areas indicating scarcity of resources. For example, research in China has shown that there are twice the number of computers in urban primary education centres (14:1) than in rural centres (29:1) (Zeng et al., 2012). In contrast, computers are more available in Tajikistan in rural areas due to the decision to provide all schools with a laboratory with the same fixed number of devices regardless of enrolment, which has the effect of favouring pupils in small rural schools over large urban institutions (ADB, 2012).

While the LCR indicator does not provide information on the intensity of computer usage, it may be considered as a proxy measure for the quality of computer-assisted instruction (CAI), since there is a relationship between LCR and individual learner time using computers. In other words, the lower the ratio, the more potential time each pupil has access to a computer. While some countries are aiming to achieve 1:1 ratios across their education systems, the ratio in most countries is typically greater than 1:1, whereby more than one student must share a single computer or device. Nonetheless, even where small numbers of students share one computer, group work complemented by structured sharing schedules may have significant learning benefits – especially if based on collaborative and cooperative learning models. At the other end of the continuum, however, the number of learners sharing a single computer may be so high that the time on task is too limited per pupil to allow a meaningful learning experience. In some countries, including India, computers in schools are also often shared with the general community, further limiting pupil access if scheduling is not enacted to prioritise them (India, 2012). To minimise existing shortages, alternative strategies may potentially improve the availability and management of ICT-assisted instruction in schools. For instance, the use of multi-seat computers or networked PCs, where users simultaneously operate from a single central processing unit (CPU) and server while possessing their own individual monitors and keyboards, is one available option.

Figure 3 shows the LCRs for primary, lower secondary and upper secondary education. At the primary level, data show that available computer resources are greatly overstretched in the Philippines (412:1) and the Islamic Republic of Iran (83:1). In Nepal, where the proportion of primary schools with CAI is less than 0.5%, the national LCR is high, at more than 500 primary school pupils per computer. Based on combined data for the primary and secondary levels, computer resources are also greatly overstretched in Indonesia (136:1), Sri Lanka (98:1), India (89:1) and Bhutan (79:1).

Figure 3. Learner-to-computer ratio (LCR) by level of education, 2012





Notes: m = missing. Data for Hong Kong Special Administrative Region of China, Georgia, Japan, Kazakhstan and Thailand are country estimates. Data for the Republic of Korea, China and Japan refer to 2008, 2010 and 2013, respectively. Data for Kyrgyzstan, Malaysia and Singapore refer to 2011. Data for Azerbaijan, Cambodia, China, Japan, Kazakhstan, Malaysia, Philippines, Singapore and Sri Lanka cover public schools only. Data for Bhutan, Cambodia, China, India, Nepal and Samoa represent UIS estimates. Secondary data for Nepal and Australia reflect combined secondary education.

Source: UNESCO Institute for Statistics database and Statistical Table 5

Cambodia, which like Bhutan also lacks policy and plans to integrate ICT in education in primary and lower secondary education, also has a very high lower secondary LCR of >500:1. Recommendations to integrate ICT in education only begin to appear in Cambodia at the upper secondary level for instruction in natural sciences and are reflected in a somewhat lower LCR of 441:1, a value that continues to demonstrate significant challenges in meeting national curricular objectives. Data to calculate a primary LCR in Cambodia are unavailable.

Currently an international LCR target does not exist. However, to achieve national ICT in education objectives and meet standard curriculum, many countries have developed policy surrounding reductions to their LCR. Kazakhstan, which recommends the integration and use of ICT in all subjects at primary and secondary levels, targeted 10-15 students per computer and is estimated to have achieved an LCR of 18:1 in 2010 (ADB, 2012); while Kyrgyzstan, which currently does not have formal recommendations to integrate ICT into curriculum, targeted a substantially higher LCR of 100:1 but nevertheless was estimated to have achieved an LCR of 57:1 in 2011. While this is a significant improvement from a ratio of 249:1 in 2001, the ratio for “new” computers was only 240:1 in 2010 and can be attributed to a general lack of funding in the mountainous regions (Fesenko, 2011).

In most countries, LCRs decrease from the primary to secondary level of education indicating greater levels of access. For instance, in the Philippines computer resources are greater in lower secondary education than in primary education where LCRs are 49:1 and 412:1, respectively. Secondary level LCRs are also lower in Malaysia and China decreasing from 17:1 and 24:1 for primary to 12:1 and 16:1 for lower secondary, and to 7:1 and 9:1 for upper secondary levels, respectively.

In Singapore and the Republic of Korea, where recommendations exist for integrating ICT across the curricula and at most grades, four and five children, respectively, share a computer across the national education system, while in Australia there are two learners per computer in combined secondary education.

Georgia, which has achieved a combined LCR of 7:1, provides an example of a country that has witnessed substantial progress in decreasing its national LCR. In 2005, the ambitious Deer Leap Program was launched to provide computers to all schools, including educational software, services and technical support in preparation for full integration of ICT across the curriculum. Under the effective management of a foundation, including members from government, elected officials, civil society, private partners, university academics and teachers, systematic planning and a sizeable budget helped Georgia to substantially decrease its LCR of more than 200:1 and modernised its outdated computers (Georgia, 2007). Mongolia has also been successful in acquiring ICT resources (17:1) in the form of durable XO computers by participating in the One Laptop Per Child project *(see **Box 4**).*

Box 4. Implementing one-to-one computing through low-cost laptops and tablets: Costs versus benefits

Few, if any, national ICT in education policies provide rationale for specified LCRs, nor do they suggest what these ratios intend to achieve in curricular outcomes, student performance, skills development, classroom methodologies, levels of usage and so on. Given this lack of information, there is a need for a clearer vision going forward.

Nonetheless, one-to-one computing using low cost devices – which is being introduced in several countries (particularly in Latin America) – has proven to be effective as an ICT model to decrease LCRs. The popular initiative, One Laptop Per Child (OLPC), manufactures robust, durable and low-cost XO laptop computers specifically designed for children in developing countries to promote one-to-one computing. INTEL similarly manufactures the comparably-designed Classmate PC.

The advantage of these laptops is their low cost, durability and low energy requirements using significantly less electricity than standard laptops relying on an array of batteries, solar power panels and human-powered generators. OLPC's XO computers have also been adopted in smaller-scale pilot projects of 1,500 units or less in Armenia, Cambodia, China, India, the Islamic Republic of Iran, Malaysia, Micronesia, Pakistan, the Philippines, Thailand, Solomon Islands and Sri Lanka. Meanwhile, larger-scale deployments have recently been pursued in rural Australia (4,400 units), Afghanistan (5,000 units), Papua New Guinea (2,350 units), Nepal (6,000 units) and Mongolia (14,500 units) where the population is widely dispersed and in many areas nomadic (OLPC, 2013). In the case of Nepal and Mongolia, XO computers account for more than one-third to one-half of all computers available.

Thailand has also been relatively active in promoting one-to-one computing, adopting the One Tablet Per Child (OTPC) scheme which provided one tablet per child in Grade 1 by 2013. Given that each year every new Grade 1 cohort is given tablets, all primary pupils will have their own tablet by approximately 2018. In 2014, this scheme is also being extended to cover Grade 7 students to achieve one-to-one computing in secondary education (Thailand, 2013).

The impact of OLPC or any 1:1 computing project is potentially significant, particularly for many developing countries, and is so large that it could have considerable financial and resource implications on many other areas of education provision, especially where classrooms and teachers are more urgently needed. For example, with such reasoning in mind, India has opted not to expand their OLPC project beyond a pilot phase for the current time (Kraemer et al., 2009).

In addition to financial barriers, operational challenges exist. For example, teachers need to be trained to use the computers competently to teach different subjects. Moreover, well-trained servicing and maintenance facilities for the XO computers are probably less available than services for standard computers, unless there has been a large deployment nationally. In the programme conducted in Uruguay *(El Ceibal)*, repairs have been the responsibility of the family, leading to complaints that poorer families are at a disadvantage which contradicts the notion that the XO computers help to eliminate the domestic digital divide (OLPC, 2010).

Finally, there is currently little evidence that 1:1 computing projects have the intended student outcomes that policymakers hope to achieve. In the United States, one-to-one laptop projects in primary schools did not lead to measureable improvements in reading or writing skills, nor did it harm them. This can be interpreted either as technology not adding anything to education, or as standardised tests failing to measure the skills learned using technology. Laptop programmes did however improve the abilities of students to deal with information and to collaborate (Camfield et al., 2007). Similarly in Peru, which has the largest deployment of XO computers globally, the expansion in access translated into substantial increases in computer use both at school and at home, but there was no evidence of positive effects on enrolment and test scores in mathematics and languages. Nonetheless, some positive effects were found in general cognitive skills based on particular measures (Cristia et al., 2012).

LCRs in schools which offer computer-assisted instruction (CAI)

The LCR is a system-wide indicator and does not reflect schools that do not use computers for pedagogical purposes. Based on enrolment data from schools that offer CAI, the *learner-to-computer ratio (LCR) in schools with computer-assisted instruction (CAI)* provides information on the availability of computers in educational institutions which use computers for pedagogical purposes and thus sheds light on the quality of the CAI offered.

Table 3 shows that in countries where CAI is universal, including Hong Kong Special Administrative Region of China, Japan, Malaysia and Singapore, LCRs in schools with CAI are logically identical to ratios presented in Figure 5; however, in countries where only a sub-portion of schools offer CAI, such as in Thailand, the Islamic Republic of Iran, Sri Lanka and the Philippines, LCRs in schools with CAI are lower than the national level LCR.

In the Islamic Republic of Iran, the national LCR for primary education of 83:1 indicates scarcity of resources and relatively low access for pupils, compared to Singapore where the LCR is 4:1. However, considering that in the Islamic Republic of Iran just 46% of primary schools offer CAI, a primary LCR in schools with CAI of 18:1 shows relatively greater access for pupils enrolled in these schools. Similarly, the primary-level LCR in schools with CAI in the Philippines decreases to 151:1, compared to a national LCR of 412:1. Unlike in the Islamic Republic of Iran, however, an LCR of 151:1 demonstrates that access remains a challenge for schools which use computers for pedagogical purposes. Computer access is also a challenge for pupils in Sri Lanka where the LCR in schools with CAI is 55:1 for primary and secondary schools combined.

Table 3. Learner-to-computer ratio (LCR) in primary and secondary schools versus LCR in schools with computer-assisted instruction (CAI), 2012

	Primary			Secondary		
	Proportion of schools with computer-assisted instruction (CAI) (%)	Learner-to-computer ratio (LCR)	Learner-to-computer ratio (LCR) in schools with computer-assisted instruction (CAI)	Proportion of schools with computer-assisted instruction (CAI) (%)	Learner-to-computer ratio (LCR)	Learner-to-computer ratio (LCR) in schools with computer-assisted instruction (CAI)
Philippines	41	412	151	87	49	47
Sri Lanka	60	98	55	x	x	x
Iran, Islamic Rep.	46	83	18	76	21	8
Thailand	99	15	11	99	14	9
Malaysia	100	17	17	100	9	9
China, Hong Kong	100	9	9	100	9	9
Japan	100	7	7	100	x	x
Korea, Rep.	100	5	5	100	5	5
Singapore	100	4	4	100	x	x

Notes: x= included in another category. Data for Japan, Malaysia, the Philippines, Singapore and Sri Lanka cover public institutions only. Data for the Philippines cover primary and lower secondary education. Data for the Republic of Korea and Japan refer to 2008 and 2013, respectively. Data for Malaysia and Singapore refer to 2011. Data for Hong Kong Special Administrative Region of China, Japan and Thailand are country estimates.

Source: UNESCO Institute for Statistics database and Statistical Table 5

Allocation of computer resources: Pedagogy versus administration

Building infrastructure to support newer forms of ICT-assisted instruction, including the use of computers and the Internet, requires substantial resources. To ensure students have access schools need to maintain adequate numbers of computers, keeping pace with student enrolment and technological change. However, education systems also require computer resources for administrative and operational functions, and in many countries, several schools make computer resources available to the general community during specified times. Given the apparent competition for resources, policy development that supports equitable allocation and sharing schemes can play an important role in sustaining general access to ICT among teachers and learners.

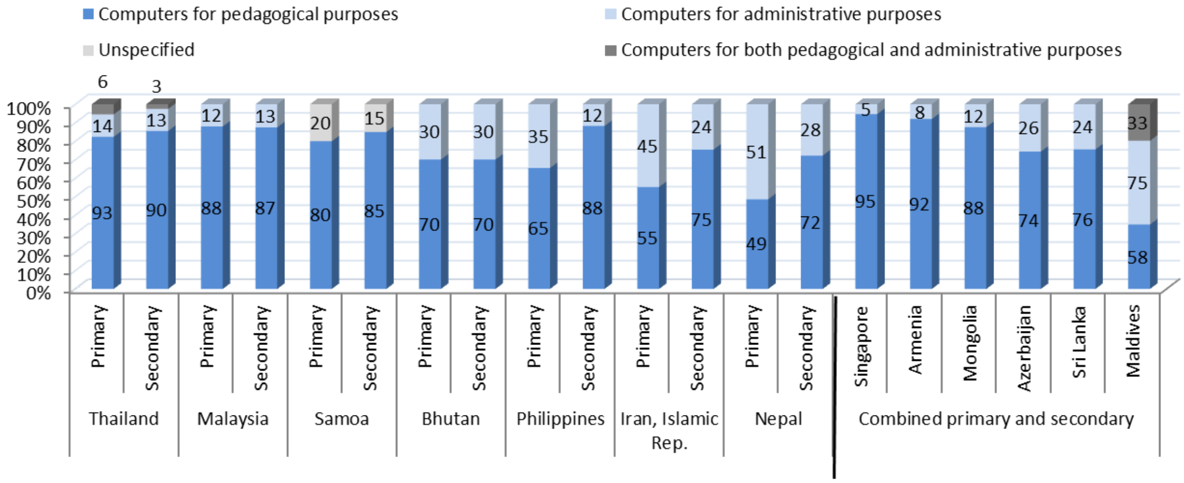
Countries provide data on the total number of computers within the education system, including those allocated to learners and teachers, and those to administrative staff. An understanding of computer allocation strategy is important to have a grasp of the level of access to support learning and teaching. Moreover, it provides insight into a possible redistribution of resources. For instance, in countries where computers are scarce and a high proportion is used for administrative purposes, a reallocation strategy might lead to more equitable sharing for students and teachers. Reallocating computers to pedagogy, however, needs to be carefully planned ensuring that the curriculum is well aligned to CAI and that teachers are prepared and have acquired the knowledge and skills to integrate ICT into teaching and learning.

Figure 4 sheds light on the allocation strategy for computers in primary and secondary education for 14 countries across different parts of Asia. The proportion of computers allocated to pedagogical purposes is highest in Singapore (95%), which is a high-income country with a low LCR of 4:1. The share is also relatively high in a number of middle-income countries with relatively low LCRs. For example, Thailand and Malaysia, which allocate 93% and 88% of computers to pedagogy in primary schools, respectively, have primary LCRs of 17:1 and 15:1 and secondary LCRs of 14:1 and 9:1 *(see Figure 5).*

In contrast, middle-income countries with relatively high LCRs allocate a smaller percentage of computers to pedagogy. In the Philippines and the Islamic Republic of Iran, where primary LCRs are 412:1 and 83:1, respectively, 65% and 55% of computers are allocated to pedagogy. As such, there may be some latitude for the reallocation of computers in both countries. While increasing the number of computers allocated to pedagogy may not be realistic or may even have negligible effects for many schools, reallocation or even computer-sharing strategies for schools where ICT was previously absent could increase access for many students.

Low-income countries, which typically have the highest LCRs, allocate the smallest proportion of computers to pedagogy. For example, in Nepal, where the primary level LCR was previously reported to be >500:1 *(see Figure 2),* 49% of computers are allocated to teaching and learning. While relatively few computers are allocated to pedagogy in some low-income countries, reallocation of computers to teaching and learning is not necessarily an option as resources are overall very scarce. Reallocation may also not be viable since most schools lack the infrastructural requirements, particularly electricity, to support their usage.

Figure 4. Computers in educational institutions allocated by purpose, by level of education, 2012



Notes: m = missing. Data for Azerbaijan, Malaysia, the Philippines, Singapore and Sri Lanka cover public institutions only. Both primary and upper secondary data for Bhutan include the lower secondary level. Data for the Philippines includes lower secondary education only. Data for Malaysia and Singapore refer to 2011.
Source: UNESCO Institute for Statistics database and Statistical Table 5

Computer-assisted instruction: The role of computer laboratories and ICT support services

CAI is defined as an interactive learning method in which a computer is used by teachers or pupils to present instructional material, perform tasks for learning, and help in selecting and accessing additional pedagogical material (UIS, 2009) *(see **Box 5**).* It is undeniable that an adequate number or critical mass of computers is important to provide sufficient exposure to CAI. However, to be delivered effectively, CAI also requires more than a haphazard distribution of computers across schools; computer laboratories and ICT support services may also play important roles in how CAI is delivered.

Establishing computer laboratories in schools is typically perceived to be a significant upgrade from classrooms with one desktop computer at the back of the room. Computer laboratories offer the promise of a learning environment with one device per child, structured and controlled by a well-trained and knowledgeable teacher.

More recently, educational technologists argue that computer laboratories are rapidly becoming obsolete and may, in fact, provide a disservice to education. For example, given the multitude of both school- and personally-owned devices (including laptops, tablets and mobile devices), detractors argue that laboratories imply a separation between computing as a subject and the general curriculum. Others meanwhile argue that the inclusion of a smaller number of computers and other devices in classrooms helps to build stronger links between ICT and curriculum facilitating the development of 'higher-order' skills (Pedro, 2012; Trucano, 2005; UNESCO, 2011a).

Box 5. Four types of ICT-assisted instruction

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-assisted instruction (RAI)** includes both radio broadcast education and interactive radio instruction. Radio broadcast education entails an audio lecture or lesson, with printed material for pupils to follow the lecture. Interactive radio instruction (IRI) turns a typically one-way technology into a tool for active learning inside and outside the classroom. It requires that pupils react to questions and exercises through verbal responses to radio programme contributors, group work, and physical and intellectual activities while the programme is on air.
- **Television-assisted instruction (TAI)** is similar to radio broadcast education, with the additional benefit of video. It helps to bring abstract concepts to life through clips, animations, simulations, visual effects and dramatisation. It can also connect a classroom to the world but shares the same rigid scheduling and lack of interactivity as radio broadcast education.
- **Computer-assisted instruction (CAI)** is an interactive learning method in which a computer is used by teachers and/or pupils to present instructional material, to perform tasks for learning and to help in selecting and accessing additional pedagogical material.
- **Internet-assisted instruction (IAI)** refers to an interactive learning method using content from the World Wide Web for pedagogical purposes.

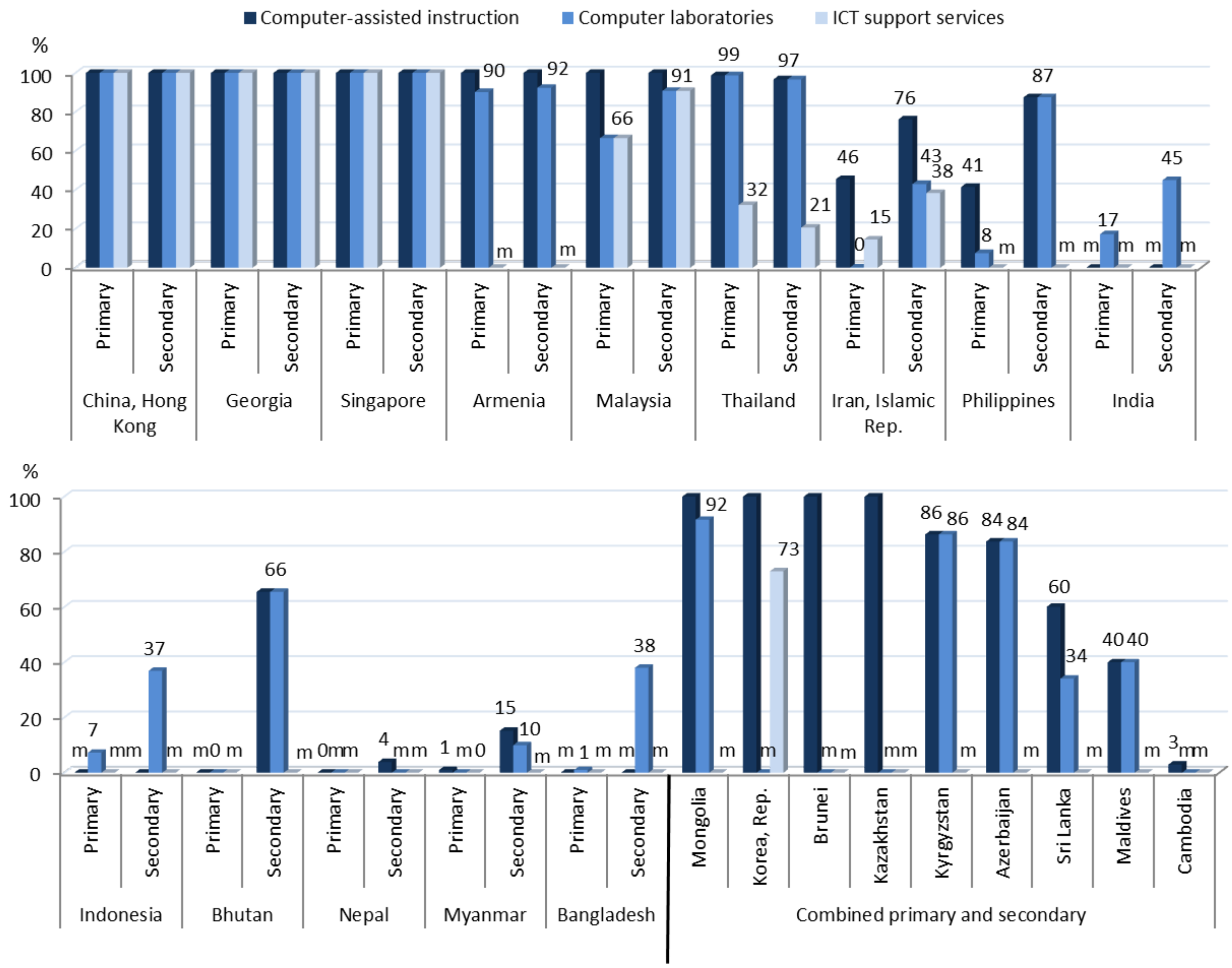
The most significant differences between developed and developing countries seem to lie in how ICTs are deployed in schools. While many developing countries promote the establishment of computer laboratories in schools, the provision and location of computers in schools amongst developed countries is increasingly varied. Shifting focus away from laboratories, schools in developed countries are emphasising computers, interactive whiteboards and light emitting diode (LED) projectors in classrooms, extensive computer provision in school libraries, and free-standing computers for student and teacher use located conveniently around the school. While this approach to ICT-assisted instruction is evolving amongst developed countries, inadequate budgets in most schools hinder ICT provision beyond a few computers, and as such, policies remain focused on establishing and maintaining computer laboratories. At the school level, this focus also seems to be bolstered by the following perceptions that: i) schools need to provide security for expensive computer hardware; ii) ICT has specialised uses similar to science laboratories; and iii) computers are for use by specialists and not by ordinary subject teachers and pupils (ADB, 2012).

In fact, as long as LCRs remain high in several countries, computer laboratories may play an important role in managing and organizing how and when children have access to CAI. For this reason, computer laboratories – in addition to classroom-based learning – may be viewed together to effectively support ICT-assisted instruction, especially computer- and Internet-assisted instruction.

As ICT expands within and across educational institutions, ICT support services will have an increasingly pivotal role for ensuring the sustainability of equipment and facilities and will be vital in the coordination, maintenance and overall viability of ICT in education efforts. These support services coordinate the effective use of ICT for both students and teachers and ensure that equipment is properly maintained and replaced (World Bank, 2010).

Figure 5 demonstrates the levels of available CAI, computer laboratories and ICT support services in countries in Asia. In high-income countries in East Asia, including Hong Kong Special Administrative Region of China and Singapore, policy and formal recommendations for curricula have institutionalised ICT in education at both primary and secondary levels, whereby all schools provide computer laboratories, as well as ICT support services helping to ensure the sustainability of programmes offering CAI. In Central Asia, Georgia also provides CAI, computer laboratories and ICT support services in all primary and secondary schools.

Figure 5. Computer-assisted instruction, computer laboratories, and ICT support services by level of education, 2012



Notes: m = missing data. Secondary data for Indonesia and the Philippines refer to lower secondary education only. Data for Azerbaijan, Bhutan, Cambodia, the Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Maldives and the Philippines refer to public institutions only. Data for Malaysia and Singapore refer to 2011.

Source: UNESCO Institute for Statistics database; Statistical Tables 3 and 4.

Most countries in Asia prioritise the establishment of ICT infrastructure at the secondary level. For example in India, where policy explicitly prioritises ICT for secondary schools (India, 2012), 45% of secondary schools have computer laboratories compared to 17% of primary schools. Similarly in the Philippines, CAI and laboratories are present in 41% and 8% of primary schools, and 87% and 87% of secondary schools, respectively. In Bhutan, which does not have a formal policy on ICT in education but has relatively high levels of electricity in both primary and secondary schools, no laboratories have yet been established in primary schools compared to about two-thirds (66%) of secondary schools. Finally, in Myanmar, where the availability of electricity in schools is uncommon, CAI is scarce, where just 1% of primary schools provide some form of CAI compared to 15% of secondary schools. Similarly, in Cambodia and Nepal, CAI is available in 3% and less than 0.5% of primary and secondary schools combined, respectively.

In many developing countries in South and West Asia, and in Central Asia, computer provision tends to be concentrated in laboratories (World Bank, 2010; ADB, 2012) and is considered a viable solution due to the limited resources for providing 1:1 computing and 'ubiquitous learning' spaces. For instance, Figure 7 shows that CAI and laboratories are intertwined being equally available in schools in Kyrgyzstan (86%), Azerbaijan (84%), Maldives (40%), and in secondary education in Bhutan (66%) and the Philippines (87%). In India, however, computer provision is increasingly linked to other strategies, including placement in libraries, teachers' common room and the school head's office (India, 2012).

The Islamic Republic of Iran is an example of a country using a mixed model of providing computers in laboratories and other locations, such as classrooms or libraries. Based on Figure 7, 46% and 76% of primary and secondary schools, respectively, offer CAI, while no primary schools and 43% of secondary-level institutions have laboratories, suggesting computers are placed in different locations across schools. Other examples of this model include Malaysia, where CAI is universal in schools but laboratories have been established in 66% and 91% of primary and secondary schools, respectively. Lastly, Sri Lanka provides CAI in 60% of all schools but laboratories in just 34% of schools.

Still, other countries struggle with infrastructure leading to different solutions to increase pupil access to computer laboratories. For example, Bangladesh – with support from the non-governmental development organization, BRAC – introduced 17 mobile ICT laboratories containing laptop computers, cameras, multimedia projectors, etc. to cover 1,000 schools in remote areas (World Bank, 2010). In contrast, Sri Lanka – through its Nensala Project – established over 700 rural tele-centres or "Nensalas", which are managed and supervised by the Nensala Community Development Task Force to build ICT skills and impart ICT education in school curricula (Nensala, 2013; World Bank, 2010).

Data on ICT support services are less-commonly reported than data on CAI or laboratories, particularly in developing countries. In the Islamic Republic of Iran, Thailand, Malaysia and the Republic of Korea, ICT support services are not available in all schools offering CAI or laboratories, which might suggest that some schools face challenges to effectively maintain ICT systems and infrastructure, potentially leading to neglect or obsolescence, while other schools might be challenged in supporting pupils and staff appropriately leading to disuse. The gap between available ICT support services and CAI is greatest in the Islamic Republic of Iran and Thailand. According to Figure 7, the Islamic Republic of Iran offers CAI in 46% and 76% of primary and secondary educational institutions, respectively, compared to 15% and 38% for ICT support services. Similarly, ICT support services in Thailand are available in less than one-half of primary schools offering CAI and laboratories and in less than one-quarter of secondary schools.

Connecting schools to support Internet-assisted Instruction

Internet-assisted instruction (IAI) refers to an interactive learning method using content from the World Wide Web for pedagogical purposes. Given that connectivity is a prerequisite for the integration of IAI, an analysis of basic Internet connectivity is primordial in determining a country's level of preparedness. Countries vary widely in terms of their capacity to provide an Internet connection to all schools in all regions. At the most basic level, the availability of electricity is a major concern for countries, particularly for some in East Asia and in South and West Asia where relatively few schools are reliably connected (World Bank, 2010). Moreover, Ministries of education, however, often have little or no control over school Internet connectivity as this depends to a great extent on the level of development of the national telecommunications infrastructure and access to a reliable power supply (World Bank, 2010).

Increasingly, the need for broadband[2] connectivity and high bandwidth are necessary to effectively support instruction over the Internet, particularly for two-way synchronous communication (e.g. video conferencing), streaming videos, and using online applications and databases that have high-capacity requirements (Broadband Commission, 2013). Rural and remote areas, which frequently have greater dependency on broadband Internet given the unequal distribution of physical media (e.g. CD-ROM, DVD, etc.), present a significant challenge since they more frequently make use of analogue telephone lines with slow data transmission speeds unsuited to the transfer of information. While furnishing narrowband Internet in schools might be considered as a temporary solution to fill gaps, analogue dial-up connections may actually be more costly than a broadband connection in urban areas.

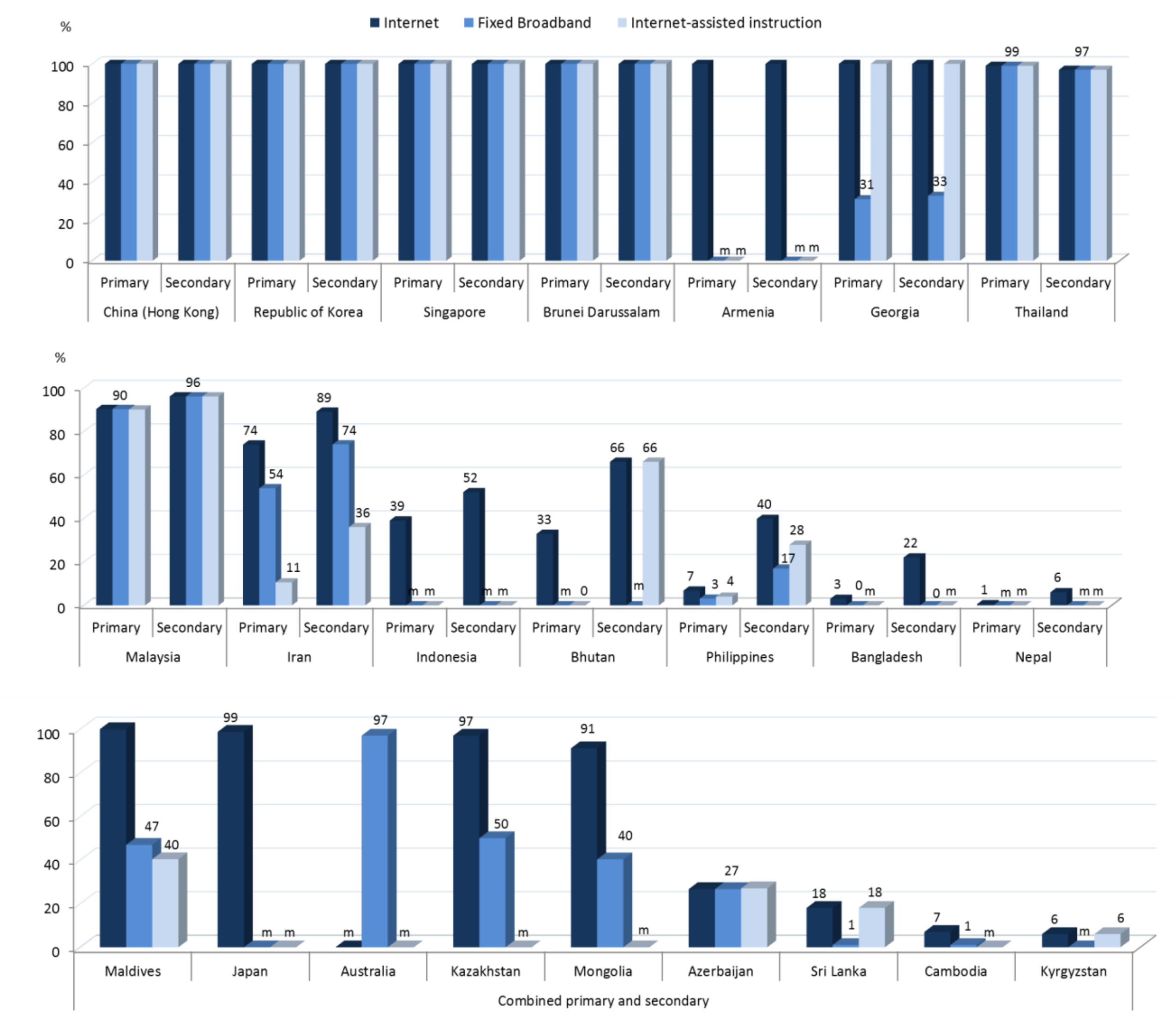
As of 2013, the Broadband Commission set the target of *Broadband for All* by 2020, an initiative that would favour the connectivity of all schools (Broadband Commission, 2013).

Figure 6 shows the proportion of primary and secondary educational institutions with: i) any type of Internet connection; ii) a fixed broadband connection; and iii) IAI, regardless of the number of computers that are connected. Data on types of Internet connection also shed light on the share of schools that may be using narrowband Internet connections, which by definition have much slower upload and download speeds, potentially hindering the full potential of IAI.

Varying levels of Internet connectivity exist in schools in Asia. It is still uncommon in many countries which lack electricity and basic telecommunication facilities in schools. Internet connectivity is particularly low in South and West Asian countries. For example, in Bangladesh and Nepal 3% and 1% of primary schools and 22% and 6% of secondary schools, respectively, are connected to the Internet. Similarly, 17% of primary and secondary schools combined in Sri Lanka are connected, of which only 1% is connected by fixed broadband. In contrast, Maldives, which has universal availability of electricity in schools, also has universal Internet connectivity, with 47% being broadband. The Islamic Republic of Iran has also made progress in connecting its schools, with 74% and 89% of primary schools and secondary schools, respectively, being connected to the Internet, of which 54% and 74% are connected via fixed broadband.

[2] The definition of fixed broadband Internet is consistent with the current definition developed by the International Telecommunication Union (ITU). It is defined as high-speed connectivity of at least 256 Kbits/sec or more in one or both directions (downloading and uploading).

Figure 6. Proportion of educational institutions with Internet, fixed broadband and Internet-assisted instruction by level of education, 2012



Notes: a = not applicable; m = missing data. Data for Cambodia includes pre-primary schools. Secondary data for Indonesia and the Philippines refer to lower secondary education only. Data for Kazakhstan and Japan represent country estimates. Total Internet data for Kazakhstan refer to 2010. Data for Japan and the Republic of Korea represent UIS estimates. Data for Bhutan, Japan, the Philippines and Sri Lanka represent public institutions only. Data for Malaysia and Singapore refer to 2011.

Source: UNESCO Institute for Statistics database and Statistical Tables 3 and 4.

In Central Asia, where electricity in schools is more common, Internet connectivity gaps may be attributed to a number of additional factors, including difficult mountainous terrain, the unwillingness of Internet service providers (ISPs) to operate in unprofitable rural areas with low population density, and limited school budgets to pay for Internet services. In some cases where Internet connectivity was previously available, services have been discontinued due to a cut in funding by external development partners (ADB, 2012).

For example, despite an adequate supply of electricity in general, Azerbaijan has yet to connect rural area schools (Abasov, 2011), meaning that only approximately one-quarter (27%) of schools have an Internet connection. In addition, the lack of fibre optic lines in rural villages and the difficulty in setting up Internet through existing copper telephone lines have been regarded as significant barriers to connecting rural schools (ADB, 2012; Azerbaijan, 2012). The absence of Internet is even greater in Kyrgyzstan, where Internet is available in just 6% of primary and secondary schools, albeit all of them being fixed broadband.

In contrast, universal Internet connectivity has been achieved in Armenia, Georgia and Kazakhstan, however, fixed broadband remains elusive for many schools. While data on broadband is unavailable for Armenia, evidence shows that reliable Internet connectivity remains a challenge, particularly in remote rural areas, and as such schools make use of a mobile computer classroom that moves between regions to provide web- or Internet-based learning in different subjects (Armenia, 2012). In Georgia, fixed broadband is present in 31% and 33% of primary and secondary schools, respectively; whereas it is somewhat more common in 50% of schools in Kazakhstan. Yet, having invested heavily in e-materials, there is an ongoing recognition in Kazakhstan of a lack of efficiency resulting from problems in connectivity, particularly in rural areas (ADB, 2012).

Mongolia, with one of the lowest population densities in Asia, has also made considerable efforts by connecting 91% of its primary and secondary schools, with 40% connected via fixed broadband. Yet despite this positive trend, some schools have voluntarily terminated Internet access due to high costs. To resolve this situation, the Ministry of Education, Culture and Science (MECS) in Mongolia subsequently attempted to meet the Internet costs of schools from central funds to ensure continued connectivity. In addition to school connections, Internet is also furnished through community-based socio-development centres or ‘high-tech centres’ and through access to mobile sites (ADB, 2012).

The greatest variability for Internet connectivity exists across countries in East Asia, where ICT in education remains rare and to the exclusion of most pupils in some countries, while others have met or exceeded ICT integration norms typical to North America and Western Europe. In Cambodia where 7% and 24% of primary and secondary schools, respectively, have electricity, the majority of these same schools do not have Internet. General Internet and fixed broadband are available in 7% and 1% of total schools, respectively. Rather than using fixed broadband, an additional 3% of schools in Cambodia use 3G mobile broadband technology, which allows users to connect a computer to the Internet using mobile devices. These connections are, however, relatively lower in bandwidth speed compared to that provided by a fixed broadband connection and are optimally used for connecting a single computer.

On the other hand, in the Philippines where most schools have electricity (>80%), Internet and fixed broadband are only available in 7% and 3% of primary schools, respectively; however general Internet and fixed broadband connectivity rates do increase to 40% and 17% of secondary educational institutions. Similarly, Indonesia also prioritises secondary schools for Internet connectivity. Whereas rates of available electricity are 80% for both primary and secondary levels in Indonesia, Internet is available in 39% of primary schools and 52% of secondary schools.

There is virtually universal fixed broadband Internet connectivity in Australia, Brunei Darussalam, Hong Kong Special Administrative Region of China, Japan, Malaysia, the Republic of Korea, Singapore and Thailand.

Figure 6 also demonstrates existing gaps between Internet availability and the provision of IAI. Internet connectivity in many schools is not intended for teaching and learning and is instead used primarily for administration. For example, in the Islamic Republic of Iran only 11% and 36% of primary and secondary schools, respectively, use Internet to offer IAI, compared to the 74% and 89% that are connected. Similarly, in the Philippines more schools have an Internet connection than offer IAI, especially at the secondary level as 28% offer IAI compared to 40% that are connected. Finally, driven by exceptionally expensive Internet access costs, IAI is available in 40% of schools in Maldives despite universal connectivity (World Bank, 2010).

Older versus newer forms of ICT-assisted instruction offered in schools: The role of radio, television, computers and the Internet

Advanced forms of ICT-assisted instruction depend on the availability of sufficient infrastructure, i.e. installation and maintenance of electricity and telephone communication facilities, acquisition and maintenance of computers, and Internet connectivity. However, in addition to the availability of requisite infrastructure and ICT resources, the particular combination of instructional strategies and technologies selected by countries are equally, if not more, influenced by national education priorities and policies, financial constraints and supply of human resources. Implementation plans need to evaluate current needs and future goals and ensure that adequate training and support are provided. The ICT-in-Education Toolkit[3] is an online tool that can help policymakers to plan during various phases of ICT in education initiatives (Haddad et al., 2007). For various factors, the continued use of older forms of ICT-assisted instruction remains a viable option to extend and enhance educational opportunities in many countries.

Of the older forms of ICT-assisted instruction, radio-assisted instruction (RAI) and television-assisted instruction (TAI) have been used as educational tools since the 1920s and 1950s, respectively, to enrich and expand the reach of education on a large scale and at a low cost by: i) targeting young adults who have left primary or secondary school before graduation, allowing them to follow curricula from a distance; and ii) providing otherwise unavailable instruction in sparsely-settled rural and remote areas (Haddad et al., 2007; Trucano, 2010; World Bank 2010). Radio has an added advantage in rural areas with little or no electrical infrastructure, since devices can be operated using batteries.

In several developing countries in Asia, the use of RAI and TAI is widespread. Radio/community radio have been used successfully in Nepal (e.g. Radio Sagarmatha), Sri Lanka (e.g. Radio Kothmale) and Afghanistan (e.g. Educational Radio and Television) in creating innovative

[3] http://www.ictinedtoolkit.org/usere/login.php

models for providing educational messages and creating community awareness (World Bank, 2010). Similarly, radio broadcasting through the Education Broadcasting Unit (EBU) of the Samoa Broadcasting Corporation (SBC) has been used extensively to reach children in rural and remote areas (Samoa, 2006).

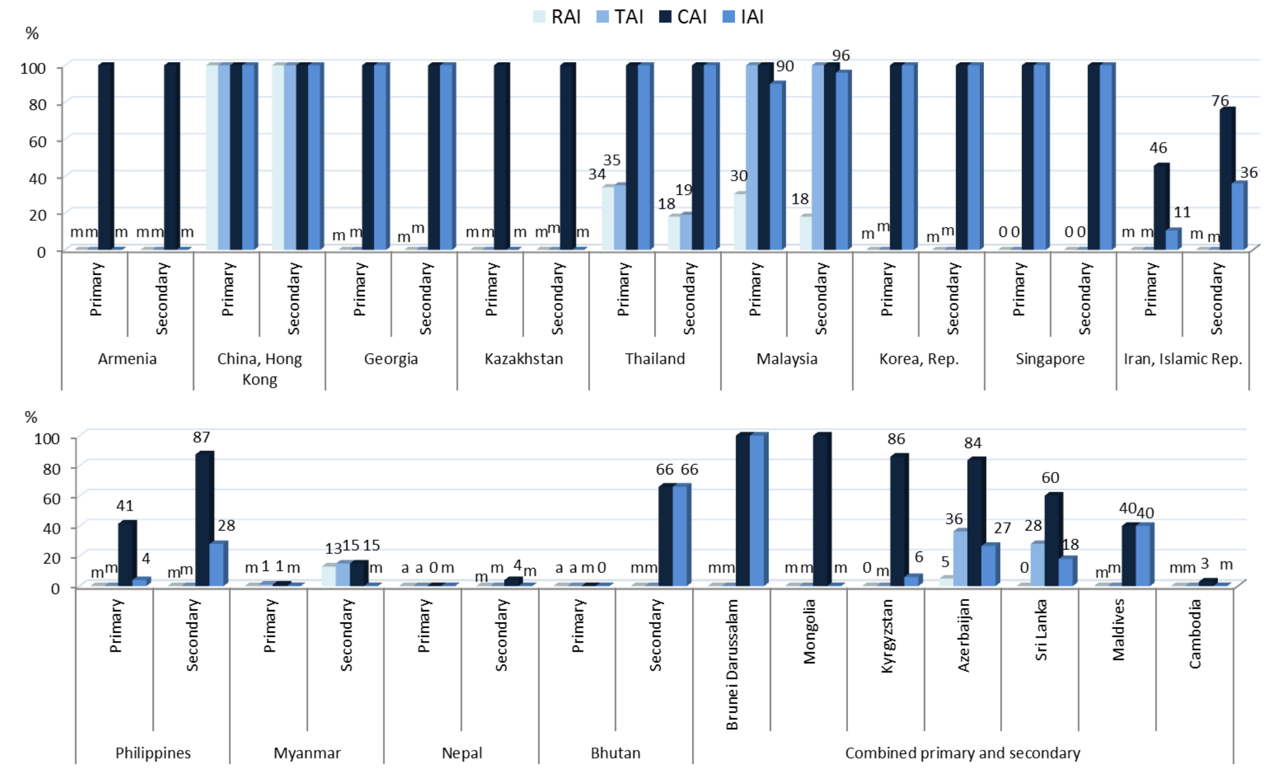
TAI has also been used extensively, for instance, through dedicated educational channels (e.g. Gyan Darshan I & II in India, Nenasa in Sri Lanka, ERTV in Afghanistan, the Knowledge Channel (KCh) in the Philippines), through educational programming on existing television channels, or in the case of India, through private educational television channels (e.g. Toppers, Tata Sky Fun Learning, etc.) (World Bank, 2010).

While traditional television and radio programmes have been a useful form of ICT in Asia, there are disadvantages in terms of lack of flexibility and limited interactivity (World Bank, 2010). Currently older forms of ICT-assisted instruction are being challenged, as well as enriched, by computers and the Internet due to their greater capacity. CAI and IAI have evolved and diversified rapidly, increasingly merging with older ICT tools to create new platforms for learning and teaching. In the 1980s, the approach of CAI was based on programmed learning or “drill and practice” software, whereas both software and hardware have since evolved. Currently, there are many new devices that have been specifically designed or are being adopted into classrooms, such as laptops (regular and low-cost), interactive whiteboards, tablets, e-readers, smart phones, etc.

One of the hallmarks of both CAI and IAI is the increased opportunity for interaction with teachers and pupils that was not possible through one-way radio and television broadcasts. This interaction may enhance educational quality if used appropriately. On the other hand, because of the increased level of technical sophistication associated with CAI and IAI, start-up and maintenance costs are substantially higher than for older technologies. Nevertheless, it is necessary to consider the gains and merits that each type of ICT might have for education in terms of the potential impact on learning, performance and motivation of both students and teachers, as well as on school-wide management and system-wide organization.

Figure 7 demonstrates the share of educational institutions which provide different forms of ICT-assisted instruction, including traditional RAI and TAI, to more technologically advanced platforms, such as CAI and IAI *(see Box 5).* The data present the proportion of schools with different types of ICT-assisted instruction but do not provide information on usage, nor about the quality of instruction*.* While challenges remain to collect comprehensive data on the types of ICT-assisted instruction available in schools, Figure 9 demonstrates that countries have different approaches for integrating ICT in education. Hong Kong Special Administrative Region of China, Malaysia and Thailand provide evidence of considerable capacity to provide a wide array of ICT-assisted instruction types. For example, all types of ICT-assisted instruction are available in all primary and secondary schools in Hong Kong Special Administrative Region of China, while in Malaysia, TAI and CAI are universally available in schools and IAI is offered in 90% and 96% of primary and secondary schools, respectively. Unlike Hong Kong Special Administrative Region of China, however, RAI is offered in a minority of schools in Malaysia – 30% and 18% of primary and secondary schools, respectively – suggesting lower prioritisation in educational planning.

Figure 7. ICT-assisted instruction by type and level of education, 2012



Notes: m = missing data; a = category not applicable. Data for Bhutan, Brunei Darussalam, Cambodia, Kazakhstan, Myanmar and the Republic of Korea are UIS estimates. Data for Brunei Darussalam refer to 2009, while data for Malaysia and Singapore refer to 2011. Data for Azerbaijan, Bhutan, Kyrgyzstan, Malaysia, Maldives, the Philippines, Singapore and Sri Lanka cover public schools only. Secondary data for Indonesia and the Philippines cover lower secondary education only.

Source: UNESCO Institute for Statistics database and Statistical Tables 3 and 4.

Although progress related to advanced types of ICT-assisted instruction has been made in a number of developing countries, access remains restricted for many children. For example, although the Philippines has achieved CAI integration rates of 41% and 87% in primary and secondary schools, respectively, the LCRs in schools providing CAI remain relatively high at 151:1 and 47:1. As such the number of computers available in the Philippines is not keeping pace with enrolment. , suggesting that time on task using computers is restricted. This raises questions about the relative impact of CAI, compared to other countries where the LCRs are substantially lower, such as in Malaysia (13:1) *(see Statistical Tables 3, 4 and 5)*.

Kyrgyzstan also faces acute challenges in the integration of advanced forms of ICT-assisted instruction. While 86% of schools have some form of CAI, the LCR of 57:1 hinders student access reducing time on task per pupil. Moreover, while some form of CAI is present in the majority of schools, IAI is only available in a small proportion of schools (6%). In South and West Asia, similar challenges also exist in Maldives and in the Islamic Republic of Iran, limiting children’s access to a full range of available online information and interaction. The existence of local area networks (LANs), however, may serve the role of mimicking some of the interactivity characterising the Internet and worldwide web.

Where advanced forms of ICT-assisted instruction are lacking, RAI and TAI might be viewed as viable alternatives to expand and enhance educational opportunities. Sri Lanka and Azerbaijan provide examples where RAI and TAI might be used to fill in gaps left by a lack of Internet infrastructure to support online interaction. For example, while IAI is available in 18% and 27% of primary and secondary schools combined in Sri Lanka and Azerbaijan, respectively, TAI is somewhat more common being offered in 28% and 36% of schools. Clearly TAI cannot simply replace all features inherent to advanced forms of ICT-assisted instruction; however, the appropriate use of TAI as an alternative might minimise some of the gaps left by a lack of CAI and IAI.

Ultimately, few countries can provide data on the proportion of schools providing programmes with older types of ICT-assisted instruction. Where available, data show RAI and TAI continue to be used in both developed and developing countries. Yet, RAI and TAI are not necessarily widespread in developing countries where they could play a role in enhancing educational opportunities when more advanced forms of ICT-assisted instruction are absent, particularly in rural areas with little infrastructure. For example, while CAI is only available in 1% and 15% of primary and secondary educational institutions in Myanmar, respectively, radios for pedagogical purposes are available in 13% of secondary schools[4] and televisions for pedagogical purposes are available in 1% of primary and 15% of secondary schools.

7. Participation in ICT-assisted instruction

There are three aspects to the digital divide in Asia: i) the divide between Asia versus other regions; ii) the divide across Asia (e.g. high-income OECD member countries versus low-income countries); and iii) the divide within some Asian countries according to demographics, including socio-economic status, location (e.g. urban versus rural), culture and ethnicity.

While the integration of ICT in education may help to bridge the digital divide, it may also exacerbate it in some contexts. This can occur, for example, if particular groups tend to be systematically excluded from educational opportunities and if schools are the only place where certain children can readily access and take advantage of the learning provided by ICT.

Gender can also have an impact on access to, participation in, retention and completion of education (UIS, 2010). Yet, if girls are to leave school ready to participate equally in the knowledge economy, then they too will require the benefits of ICT-assisted instruction, including the knowledge, skills and attitudes imparted by using these tools. There has been substantial analysis of the digital divide based on gender (Gorski, 2005; Hilbert, 2012). Many researchers have focused on differences in the manner in which girls and boys access and use ICT to learn and experience the world around them (Sutton, 1991; Volman and van Eck, 2001; Volman et al., 2005), while household data generally suggest that boys are more likely than girls to use the Internet at home, work and informal settings in both developed and developing countries (ITU, 2013). Based on these perspectives, it is important to assess access to ICT in education, not only at an institutional level but also at the enrolment level, through the lens of gender (Hafkin and Huyer, 2008).

Table 4 shows sex-disaggregated data based on total enrolment in programmes offering TAI, CAI, IAI, as well as in courses offering basic computer skills or computing. However, an important caveat to consider is that gender disparities for general enrolment exist in some countries given that girls and boys may be out-of-school in different numbers. As such, some of

4 Data on the provision of radio-assisted instruction in primary schools in Myanmar are missing.

the following enrolment data in ICT-supported programmes suffer from sampling bias. In other words, while these data shed light on the extent that girls and boys who are already enrolled in school have access to ICT in education, the data do not address pre-existing gender disparities in general school enrolment.

Data on enrolment in programmes offering ICT-assisted instruction are scarce based on the most recent data collection in Asia; however, a few conclusions may be drawn. Enrolment is high, if not universal, in high-income countries where infrastructure is widespread across a majority of schools. For example, there is full enrolment in programmes offering CAI, IAI and basic computer skills or computing in Singapore, while there is also full enrolment in programmes offering TAI and basic computer skills or computing in Hong Kong Special Administrative Region of China. No children are enrolled in TAI in Singapore.

Table 4. Proportion of pupils enrolled in programmes offering ICT-assisted instruction, by gender, 2012

		Enrolment in TAI			Enrolment in CAI			Enrolment in IAI			Enrolment in basic computer skills or computing		
		Primary	Lower Secondary	Upper Secondary	Primary	Lower Secondary	Upper Secondary	Primary	Lower Secondary	Upper Secondary	Primary	Lower Secondary	Upper Secondary
Georgia	M	…	…	…	100	100	100	100	100	100	100	100	100
	F	…	…	…	100	100	100	100	100	100	100	100	100
Kyrgyzstan	M	…	…	…	…	…	…	…	…	…	…	93	…
	F	…	…	…	…	…	…	…	…	…	…	93	…
Mongolia	M	…	…	…	…	…	…	…	…	…	22	100	100
	F	…	…	…	…	…	…	…	…	…	22	100	100
China, Hong Kong	M	100	100	100	…	…	…	…	…	…	100	100	100
	F	100	100	100	…	…	…	…	…	…	100	100	100
Malaysia	M	100	100	100	100	100	100	100	100	100	100	61	24
	F	100	100	100	100	100	100	100	100	100	100	62	21
Philippines	M	…	…	…	37	95	…	22	65	…	37	95	…
	F	…	…	…	37	95	…	22	65	…	37	95	…
Singapore	M	.	.	.	100	100	100	100	100	100	100	100	100
	F	.	.	.	100	100	100	100	100	100	100	100	100
Thailand	M	27*	15*	5*	72*	76*	48*	…	…	…	94*	88*	70*
	F	28*	17*	21*	72*	76*	64*	…	…	…	93*	89*	82*
Bangladesh	M	…	…	…	…	…	…	…	…	…	…	5	7
	F	…	…	…	…	…	…	…	…	…	…	x(M)	x(M)
Iran, Islamic Rep.	M	…	…	…	21	50	32	…	…	…	…	…	33
	F	…	…	…	x(M)	x(M)	x(M)	…	…	…	…	…	19
Sri Lanka	M	1	12	17	75	45	36	…	…	…	…	…	7
	F	1	12	21	75	45	47	…	…	…	…	…	x(M)

Notes: … = missing; x = included in another category; * = country estimation; M = males; F = females. Data for the Islamic Republic of Iran, the Philippines, Singapore and Sri Lanka cover public schools only. Data for Malaysia and Singapore refer to 2011.

Source: UNESCO Institute for Statistics database and Statistical Tables 6 and 7.

Enrolment in programmes offering CAI, IAI and basic computer skills or computing is also universal in some middle-income countries, including Malaysia and Georgia, where the Deep Leap programme has helped advocate the integration of computers, Internet, educational software and ICT support services into all schools (Georgia, 2007).

Meanwhile, as infrastructure is not yet universal in all middle-income countries, enrolment in programmes offering ICT-assisted instruction varies elsewhere, such as the Philippines, Thailand, the Islamic Republic of Iran and Sri Lanka. In the Philippines, for instance, enrolment increases from the primary to the secondary level as 37%, 22% and 37% of primary pupils are enrolled in CAI, IAI and basic computer skills or computing, compared to 95%, 65% and 95% of secondary pupils, respectively. In contrast, participation in CAI in Sri Lanka is highest at the primary level with 75% enrolled, decreasing to 43% at the secondary level *(see Statistical Tables 6 and 7)*.

Among low-income countries, enrolment in courses offering basic computer skills or computing is low in Bangladesh at 5% and 7% of lower and upper secondary education, respectively *(see Statistical Tables 6 and 7)*.

Among available sex-disaggregated indicators, data presented in Table 4 show few gender differences; where disparities are present, it is most common in upper secondary education. For example, in Thailand and Sri Lanka there are greater proportions of upper secondary girls enrolled in CAI (64%) and basic computer skills or computing (82%) than boys (48% and 70% respectively). It is noteworthy that disparity in general enrolment data only begins to emerge in these three countries in secondary education; as such, it is difficult to determine to what degree differences in the proportion of out-of-school girls and boys influence these figures.

8. Teaching and learning and ICT in education

Teacher preparedness and ICT in education

Teachers are frequently considered to be the most important influence on classroom learning and, as such, play an invaluable role in ensuring that pupils use ICT effectively inside the school. However, there has been little or no research on exactly how much teacher training is required, how often it should take place, what kind of training is most appropriate and affordable, and what it should cover to create a teaching workforce that is motivated to use ICT in the classroom in the context of new curricula and new pedagogies.

Complicating matters, the integration of ICT into education is frequently resisted by teachers and their unions, particularly in countries with an aging, underpaid teaching workforce, and where there has been inadequate training and preparation. In these circumstances, a lack of motivation to learn new skills and teaching and learning methodologies may occur, which is often compounded by feeling threatened by newer forms of ICT that students will understand better than teachers do. This concern has been recognised by the Ministry of Education in Kazakhstan, owing to the high proportion of “older” teachers in the last quartile of their teaching career. In particular, Kazakhstan has concerns about a general lack of efficiency in the use of e-curriculum, which is an important focus in their education system (ADB, 2012).

The UNESCO ICT Competency Framework for Teachers [5]is a useful tool to inform education policymakers, educators and providers of professional learning of the role of ICT in educational reform, as well as to assist Member States in developing national ICT competency standards for teachers. It emphasises that it is not enough for teachers to just have ICT competencies and be able to teach them to students. Rather, teachers need training to facilitate students in becoming collaborative, problem-solving, creative learners through the use of ICT, which is argued enhances student outcomes including academic achievement (UNESCO, 2011b). Pre-service teacher-training programmes delivered through teacher education institutions remain a crucial component not only to enable teachers to overcome the technology barrier but also to integrate appropriate technology into teaching and learning. In support of such efforts, UNESCO Regional Office in Bangkok has gathered case studies of pre-service courses on “Education Technology” to equip pre-service teachers with the relevant knowledge, skills and tools to effectively use ICT in the classroom[6] (UNESCO Bangkok, 2013).

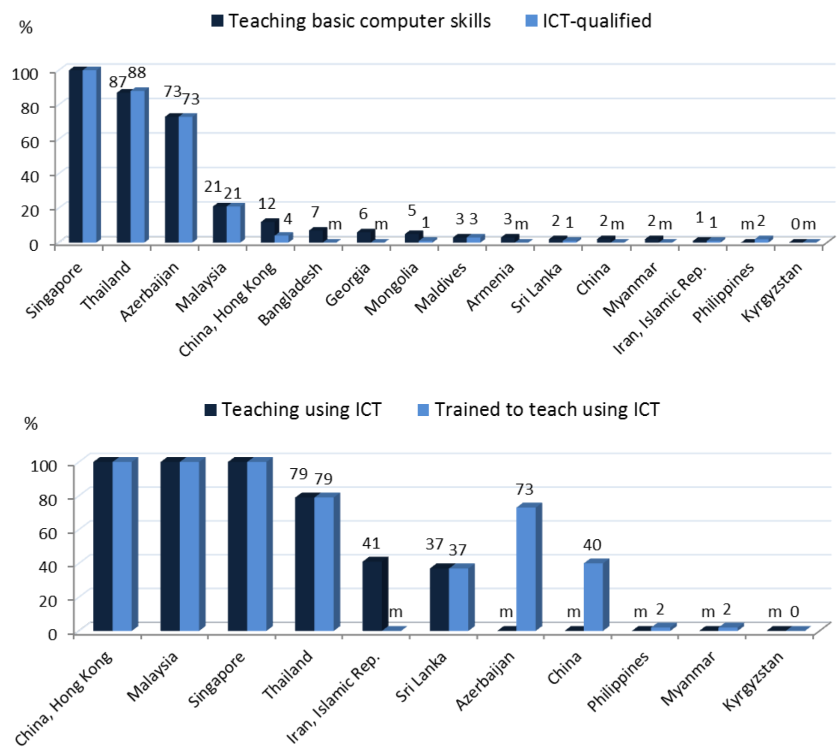
While there are no international targets, countries where ICT is widespread require greater proportions of teachers that can teach how to use ICT as well as use it in their teaching. For example, the needs in Georgia, which has integrated CAI universally in all schools and has an LCR of 7:1 in primary and secondary schools combined, would be greater than in Myanmar where a minority of schools provide any form of ICT-assisted instruction. While the development of basic computer skills is seen to have a role in the teaching and learning process, experience from developed countries suggests that ICT skills are more important as an enabler of other teaching and learning practices and that targeted teaching of ICT skills is not too important in and of themselves. For example, schools that report the highest levels of student ICT-related skills and experience are often not those with heavy computer course requirements but rather ones that made use of ICT on a routine basis throughout the professional development of teachers and the teaching and learning process (Trucano, 2005).

Figure 8 shows the proportion of primary- and secondary-level teachers who according to nationally-defined qualification standards are: i) ICT-qualified to teach basic computer skills or computing versus the proportion teaching basic computer skills or computing; and ii) trained to teach subjects using ICT versus the proportion of teachers currently doing so. In terms of the proportion of ICT-qualified teachers trained to teach basic computer skills or computing, data suggest that countries have adopted different strategies whereby some train a minority of specialised teachers versus other countries that train a significant core of the teacher workforce. For example, while 100%, 88% and 73% of teachers in Singapore, Thailand and Azerbaijan are trained, respectively, the proportion is less than 5% in most other countries. In Maldives, where 3% of teachers are trained to teach basic computer skills, Maldives’s unique geography consisting of many islands (atolls) has presented logistical challenges to train additional teachers for who find it difficult and costly to travel. As a response to the situation, radio-assisted instruction, as well as *Teacher Resource Centres* in 20 different atolls, have been established to provide ICT-related training (Maldives, 2012; World Bank, 2010).

[5] http://www.unesco.org/new/en/unesco/themes/icts/teacher-education/unesco-ict-competency-framework-for-teachers/

[6] http://www.unescobkk.org/resources/e-library/publications/article/case-studies-on-integrating-ict-into-teacher-education-curriculum-in-asia/

Figure 8. Proportion of combined primary- and secondary-level teachers teaching basic computer skills and subjects using ICT versus proportions trained, 2012



Notes: m = missing data. Data for the Philippines cover primary and lower secondary education only. Data for Azerbaijan, Bangladesh, the Islamic Republic of Iran, the Philippines, Singapore and Sri Lanka cover public institutions only. Data for teachers who teach basic computer skills or computing for Myanmar cover lower secondary education only, while data for teachers trained to teach subjects using ICT cover primary and lower secondary education only. Data for China, Malaysia and Singapore refer to 2011.

Source: UNESCO Institute for Statistics database and Statistical Table 8

In terms of gaps between the proportion of teachers trained versus those currently teaching basic computer skills, Figure 10 shows that, while there are few teachers teaching computer skills in a number of countries, the majority have generally completed the minimum level of required training (i.e. ICT-qualified), the exception being Hong Kong Special Administrative Region of China where 12% of teachers are teaching basic computer skills versus the 4% who are trained to do so.

The indicator on the proportion of teachers trained to teach subjects using ICT measures the number of teachers trained, according to nationally-defined qualification standards, to teach one or more subjects using ICT to support instruction in the classroom. Effective usage of ICT in teaching is especially important since poor or improper usage and management of ICT may, in fact, result in diminished educational outcomes compared to if no ICT had been employed – particularly so if ICT-assisted instruction is inefficiently consuming time that could be used to learn content.

In countries where ICT is well integrated into curricula, including Hong Kong Special Administrative Region of China, Malaysia and Singapore, teachers are universally trained to teach using ICT in their classrooms. On the other hand, few teachers are trained in countries where ICT is scarce. In the Philippines and Myanmar, 2% of teachers are trained to use ICT, while no teachers in Kyrgyzstan have been trained.

ICT courses are typically absent in pre-service teacher training in a number of Central Asian countries, including Kyrgyzstan and Azerbaijan (ADB, 2012). In order to meet the training needs of teachers, in-service training might be offered to ensure that teachers have the minimum requirements to teach the use of ICTs as well as how to use them effectively in teaching. In Azerbaijan, where the majority of teachers are female, in-service training presented an obstacle in that many teachers, for family reasons, could not easily attend residential training for extended periods of time. As a result, in-service efforts are provided by commercial companies and NGOs in regional training centres established across the country. Nevertheless, while such efforts have resulted in 73% of teachers having been trained to use ICT effectively in their teaching, the upgrading of teaching skills remains a concern as current training covers 25 days every five years and therefore does not match the speed of technological change (ADB, 2012).

Finally, China has trained approximately 40% of its teachers to teach subjects using ICT. While urban versus rural disparities are common in several countries, China – through a number of initiatives and projects – has made strides in eliminating this gap by furnishing ICT and the requisite teacher training to schools in western and rural areas of the country (Zeng et al., 2012).

Educational outcomes and ICT in education

The global expansion of ICT in education has ushered in growing concern about its effectiveness to improve the quality of instruction and to improve overall student outcome measures, such as increasing achievement and decreasing dropout. For many, there is widespread belief that ICT empowers learning through a transformational effect leading to new student-centred educational paradigms that help foster intellectual creativity, problem-solving abilities, communication skills and other forms of higher-order thinking (Trucano, 2005). This belief is often reflected in national policy to integrate ICT across the curriculum, for example, the extensive development and usage of e-materials in Kazakhstan (ADB, 2012), while it may also be reflected in national education targets, such as the goal in the Philippines to achieve a 5% mean increase in national test scores in all ICT-enabled schools (Philippines, 2005).

While many studies have been conducted to determine whether or not computers and ICT affect academic achievement and other student outcomes measures favourably, there are currently few comparable data to support this claim. For every study that cites a significant positive impact, another study finds little or no effect. The most significant part of the problem in conducting impact assessments comes from the difficulty of isolating the influence of ICT on learning outcomes from the large number of other potential factors. A recent study, which summarises 25 previous meta-analyses based on more than 40 years of research, concluded that computer use in the classroom does have an overall positive effect on achievement (Tamim et al., 2011). Still, given the imperfect relationship, it cannot be concluded that ICT necessarily leads to improved outcomes. Other factors are also vital, including effective teacher training and appropriately linking ICT usage to sound pedagogy.

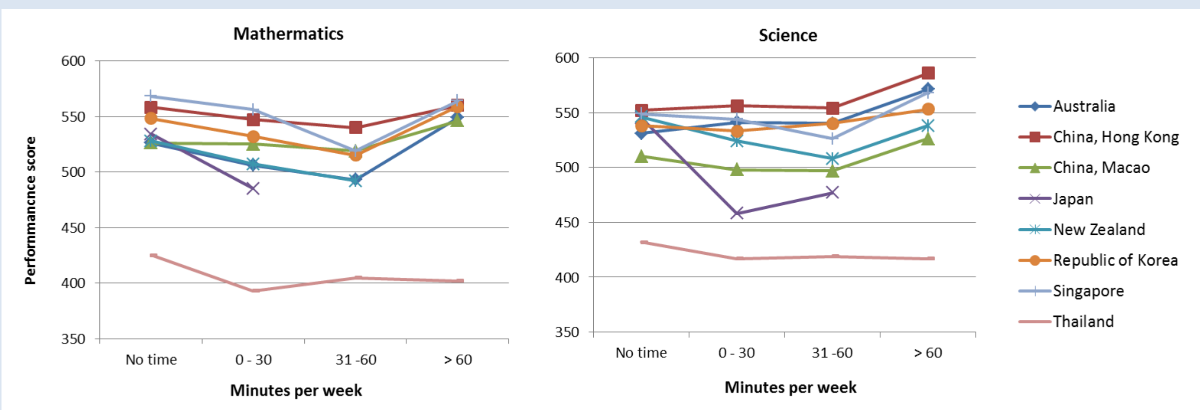
The integration of ICT in schools in Asia is characterised by numerous approaches, including integrating radio, television, computers and the Internet in classrooms, computer laboratories, and other locations, as well as developing a structure to support mobile learning using different smart phone and tablet devices (Valk, Rashid and Elder, 2010). In developing countries, ICT is not universally available across schools. In South and West Asia, for instance, computer laboratories, which have been the preference for delivering ICT-assisted instruction, are strained by high enrolment limiting student access to a single period per week covering only basic I.T. learning, while many others have none (ADB, 2012). In contrast, ICT is more integrated in education in high-income countries, such as the Republic of Korea and Singapore, permitting more time to use ICT in a variety of subjects. Despite availability, ICT may nevertheless be used infrequently or not at all in many schools.

In efforts to enshrine minimum standards for duration of use with ICT, countries often set statutory or curriculum recommended instructional hours for ICT in education *(see Section 5)* despite the lack of consistent evidence of the influence of duration using ICT on student achievement *(see **Box 6**)*. Moreover, rather than only viewing ICT usage from a quantity perspective, the *Trends in International Mathematics and Science Study (TIMSS)* provides additional research measuring the frequency of particular types of ICT related learning behaviours for students where instruction is supplemented with computers in schools *(see **Box 7**)*.

Box 6. Usage of ICT in education in Asia: Evidence from PISA (2009) of the relationship between frequency and performance in mathematics and science

International survey data from the *Programme for International Student Assessment (PISA)* of 15-year-old students sheds some light on the relationship between time using computers and performance in mathematics and science. **Figure 9** shows test scores for eight countries in Asia in relation to the number of minutes per week that students use computers in lessons. For mathematics, performance scores are generally curvilinear, whereby students not using computers during class as well as those using computers more than 60 minutes per week score higher than those using computers 60 minutes or less. In science, however, results are more mixed. For example, students using computers for more than 60 minutes per week in Australia and Hong Kong Special Administrative Region of China demonstrate performance scores which are 8% and 6% greater, respectively, than those not using computers. In contrast, the more students use computers in class in Thailand, the lower their test scores in science.

Figure 9. Performance in mathematics and science by duration of computer usage during lessons, 2009



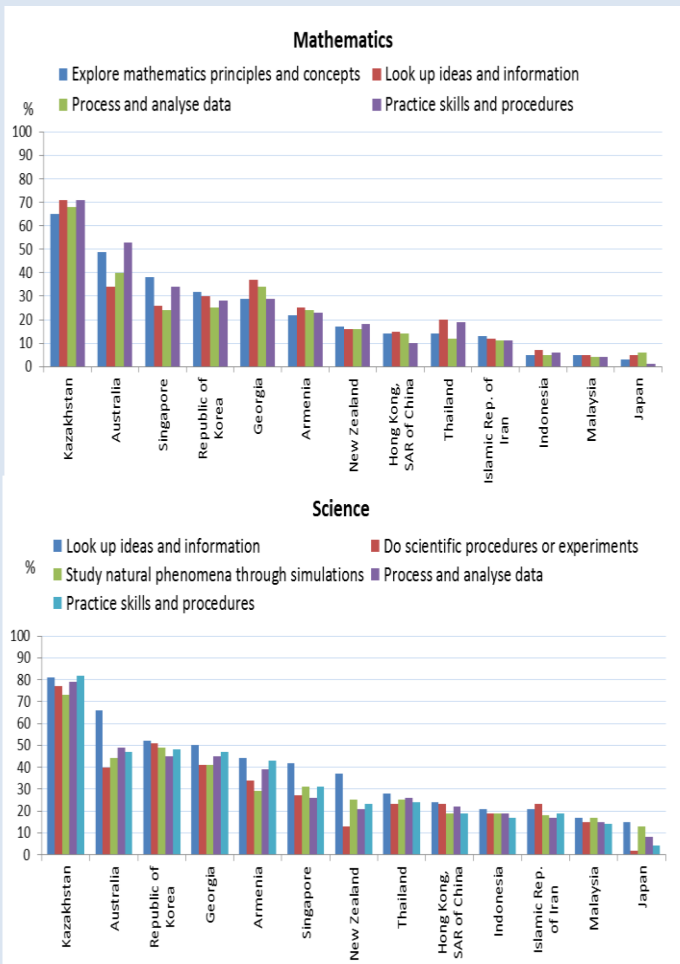
Source: OECD, 2011.

Caution should be taken when interpreting the data since: i) lower-performing students are often assigned disproportionate time using computers for remedial purposes; ii) it is difficult to isolate the influence of home computer use on school performance; and iii) not all countries have successfully integrated ICT in pedagogically meaningful ways. As such, training teachers to effectively use ICT in the classroom cannot be understated. Furthermore, since PISA does not use experimental designs, cause-effect relationships should be avoided. Lastly, since usage data is based on students' self-reports, biases may influence the findings. In order to better understand the effects of usage on performance, further analysis of the types of activities undertaken by pupils might shed light on how to improve ICT in education.

Box 7. ICT usage by learning activity and achievement in mathematics and science: Evidence from Asian countries from TIMSS (2011)

ICT in education is widely promoted to have a net positive impact on extending access and enhancing student learning, but as previously mentioned, evidence to support such claims are scattered and inconsistent. The international student assessment study known as *Trends in International Mathematics and Science Study (TIMSS)* collects, among other areas, data on computer usage and student achievement for pupils in several developed and developing countries. **Figure 10** shows data for Grade 8 pupils in 13 Asian countries using computers at least once monthly to perform particular learning activities in both mathematics and science. It also shows the average achievement of students in the same subjects who use computers and those who do not.

Figure 10. Computer usage by learning activities and student achievement in mathematics and science among Grade 8 pupils, as reported by teachers, 2011



MATHEMATICS	Average Achievement		
	Computers available	No computers available	Difference %
Kazakhstan	487	490	-0.6
Australia	510	506	0.8
Singapore	614	606	1.3
Republic of Korea	617	607	1.6
Georgia	427	429	-0.5
Armenia	473	464	1.9
New Zealand	482	491	-1.8
China, Hong Kong	587	585	0.3
Thailand	426	427	-0.2
Iran	460	402	14.4
Indonesia	375	388	-3.4
Malaysia	434	442	-1.8
Japan	572	569	0.5
SCIENCE	**Average Achievement**		
	Computers available	No computers available	Difference %
Kazakhstan	489	500	-2.2
Australia	522	536	-2.6
Republic of Korea	562	556	1.1
Georgia	420	419	0.2
Armenia	447	430	4.0
Singapore	584	598	-2.3
New Zealand	499	519	-3.9
Thailand	455	449	1.3
China, Hong Kong	526	540	-2.6
Indonesia	390	411	-5.1
Iran	500	462	8.2
Malaysia	447	421	6.2
Japan	559	557	0.4

Source: Martin et al., 2012; Mullis et al., 2012

Overall, students were more likely to use computers in science than in mathematics, but this varies. In both subjects, students from Kazakhstan, where there has been a lot of emphasis on developing specialised e-materials for classrooms, were the most likely to use computers at least once a month. Approximately 71% of Grade 8 pupils both look up ideas and information, and practice skills and procedures in mathematics, while 81% and 82% of students, respectively, do so in science. In contrast, the proportions of students from Japan to use computers monthly in both mathematics and science were the least, representing no more than 6% and 15%, respectively.

Among the countries under study, some demonstrate that students using computers have higher average achievement scores. Pupils in the Islamic Republic of Iran who use school computers to supplement learning have average achievement scores that are 14% and 8% greater in mathematics and science, respectively, than students with no school-based computers. However, it should be noted that schools in the Islamic Republic of Iran, which are well-equipped with computers and other forms of ICT, also tend to be from regions of higher socio-economic status (SES), a factor that is consistently positively related with achievement (OECD, 2010; Willms, 2006). Therefore, unless the effect of SES can be discounted, correlations between the availability of technology and learning outcomes should be approached with caution. In contrast other countries demonstrate lower achievement levels for students using computers in school. This is truer of science than mathematics where students without computers perform about 5% and 4% in Indonesia, New Zealand, respectively, and 3% higher in both Australia and Hong Kong Special Administrative Region of China. Incidentally, as computers are often used for remedial purposes in many countries, this factor also needs to be evaluated.

9. Next steps: Looking forward

The current report has provided a comparative analysis of ICT integration across Asia, including countries in Central Asia, South and West Asia and East Asia, by looking at four specific types of data: i) use of ICT in policy and key curricular areas; ii) ICT infrastructure and its importance to integrating ICT-assisted instruction; iii) participation in programmes offering ICT; and iv) teaching and learning as they relate to ICT in education. These data provide a snapshot of ICT access, as well as basic usage of ICT for education, across the vast region.

As ICT adoption and use in the wider socio-economic context of countries becomes more prevalent, it becomes clear that ICT adoption and policies in education are areas that require further study. In this regard, all aspects of the ICT in education ecosystem, such as content (e.g. open educational resources (OER), free and open-source software (FOSS), and other open learning solutions), access to and use of hardware (e.g. new devices, including mobile technologies, one-to-one computing options etc.), connectivity, ICT issues related to pedagogy and learning (including digital literacy, and issues of assessment), as well as teacher training, need to be explored in greater detail to have a fuller picture of the contribution of ICT to quality teaching and learning. Demonstrating meaningful impacts on learning and student outcomes in general are also needed urgently to help policymakers set national priorities and develop policies more effectively.

More specifically, new indicators need to be considered and developed. In particular, statistical methodology relating to enrolment should be refined to include the calculation of population-based indicators to better understand existing gaps based on all school-age children. Existing participation indicators are based on current enrolment and do not consider out-of-school children; as such, gender disparity in general enrolment data results in the calculation of indicators that do not provide a full picture of girls' and boys' access to ICT in education.

Acknowledging the challenges in building a reliable international database on ICT in education statistics, one of the recommendations of the Asia Pacific Ministerial Forum on ICT in Education 2012 was to increase the mutual sharing of data so that the value of ICT in education data and indicators increase for researchers, policymakers and educators alike (UNESCO Bangkok, 2012). In such a dynamic, rapidly-changing field, where metrics become a key principle to informed decision-making, the UIS looks forward to future collaboration with its Member States in the elaboration of new instruments (or refining existing ones) to collect relevant data that can effectively contribute to facilitating evidence-based policymaking in the area of ICT in education.

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Reader's Guide

The following symbols are used throughout the report and the statistical tables:

SYMBOL	INTERPRETATION
…	Data missing (or not available)
*	Country estimation
**	UIS estimation
–	Magnitude nil or negligible
.	Not applicable
+*n*	Data refer to the school or financial year *n* years after the reference year
-*n*	Data refer to the school or financial year *n* years prior to the reference year
x[y]	Data included in column [y] of the table (or indicated with a comment)
a	Public institutions only
b	Private institutions only
c	Refers to ISCED 1-2
d	Refers to ISCED 1-3
e	Refers to ISCED 2 only
f	Refers to ISCED 3 only
g	Independent secondary schools are not covered. In the Indian education system, independent secondary schools refers to secondary schools offering education programmes at ISCED 2 and/or 3 levels exclusively both public and private.
h	Pre-primary schools are included
i	Data available for West Bank schools only
j	No private institutions at ISCED 3 level

Annex. Statistical tables

Annex. Statistical tables

1.1 Political Commitments on ICT in Education | ISCED 1, 2 and 3 | 2012

REGION	Strategies to promote integration of ICT in education					
	National Policy			National Plan		
Country or territory	Primary (ISCED 1)	Lower Secondary (ISCED 2)	Upper secondary (ISCED 3)	Primary (ISCED 1)	Lower Secondary (ISCED 2)	Upper secondary (ISCED 3)
	(1)	(2)	(3)	(4)	(5)	(6)
CENTRAL ASIA						
Armenia	√	√	√	x	x	x
Azerbaijan	√	√	√	√	√	√
Georgia	√	√	√	√	√	√
Kazakhstan	x	x	√	x	x	√
Kyrgyzstan	√	√	√	…	…	…
Mongolia	√	√	√	√	√	√
EAST ASIA AND THE PACIFIC						
Australia	√	√	√	…	√	√
Brunei Darussalam	…	…	…	…	…	…
Cambodia	x	x	√	x	x	√
China	√	√	√	√	√	√
China, Hong Kong Special Administrative Region	√	√	√	√	√	√
China, Macao Special Administrative Region	√	√	√	√	√	√
Indonesia	√	√	√	√	√	√
Japan	√	√	√	√	√	√
Lao People's Democratic Republic	x	x	x	x	x	x
Malaysia	√	√	√	√	√	√
Myanmar	√	√	√	√	√	√
New Zealand	√	√	√	√	√	√
Philippines	√	√	…	√	√	…
Republic of Korea	√	√	√	√	√	√
Samoa	√	√	√	√	√	√
Singapore	√	√	√	√	√	√
Thailand	√	√	√	√	√	√
SOUTH AND WEST ASIA						
Bangladesh	√	√	√	√	√	√
Bhutan	x	x	x	x	x	x
India	√	√	√	x	x	x
Iran (Islamic Republic of)	√	√	√	√	√	√
Maldives	x	x	x	x	x	x
Nepal	√	√	√	√	√	√
Sri Lanka	√	√	√	√	√	√

√ = Yes x = No

1. 2 Political commitments on ICT in Education | ISCED 1, 2 and 3 | 2012

REGION	Strategies to promote integration of ICT in education					
	Regulatory Provision(s)			Regulatory Institution		
Country or territory	Primary (ISCED 1)	Lower Secondary (ISCED 2)	Upper secondary (ISCED 3)	Primary (ISCED 1)	Lower Secondary (ISCED 2)	Upper secondary (ISCED 3)
	(7)	(8)	(9)	(10)	(11)	(12)
CENTRAL ASIA						
Armenia	√	√	√	√	√	√
Azerbaijan	√	√	√	√	√	√
Georgia	x	x	x	√	√	√
Kazakhstan	x	x	√	x	x	√
Kyrgyzstan	x	x	x	x	x	x
Mongolia	x	x	x	√	√	√
EAST ASIA AND THE PACIFIC						
Australia	x	x	x	x	x	x
Brunei Darussalam	…	…	…	…	…	…
Cambodia	x	x	x	x	x	√
China	x	x	x	√	√	√
China, Hong Kong Special Administrative Region	x	x	x	√	√	√
China, Macao Special Administrative Region	x	x	x	√	√	√
Indonesia	√	√	√	√	√	√
Japan	x	x	x	x	x	x
Lao People's Democratic Republic	x	x	x	x	x	x
Malaysia	√	√	√	√	√	√
Myanmar	√	√	√	√	√	√
New Zealand	x	x	x	x	x	x
Philippines	x	x	…	√	√	…
Republic of Korea	…	…	…	…	…	…
Samoa	x	x	x	x	x	x
Singapore	x	x	x	x	x	x
Thailand	x	x	x	√	√	√
SOUTH AND WEST ASIA						
Bangladesh	x	x	x	√	x	x
Bhutan	x	x	x	√	√	√
India	x	x	x	√	√	√
Iran (Islamic Republic of)	√	√	√	√	√	√
Maldives	x	x	x	x	x	x
Nepal	…	…	…	…	…	…
Sri Lanka	x	x	x	√	√	√

√ = Yes x = No

2.1 Curriculum and ICT in Education | ISCED 1, 2 and 3 | 2012

REGION	Strategies to promote integration of ICT in education								
	Curriculum includes specific objectives or a subject on basic computer skills (or computing)			Curriculum includes recommendations for ICT-assisted instruction to form part of subject delivery in the following subjects					
				Mathematics			Science		
Country or territory	Primary (ISCED 1)	Lower Secondary (ISCED 2)	Upper secondary (ISCED 3)	Primary (ISCED 1)	Lower Secondary (ISCED 2)	Upper secondary (ISCED 3)	Primary (ISCED 1)	Lower Secondary (ISCED 2)	Upper secondary (ISCED 3)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CENTRAL ASIA									
Armenia	x	√	√	x	x	x	x	x	x
Azerbaijan	√	√	√	√	√	√	√	√	√
Georgia	√	√	√	√	√	√	√	√	√
Kazakhstan	…	…	√	√	√	√	√	√	√
Kyrgyzstan	…	√	…	…	…	…	…	…	…
Mongolia	√	√	√	x	√	√	x	x	x
EAST ASIA AND THE PACIFIC									
Australia	√	√	√	√	√	√	√	√	√
Brunei Darussalam	…	…	…	…	…	…	…	…	…
Cambodia	x	x	√	x	x	x	x	x	√
China	√	√	√	√	√	√	√	√	√
China, Hong Kong Special Administrative Region	√	√	√	√	√	√	√	√	√
China, Macao Special Administrative Region	√	√	√	√	√	√	√	√	√
Indonesia	√	√	√	x	x	√	x	x	√
Japan	√	√	√	√	√	√	√	√	√
Lao People's Democratic Republic	x	√	√	…	…	…	…	…	…
Malaysia	√	√	√	√	√	√	√	√	√
Myanmar	x	x	√	…	…	…	…	…	…
New Zealand	√	√	√	…	…	…	…	…	…
Philippines	x	√	√	√	√	…	√	√	…
Republic of Korea	…	…	…	…	…	…	…	…	…
Samoa	…	√	√	…	…	…	…	…	…
Singapore	√	√	√	√	√	√	√	√	√
Thailand	√	√	√	√	√	√	√	√	√
SOUTH AND WEST ASIA									
Bangladesh	√	√	√	√	√	x	√	√	x
Bhutan	x	√	√	x	x	x	x	x	x
India	…	…	…	…	…	…	…	…	…
Iran (Islamic Republic of)	√	√	√	√	√	√	√	√	√
Maldives	√	√	√	x	x	x	x	x	x
Nepal	x	x	√	…	…	…	…	…	…
Sri Lanka	x	x	√	√	√	√	√	√	√

√ = Yes x = No

2.2 Curriculum and ICT in Education | ISCED 1, 2 and 3 | 2012

REGION	Strategies to promote integration of ICT in education								
	Curriculum includes recommendations for ICT-assisted instruction to form part of subject delivery in the following subjects								
	Social Sciences			Language			Second Language		
Country or territory	Primary (ISCED 1)	Lower Secondary (ISCED 2)	Upper secondary (ISCED 3)	Primary (ISCED 1)	Lower Secondary (ISCED 2)	Upper secondary (ISCED 3)	Primary (ISCED 1)	Lower Secondary (ISCED 2)	Upper secondary (ISCED 3)
	(7)	(8)	(9)	(13)	(14)	(15)	(16)	(17)	(18)
CENTRAL ASIA									
Armenia	√	√	√	√	√	√	√	√	√
Azerbaijan	√	√	√	√	√	√	√	√	√
Georgia	√	√	√	√	√	√	√	√	√
Kazakhstan	√	√	√	√	√	√	√	√	√
Kyrgyzstan	x	x	x	x	x	x	x	x	x
Mongolia	x	x	x	x	x	x	x	x	x
EAST ASIA AND THE PACIFIC									
Australia	√	√	√	√	√	√	√	√	√
Brunei Darussalam	…	…	…	…	…	…	…	…	…
Cambodia	x	x	x	x	x	x	x	x	x
China	√	√	√	√	√	√	√	√	√
China, Hong Kong Special Administrative Region	√	√	√	√	√	√	√	√	√
China, Macao Special Administrative Region	√	√	√	√	√	√	√	√	√
Indonesia	x	x	√	x	x	√	x	x	x
Japan	√	√	√	√	√	√	√	√	√
Lao People's Democratic Republic	x	x	x	x	x	x	x	x	x
Malaysia	√	√	√	√	√	√	√	√	√
Myanmar	…	…	…	…	…	…	…	…	…
New Zealand	…	…	…	…	…	…	…	…	…
Philippines	√	√	…	√	√	…	√	√	…
Republic of Korea	…	…	…	…	…	…	…	…	…
Samoa	…	…	…	…	…	…	…	…	…
Singapore	√	√	√	√	√	√	√	√	√
Thailand	√	√	√	√	√	√	√	√	√
SOUTH AND WEST ASIA									
Bangladesh	√	x	…	x	√	…	x	x	…
Bhutan	x	x	x	x	x	x	x	x	x
India	…	…	…	…	…	…	…	…	…
Iran (Islamic Republic of)	√	√	√	√	√	√	√	√	√
Maldives	…	…	…	…	…	…	…	…	…
Nepal	…	…	…	…	…	…	…	…	…
Sri Lanka	√	√	√	√	√	√	√	√	√

√ = Yes x = No

3.1 ICT infrastructure in primary educational institutions | ISCED 1 |2012

REGION / Country or Territory	Educational institutions with electricity (%) Total	Educational institutions with electricity (%) Public	Educational institutions with a telephone communication facility (%) Total	Educational institutions with a telephone communication facility (%) Public	Educational institutions with radio-assisted instruction (RAI) (%) Total	Educational institutions with radio-assisted instruction (RAI) (%) Public	Educational institutions with television-assisted instruction (TAI) (%) Total	Educational institutions with television-assisted instruction (TAI) (%) Public
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CENTRAL ASIA								
Armenia	100	100	80	82	…	…	…	…
Azerbaijan	100 [d]	100 [d]	100 [d]	100 [d]	…	5 [d]	…	36 [d]
Georgia	100	100	100	100	…	…	…	…
Kazakhstan	…	…	…	…	…	…	…	…
Kyrgyzstan	100 [d]	100 [d]	…	…	- [d]	- [d]	…	…
Mongolia	91 [d]	90 [d]	…	…	…	…	…	…
EAST ASIA AND THE PACIFIC								
Australia	…	…	…	…	…	…	…	…
Brunei Darussalam	…	…	…	…	100 [**,-3]	100 [**,-3]	…	…
Cambodia	…	7	…	…	…	…	…	…
China	…	…	…	…	…	…	…	…
China, Hong Kong Special Administrative Region	100	100	100	100	…	100	100	100
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…
Indonesia	80	81	…	…	…	…	…	…
Japan	…	…	…	…	…	…	…	…
Lao People's Democratic Republic	19	17	14	12	…	…	…	…
Malaysia	100 [-1]	100 [-1]	88 [-1]	88 [-1]	…	30 [-1]	…	100 [-1]
Myanmar	7	…	-	…	…	…	1	…
New Zealand	100 [d,-1]	100 [d,-1]	100 [d,-1]	100 [d,-1]	…	…	…	…
Philippines	…	83	…	11	…	…	…	…
Republic of Korea	100 [**]	100 [**]	100 [**]	100 [**]	…	…	…	…
Samoa	…	…	…	…	…	…	…	…
Singapore	…	100 [-1]	…	100 [-1]	. [-1]	. [-1]	…	. [-1]
Thailand	99 [*]	100 [*]	40 [*]	37 [*]	…	34 [*]	34 [*]	35 [*]
SOUTH AND WEST ASIA								
Bangladesh	55	72	…	-	…	-	…	-
Bhutan	67	66	…	…	.	.	.	.
India	45	38	11	6	…	…	…	…
Iran (Islamic Republic of)	…	99	89	88	…	…	…	…
Maldives	100	100	100	100	…	…	…	…
Nepal	6 [-1]	6 [-1]	…	…	…	…	…	…
Sri Lanka	82 [d,-1]	82 [d,-1]	32 [d,-1]	31 [d,-1]	- [d,-1]	- [d,-1]	28 [d,-1]	28 [d,-1]

3.2 ICT infrastructure in primary educational institutions | ISCED 1 |2012

REGION / Country or Territory	Educational institutions with computer-assisted instruction (CAI) (%)		Educational institutions with computer laboratories (%)		Educational institutions with access to the Internet (%)		Educational institutions with fixed broadband Internet access (%)	
	Total	Public	Total	Public	Total	Public	Total	Public
	(9)	(10)	(11)	(12)	(15)	(16)	(17)	(18)
CENTRAL ASIA								
Armenia	100	100	90	92	100	100	…	…
Azerbaijan	…	84 [d]	…	84 [d]	…	27 [d]	…	27 [d]
Georgia	100	100	100	100	100	100	31 [*]	25 [*]
Kazakhstan	…	100 [**]	…	…	97 [*,d,-2]	…	50 [*,d]	…
Kyrgyzstan	…	86 [d]	…	86 [d]	6 [d]	3 [d]	…	…
Mongolia	100 [d]	100 [d]	92 [d]	93 [d]	91 [d]	93 [d]	40 [d]	44 [d]
EAST ASIA AND THE PACIFIC								
Australia	…	…	…	…	…	…	97 [d,*,-2]	…
Brunei Darussalam	100 [**,-3]	…	…	…	100 [**,-3]	…	100 [**,-3]	…
Cambodia	…	3 [**,d]	…	…	…	7 [d,h]	…	1 [d,h]
China	…	…	…	…	…	…	..	…
China, Hong Kong Special Administrative Region	…	100	…	100	100	100	100	100
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…
Indonesia	…	…	7	6	39	39	…	…
Japan	…	…	…	…	…	99 [*,d,+1]	…	99 [d,+1]
Lao People's Democratic Republic	…	…	…	…	…	…	…	…
Malaysia	…	100 [-1]	67 [-1]	66 [-1]	90 [-1]	90 [-1]	90 [-1]	90 [-1]
Myanmar	1	…	-	…	…	…	…	…
New Zealand	…	…	…	…	…	…	…	…
Philippines	…	41	…	8	…	7	…	3
Republic of Korea	100 [**]	100 [**]	…	…	100 [**]	100 [**]	100 [**]	100 [**]
Samoa	…	…	…	…	…	…	…	…
Singapore	…	100 [-1]	…	100 [-1]	…	100 [-1]	…	100 [-1]
Thailand	99 [*]	100 [*]	99 [*]	100 [*]	99 [*]	100 [*]	99 [*]	100 [*]
SOUTH AND WEST ASIA								
Bangladesh	…	-	1 [**]	…	…	3	…	-
Bhutan	…	…	…	…	…	32	…	…
India	…	…	17	10	…	…	…	…
Iran (Islamic Republic of)	46	45	…	-	74	72	54	52
Maldives	…	40 [d,**]	…	40 [d,**]	…	100 [d]	…	47 [d]
Nepal	- [-1]	- [-1]	…	…	1 [-1]	- [-1]	…	…
Sri Lanka	60 [d,-1]	60 [d,-1]	34 [d,-1]	33 [d,-1]	18 [d,-1]	17 [d,-1]	…	1 [d,-1]

3.3 ICT infrastructure in primary educational institutions | ISCED 1 |2012

REGION	Educational institutions with Internet-assisted instruction (IAI)		Educational institutions with ICT support services		Educational institutions with open educational resources (OER)		Educational institutions with a website	
	(%)		(%)		(%)		(%)	
Country or Territory	Total	Public	Total	Public	Total	Public	Total	Public
	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
CENTRAL ASIA								
Armenia	…	…	…	…	…	…	…	…
Azerbaijan	…	27 [d]	…	…	…	27 [d]	…	27 [d]
Georgia	100	100	100	100	100	…	14 [d]	7 [d]
Kazakhstan	…	…	…	…	…	…	…	…
Kyrgyzstan	6 [d]	3 [d]	- [d]	- [d]	…	…	…	…
Mongolia	…	…	…	…	…	…	…	…
EAST ASIA AND THE PACIFIC								
Australia	…	…	…	…	…	…	…	…
Brunei Darussalam	100 [**,-3]	…	…	…	…	…	…	…
Cambodia	…	…	…	…	…	…	…	…
China	…	…	…	…	…	…	…	…
China, Hong Kong Special Administrative Region	…	100	…	100	…	100	…	100
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…
Indonesia	…	…	…	…	…	…	…	…
Japan	…	…	…	…	…	…	…	…
Lao People's Democratic Republic	…	…	…	…	…	…	…	…
Malaysia	90 [-1]	90 [-1]	67 [-1]	66 [-1]	…	…	37 [-1]	37 [-1]
Myanmar	…	…	…	…	…	…	…	…
New Zealand	…	…	…	…	…	…	…	…
Philippines	…	4	…	8	…	8	…	…
Republic of Korea	100 [**]	100 [**]	73 [d,-4]	…	…	…	…	…
Samoa	…	…	…	…	…	…	…	…
Singapore	…	100 [-1]	…	100 [-1]	…	100 [-1]	…	100 [-1]
Thailand	99 [*]	100 [*]	32 [*]	34 [*]	…	…	71 [*]	74 [*]
SOUTH AND WEST ASIA								
Bangladesh	…	-	-	-	1	1	-	-
Bhutan	-	-	…	…	…	…	…	- [*]
India	…	…	…	…	…	…	…	…
Iran (Islamic Republic of)	11	9	15	11	…	…	13	12
Maldives	…	40 [d,**]	…	…	…	…	…	…
Nepal	…	…	…	…	…	…	…	…
Sri Lanka	18 [d,-1]	17 [d,-1]	- [d,-1]	- [d,-1]	…	…	…	5 [d,-1]

4.1 ICT infrastructure in secondary educational institutions | ISCED 2 and 3 | 2012

REGION / Country or Territory	Educational institutions with electricity (%)		Educational institutions with a telephone communication facility (%)		Educational institutions with radio-assisted instruction (RAI) (%)		Educational institutions with television-assisted instruction (TAI) (%)	
	Total	Public	Total	Public	Total	Public	Total	Public
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CENTRAL ASIA								
Armenia	100	100	80	82	…	…	…	…
Azerbaijan	100 [d]	100 [d]	100 [d]	100 [d]	…	5 [d]	…	36 [d]
Georgia	100	100	100	100	…	…	…	…
Kazakhstan	…	…	…	…	…	…	…	…
Kyrgyzstan	100 [d]	100 [d]	…	…	-	-	…	…
Mongolia	91 [d]	90 [d]	…	…	…	…	…	…
EAST ASIA AND THE PACIFIC								
Australia	…	…	…	…	…	…	…	…
Brunei Darussalam	…	…	…	…	100 [**,-3]	…	…	…
Cambodia	…	24	…	…	…	…	…	…
China	…	…	…	…	…	…	…	…
China, Hong Kong Special Administrative Region	100	100	100	100	…	100	100	100
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…
Indonesia	80 [e]	79 [e]	…	…	…	…	…	…
Japan	…	…	…	…	…	…	…	…
Lao People's Democratic Republic	53	50	38	36	…	…	…	…
Malaysia	100 [-1]	100 [-1]	76 [-1]	74 [-1]	…	18 [-1]	…	100 [-1]
Myanmar	4	…	2	…	13	…	15	…
New Zealand	100 [d,-1]	100 [d,-1]	100 [d,-1]	100 [d,-1]	…	…	…	…
Philippines	…	95 [*,e]	…	26 [*,e]	…	…	…	…
Republic of Korea	100 [**]	100 [**]	100 [**]	100 [**]	…	…	…	…
Samoa	…	…	…	…	…	…	…	…
Singapore	…	100 [-1]	…	100 [-1]	. [-1]	. [-1]	…	. [-1]
Thailand	97 [*]	100 [*]	35 [*]	29 [*]	…	18 [*]	19 [*]	19 [*]
SOUTH AND WEST ASIA								
Bangladesh	71	85 [**]	93 [*]	85 [**]	…	…	…	…
Bhutan	91	90	…	…	.	.	.	.
India	68 [g]	59 [g]	25 [g]	17 [g]	…	…	…	…
Iran (Islamic Republic of)	100	100	98	98	…	…	…	…
Maldives	100	100	100	100	…	…	…	…
Nepal	24 [-1]	27 [-1]	…	…	…	…	…	…
Sri Lanka	82 [d,-1]	82 [d,-1]	32 [d,-1]	31 [d,-1]	- [d,-1]	- [d,-1]	28 [d,-1]	28 [d,-1]

4.2 ICT infrastructure in secondary educational institutions | ISCED 2 and 3 | 2012

REGION	Educational institutions with computer-assisted instruction (CAI)		Educational institutions with computer laboratories		Educational institutions with access to the Internet		Educational institutions with fixed broadband Internet access	
	(%)		(%)		(%)		(%)	
Country or Territory	Total	Public	Total	Public	Total	Public	Total	Public
	(9)	(10)	(11)	(12)	(15)	(16)	(17)	(18)
CENTRAL ASIA								
Armenia	100	100	92	95	100	100	…	…
Azerbaijan	…	84 [d]	…	84 [d]	…	27 [d]	…	27 [d]
Georgia	100	100	100	100	100	100	33 [*]	27 [*]
Kazakhstan	…	100 [**]	…	…	97 [*,d,-2]	…	50 [*,d]	…
Kyrgyzstan	…	86 [d]	…	86 [d]	6 [d]	3 [d]	…	…
Mongolia	100 [d]	100 [d]	92 [d]	93 [d]	91 [d]	93 [d]	40 [d]	44 [d]
EAST ASIA AND THE PACIFIC								
Australia	…	…	…	…	…	…	97 [d,*,-2]	…
Brunei Darussalam	100 [**,-3]	…	…	…	100 [**,-3]	…	100 [**,-3]	…
Cambodia	…	3 [**,d]	…	…	…	7 [d,h]	…	1 [d,h]
China	…	…	…	…	…	…	…	…
China, Hong Kong Special Administrative Region	…	100	…	100	100	100	100	100
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…
Indonesia	…	…	37 [e]	33 [e]	52 [e]	49 [e]	…	…
Japan	…	…	…	…	…	99 [*,d,+1]	…	99 [d,+1]
Lao People's Democratic Republic	…	…	…	…	…	…	…	…
Malaysia	…	100 [-1]	92 [-1]	91 [-1]	96 [-1]	96 [-1]	96 [-1]	96 [-1]
Myanmar	15	…	10	…	…	…	…	…
New Zealand	…	…	…	…	…	…	…	…
Philippines	…	87 [*,e]	…	87 [*,e]	…	40 [*,e]	…	17 [*,e]
Republic of Korea	100 [**]	100 [**]	…	…	100 [**]	100 [**]	100 [**]	100 [**]
Samoa	…	…	…	…	…	…	…	…
Singapore	…	100 [-1]	…	100 [-1]	…	100 [-1]	…	…
Thailand	97 [*]	100 [*]	97 [*]	100 [*]	97 [*]	100 [*]	97 [*]	97 [*]
SOUTH AND WEST ASIA								
Bangladesh	…	…	38 [**]	…	22	…	…	…
Bhutan	…	66	…	66	…	66	…	…
India	…	…	45 [g]	36 [g]	…	…	…	…
Iran (Islamic Republic of)	76	76	…	43	89	89	74	74
Maldives	…	40 [d,**]	…	40 [d,**]	…	100 [d]	…	47 [d]
Nepal	4 [-1]	3 [-1]	…	…	6 [-1]	5 [-1]	…	…
Sri Lanka	60 [d,-1]	60 [d,-1]	34 [d,-1]	33 [d,-1]	18 [d,-1]	17 [d,-1]	…	1 [d,-1]

4.3 ICT infrastructure in secondary educational institutions | ISCED 2 and 3 | 2012

REGION	Educational institutions with Internet-assisted instruction (IAI)		Educational institutions with ICT support services		Educational institutions with open educational resources (OER)		Educational institutions with a website	
	(%)		(%)		(%)		(%)	
Country or Territory	Total	Public	Total	Public	Total	Public	Total	Public
	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
CENTRAL ASIA								
Armenia	…	…	…	…	…	…	…	…
Azerbaijan	…	27 [d]	…	…	…	27 [d]	…	27 [d]
Georgia	100	100	100	100	100	100	14 [d]	7 [d]
Kazakhstan	…	…	…	…	…	…	…	…
Kyrgyzstan	6 [d]	3 [d]	- [d]	- [d]	…	…	…	…
Mongolia	…	…	…	…	…	…	…	…
EAST ASIA AND THE PACIFIC								
Australia	…	…	…	…	…	…	…	…
Brunei Darussalam	100 [**,-3]	…	…	…	…	…	…	…
Cambodia	…	…	…	…	…	…	…	…
China	…	…	…	…	…	…	…	…
China, Hong Kong Special Administrative Region	…	100	…	100	…	100	…	100
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…
Indonesia	…	…	…	…	…	…	…	…
Japan	…	…	…	…	…	…	…	87
Lao People's Democratic Republic	…	…	…	…	…	…	…	…
Malaysia	96 [-1]	96 [-1]	92 [-1]	91 [-1]	…	…	61 [-1]	64 [-1]
Myanmar	…	…	…	…	…	…	-	…
New Zealand	…	…	…	…	…	…	…	…
Philippines	…	28 [*,e]	…	87 [*,e]	…	87 [*,e]	…	…
Republic of Korea	100 [**]	100 [**]	73 [d,-4]	…	…	…	…	…
Samoa	…	…	…	…	…	…	…	…
Singapore	…	100 [-1]	…	100 [-1]	…	100 [-1]	…	100 [-1]
Thailand	97 [**]	100 [**]	21 [*]	23 [*]	…	…	81 [*]	91 [*]
SOUTH AND WEST ASIA								
Bangladesh	…	…	…	…	..	…	1 [**]	6 [**]
Bhutan	…	66	…	…	…	…	…	11 [*]
India	…	…	…	…	…	…	…	…
Iran (Islamic Republic of)	36	37	38	38	…	…	26	27
Maldives	…	40 [d,**]	…	…	…	…	…	…
Nepal	…	…	…	…	…	…	…	…
Sri Lanka	18 [d,-1]	17 [d,-1]	- [d,-1]	- [d,-1]	…	…	…	5 [d,-1]

5.1 Computers | ISCED 1, 2 and 3 | 2012

REGION / Country or Territory	Proportion of all computers available for pedagogical use (%)				Learners-to-computer ratio (for pedagogical purposes)			
	Primary		Secondary		Primary		Secondary	
	Total	Public	Total	Public	Total	Public	Total	Public
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CENTRAL ASIA								
Armenia	x[3]	x[4]	92 [d]	92 [d]	x[7]	x[8]	25 [d]	25 [d]
Azerbaijan	…	x[4]	…	74 [d]	…	x[8]	…	33 [**,d]
Georgia	x[3]	x[4]	100 [d]	100 [d]	x[7]	x[8]	7 [*,d]	7 [*,d]
Kazakhstan	…	…	…	…	…	x[8] [*]	…	18 [*,d]
Kyrgyzstan	…	30 [c]	…	29 [f]	x[7]	…	57 [*,d,-1]	…
Mongolia	x[3]	x[4]	88 [d]	88 [d]	x[7]	x[8]	17 [d]	18 [d]
EAST ASIA AND THE PACIFIC								
Australia	…	…	…	…	…	…	2 [**]	…
Brunei Darussalam	…	…	…	…	…	…	…	…
Cambodia	…	…	…	…	…	…	…	>500 [**]
China	…	…	…	…	…	24 [**,-1]	…	13 [**,-1]
China, Hong Kong Special Administrative Region	…	…	…	…	9 [*]	…	9 [*]	…
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…
Indonesia	…	…	…	…	x[7]	…	136 [d]	…
Japan	…	…	…	…	…	x[8]	…	7 [*,+1]
Lao People's Democratic Republic	…	…	…	…	…	…	…	…
Malaysia	…	88 [-1]	…	87 [-1]	…	17 [-1]	…	9 [-1]
Myanmar	100	…	100	…	…	…	…	…
New Zealand	…	…	…	…	…	…	…	…
Philippines	…	65	…	88 [*,e]	…	412	…	49 [*,e]
Republic of Korea	…	…	…	…	x[7]	…	5 [d,-4]	…
Samoa	…	…	…	…	x[7]	…	56 [**,d]	…
Singapore	…	x[4]	…	95 [d,-1]	…	x[8]	…	4 [d,-1]
Thailand	93 [*]	93 [*]	90 [*]	90 [*]	15 [*]	12 [*]	14 [*]	12 [*]
SOUTH AND WEST ASIA								
Bangladesh	…	80	…	…	…	…	…	…
Bhutan	…	…	…	…	x[7]	…	79 [**,d]	…
India	…	…	…	…	x[7]	…	89 [**,d,g]	…
Iran (Islamic Republic of)	55	57	75	75	83 [*]	88 [*]	21 [*]	22 [*]
Maldives	x[3]	…	58 [d]	…	x[7]	…	52 [d]	…
Nepal	49 [-1]	37 [-1]	72 [-1]	68 [-1]	>500 [**,-1]	>500 [**,-1]	378 [**,-1]	>500 [**,-1]
Sri Lanka	…	x[4]	…	76 [d,-1]	…	x[8]	…	98 [d,-1]

5.2 Computers | ISCED 1, 2 and 3 | 2012

REGION	Learners to computer ratio (in schools with CAI)				Proportion of computers connected to the Internet (%)				Proportion of all computers available for administrative purposes (%)			
Country or Territory	Primary		Secondary		Primary		Secondary		Primary		Secondary	
	Total	Public	Total	Public	Total	Public	Total	Public	Total	Public	Total	Public
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
CENTRAL ASIA												
Armenia	…	…	…	…	…	…	…	…	x[19]	x[20]	8 [d]	8 [d]
Azerbaijan	…	…	…	…	…	x[16]	…	54 [d]	…	x[20]	…	26 [d]
Georgia	x[11]	x[12]	7 [*,d]	7 [*,d]	x[15]	x[16]	100 [*,d]	100 [*,d]	…	…	…	…
Kazakhstan	…	…	…	…	…	…	…	…	…	…	…	…
Kyrgyzstan	…	…	…	…	…	- [c]	…	- [f]	…	30 [c]	…	29 [f]
Mongolia	…	…	…	…	x[15]	x[16]	33 [d]	29 [d]	x[19]	x[20]	12 [d]	12 [d]
EAST ASIA AND THE PACIFIC												
Australia	…	…	…	…	…	…	…	…	…	…	…	…
Brunei Darussalam	…	…	…	…	…	…	…	…	…	…	…	…
Cambodia	…	…	…	…	…	…	…	…	…	…	…	59
China	…	…	…	…	…	…	…	…	…	…	…	…
China, Hong Kong Special Administrative Region	…	…	…	…	…	…	…	…	…	…	…	…
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…	…	…	…	…
Indonesia	…	…	…	…	…	…	…	…	…	…	…	…
Japan	…	…	…	…	…	…	…	…	…	…	…	…
Lao People's Democratic Republic	…	…	…	…	…	…	…	…	…	…	…	…
Malaysia	…	17 [-1]	…	9 [-1]	…	…	…	…	…	12 [-1]	…	13 [-1]
Myanmar	…	…	…	…	…	…	…	…	…	…	…	…
New Zealand	…	…	…	…	…	…	…	…	…	…	…	…
Philippines	…	151	…	47 [*,e]	…	16	…	32 [*,e]	…	35	…	12 [*,e]
Republic of Korea	…	…	…	…	…	…	…	…	…	…	…	…
Samoa	…	…	…	…	…	…	…	…	…	…	…	…
Singapore	…	x[12]	…	4 [d,-1]	…	x[16]	…	100 [d,-1]	…	x[20]	…	5 [d,-1]
Thailand	11 [*]	11 [*]	9 [*]	9 [*]	94 [*]	95 [*]	88 [*]	88 [*]	14 [*]	14 [*]	13 [*]	13 [*]
SOUTH AND WEST ASIA												
Bangladesh	…	…	…	…	…	72	…	…	…	20	…	…
Bhutan	…	…	…	…	…	…	…	…	…	…	…	…
India	…	…	…	…	…	…	…	…	…	…	…	…
Iran (Islamic Republic of)	18 [*]	18 [*]	8 [*]	9 [*]	45	44	51	51	45	43	24	25
Maldives	…	…	…	…	65 [d]	…	x[13]	…	x[19]	…	75 [d]	…
Nepal	…	…	…	…	…	…	…	…	51 [-1]	63 [-1]	28 [-1]	32 [-1]
Sri Lanka	…	x[12]	…	55 [d,-1]	…	x[16]	…	34 [d,-1]	…	x[20]	…	24 [d,-1]

6.1 Enrolment in programmes using ICTs in education | ISCED 1 | 2012

REGION	Enrolment in programmes having access to electricity			Enrolment in programmes offering radio-assisted instruction (RAI)			Enrolment in programmes offering television-assisted instruction (TAI)		
	(%)			(%)			(%)		
Country or Territory	MF	M	F	MF	M	F	MF	M	F
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CENTRAL ASIA									
Armenia	…	…	…	…	…	…	…	…	…
Azerbaijan	…	…	…	…	…	…	…	…	…
Georgia	…	…	…	…	…	…	…	…	…
Kazakhstan	…	…	…	…	…	…	…	…	…
Kyrgyzstan	…	…	…	…	…	…	-	-	-
Mongolia	…	…	…	.	.	.	…	…	…
EAST ASIA AND THE PACIFIC									
Australia	…	…	…	…	…	…	…	…	…
Brunei Darussalam	…	…	…	…	…	…	…	…	…
Cambodia	…	…	…	…	…	…	…	…	…
China	…	…	…	…	…	…	…	…	…
China, Hong Kong Special Administrative Region	…	…	…	…	…	…	100	100	100
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…	…
Indonesia	…	…	…	…	…	…	…	…	…
Japan	…	…	…	…	…	…	…	…	…
Lao People's Democratic Republic	…	…	…	…	…	…	…	…	…
Malaysia	…	…	…	18 [-1]	18 [-1]	18 [-1]	100 [-1]	100 [-1]	100 [-1]
Myanmar	…	…	…	…	…	…	…	…	…
New Zealand	…	…	…	…	…	…	…	…	…
Philippines	…	…	…	…	…	…	…	…	…
Republic of Korea	…	…	…	…	…	…	…	…	…
Samoa	…	…	…	…	…	…	…	…	…
Singapore	…	…	…	. [a,-1]	. [a,-1]	. [a,-1]	. [a,-1]	. [a,-1]	. [a,-1]
Thailand	…	…	…	29 [*]	40 [*]	17 [*]	27 [*]	27 [*]	28 [*]
SOUTH AND WEST ASIA									
Bangladesh	…	…	…	…	…	…	…	…	…
Bhutan	…	…	…	.	.	.	.	.	.
India	…	…	…	…	…	…	…	…	…
Iran (Islamic Republic of)	…	…	…	…	…	…	…	…	…
Maldives	…	…	…	…	…	…	…	…	…
Nepal	…	…	…	…	…	…	…	…	…
Sri Lanka	…	…	…	- [-1]	- [-1]	- [-1]	1 [a,-1]	1 [a,-1]	1 [a,-1]

6.2 Enrolment in programmes using ICTs in education | ISCED 1 | 2012

REGION / Country or Territory	Enrolment in programmes offering computer-assisted instruction (CAI) (%)			Enrolment in programmes offering internet-assisted instruction (IAI) (%)			Enrolment in programmes offering open educational resources (OER) (%)		
	MF	M	F	MF	M	F	MF	M	F
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
CENTRAL ASIA									
Armenia	…	…	…	…	…	…	…	…	…
Azerbaijan	…	…	…	…	…	…	…	…	…
Georgia	100	100	100	100	100	100	100	100	100
Kazakhstan	…	…	…	…	…	…	…	…	…
Kyrgyzstan	…	…	…	…	…	…	…	…	…
Mongolia	…	…	…	…	…	…	…	…	…
EAST ASIA AND THE PACIFIC									
Australia	…	…	…	…	…	…	…	…	…
Brunei Darussalam	…	…	…	…	…	…	…	…	…
Cambodia	…	…	…	…	…	…	…	…	…
China	…	…	…	…	…	…	…	…	…
China, Hong Kong Special Administrative Region	…	…	…	…	…	…	…	…	…
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…	…
Indonesia	…	…	…	…	…	…	…	…	…
Japan	…	…	…	…	…	…	…	…	…
Lao People's Democratic Republic	…	…	…	…	…	…	…	…	…
Malaysia	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]	…	…	…
Myanmar	…	…	…	…	…	…	…	…	…
New Zealand	…	…	…	…	…	…	…	…	…
Philippines	37 [a]	37 [a]	37 [a]	22 [a]	22 [a]	22 [a]	37 [a]	37 [a]	37 [a]
Republic of Korea	…	…	…	…	…	…	…	…	…
Samoa	…	…	…	…	…	…	…	…	…
Singapore	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]
Thailand	72 [*]	72 [*]	72 [*]	…	…	…	…	…	…
SOUTH AND WEST ASIA									
Bangladesh	…	…	…	…	…	…	-	-	-
Bhutan	…	…	…	…	…	…	.	.	.
India	…	…	…	…	…	…	…	…	…
Iran (Islamic Republic of)	22	…	…	…	…	…	…	…	…
Maldives	…	…	…	…	…	…	…	…	…
Nepal	…	…	…	…	…	…	…	…	…
Sri Lanka	75 [a,-1]	75 [a,-1]	75 [a,-1]	…	…	…	…	…	…

7.1 Enrolment in programmes using ICTs in education | ISCED 2 and 3 | 2012

REGION / Country or Territory	Enrolment in programmes having access to electricity (%)			Enrolment in programmes offering radio-assisted instruction (RAI) (%)			Enrolment in programmes offering television-assisted instruction (TAI) (%)		
	MF	M	F	MF	M	F	MF	M	F
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CENTRAL ASIA									
Armenia	…	…	…	…	…	…	…	…	…
Azerbaijan	…	…	…	…	…	…	…	…	…
Georgia	…	…	…	…	…	…	…	…	…
Kazakhstan	…	…	…	…	…	…	…	…	…
Kyrgyzstan	…	…	…	…	…	…	-	-	-
Mongolia	…	…	…	.	.	.	…	…	…
EAST ASIA AND THE PACIFIC									
Australia	…	…	…	…	…	…	…	…	…
Brunei Darussalam	…	…	…	…	…	…	…	…	…
Cambodia	…	…	…	…	…	…	…	…	…
China	…	…	…	…	…	…	…	…	…
China, Hong Kong Special Administrative Region	…	…	…	…	…	…	100	100	100
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…	…
Indonesia	…	…	…	…	…	…	…	…	…
Japan	…	…	…	…	…	…	…	…	…
Lao People's Democratic Republic	…	…	…	…	…	…	…	…	…
Malaysia	…	…	…	17 [-1]	20 [-1]	13 [-1]	100 [-1]	100 [-1]	100 [-1]
Myanmar	…	…	…	…	…	…	…	…	…
New Zealand	…	…	…	…	…	…	…	…	…
Philippines	…	…	…	…	…	…	…	…	…
Republic of Korea	…	…	…	…	…	…	…	…	…
Samoa	…	…	…	…	…	…	…	…	…
Singapore	…	…	…	. [a,-1]	. [a,-1]	. [a,-1]	. [a,-1]	. [a,-1]	. [a,-1]
Thailand	…	…	…	21 [*]	19 [*]	22 [*]	15 [*]	10 [*]	19 [*]
SOUTH AND WEST ASIA									
Bangladesh	…	…	…	…	..	…	…	…	…
Bhutan	…	…	…	.	.	.	.	.	.
India	…	…	…	…	…	…	…	…	…
Iran (Islamic Republic of)	…	…	…	…	…	…	…	…	…
Maldives	…	…	…	…	…	…	…	…	…
Nepal	…	…	…	…	…	…	…	…	…
Sri Lanka	…	…	…	- [-1]	- [-1]	- [-1]	15 [a,-1]	14 [a,-1]	16 [a,-1]

7.2 Enrolment in programmes using ICTs in education | ISCED 2 and 3 | 2012

REGION / Country or Territory	Enrolment in programmes offering computer-assisted instruction (CAI) (%)			Enrolment in programmes offering internet-assisted instruction (IAI) (%)			Enrolment in programmes offering open educational resources (OER) (%)		
	MF	M	F	MF	M	F	MF	M	F
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
CENTRAL ASIA									
Armenia	…	…	…	…	…	…	…	…	…
Azerbaijan	…	…	…	…	…	…	…	…	…
Georgia	100	100	100	100	100	100	100	100	100
Kazakhstan	…	…	…	…	…	…	…	…	…
Kyrgyzstan	-	-	-	…	…	…	…	…	…
Mongolia	…	…	…	…	…	…	…	…	…
EAST ASIA AND THE PACIFIC									
Australia	…	…	…	…	…	…	…	…	…
Brunei Darussalam	…	…	…	…	…	…	…	…	…
Cambodia	…	…	…	…	…	…	…	…	…
China	…	…	…	…	…	…	…	…	…
China, Hong Kong Special Administrative Region	..	…	…	…	…	…	…	…	…
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…	…
Indonesia	…	…	…	…	…	…	…	…	…
Japan	…	…	…	…	…	…	…	…	…
Lao People's Democratic Republic	…	…	…	…	…	…	…	…	…
Malaysia	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]	…	…	…
Myanmar	…	…	…	…	…	…	…	…	…
New Zealand	…	…	…	…	…	…	…	…	…
Philippines	95 [*,a,e]	95 [*,a,e]	95 [*,a,e]	65 [*,a,e]	65 [*,a,e]	65 [*,a,e]	95 [*,a,e]	95 [*,a,e]	95 [*,a,e]
Republic of Korea	…	…	…	…	…	…	…	…	…
Samoa	…	…	…	…	…	…	…	…	…
Singapore	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]
Thailand	66 [*]	63 [*]	70 [*]	…	…	…	…	…	…
SOUTH AND WEST ASIA									
Bangladesh	…	…	…	…	…	…	…	…	…
Bhutan	…	…	…	…	…	…	.	.	.
India	…	…	…	…	…	…	…	…	…
Iran (Islamic Republic of)	40	…	…	…	…	…	…	…	…
Maldives	…	…	…	…	…	…	…	…	…
Nepal	…	…	…	…	…	…	…	…	…
Sri Lanka	43 [a,-1]	40 [a,-1]	46 [a,-1]	…	…	…	…	…	…

8.1 Teacher training on ICT and current practice | ISCED 1, 2 and 3 | 2012

REGION	ICT-qualified teachers (basic computer skills (or computing), BCS)						Teachers currently teaching basic computer skills or computing					
	(%)						(%)					
	Primary			Secondary			Primary			Secondary		
Country or Territory	MF	M	F	MF	M	F	MF	M	F	MF	M	F
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CENTRAL ASIA												
Armenia	…	…	…	…	…	…	x[10]	x[11]	x[12]	3 [d]	4 [d]	2 [d]
Azerbaijan	x[4]	…	…	73 [a,d]	…	…	x[10]	…	…	73 [a,d]	…	…
Georgia	…	…	…	…	…	…	x[10]	…	…	6 [**]	…	…
Kazakhstan	…	…	…	…	…	…	…	…	…	…	…	…
Kyrgyzstan	…	…	…	…	…	…	-	-	-	-	-	-
Mongolia	…	…	…	1	1	-	-	-	-	5	6	5
EAST ASIA AND THE PACIFIC												
Australia	…	…	…	…	…	…	…	…	…	…	…	…
Brunei Darussalam	…	…	…	…	…	…	…	…	…	…	…	…
Cambodia	…	…	…	…	…	…	…	…	…	…	1 [a]	…
China	…	…	…	…	…	…	2 [-1]	…	…	2 [-1]	…	…
China, Hong Kong Special Administrative Region	4	9	2	4	8	2	19	35	15	7	13	3
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…	…	…	…	…
Indonesia	…	…	…	…	…	…	…	…	…	…	…	…
Japan	…	…	…	…	…	…	…	…	…	…	…	…
Lao People's Democratic Republic	…	…	…	…	…	…	…	…	…	…	…	…
Malaysia	31 [-1]	27 [-1]	32 [-1]	11 [-1]	12 [-1]	10 [-1]	31 [-1]	27 [-1]	32 [-1]	11 [-1]	12 [-1]	10 [-1]
Myanmar	…	…	…	…	…	…	…	…	…	2 [e]	…	…
New Zealand	…	…	…	…	…	…	…	…	…	…	…	…
Philippines	1 [*,a]	…	…	5 [*,a,e]	…	…	…	…	…	…	…	…
Republic of Korea	…	…	…	…	…	…	…	…	…	…	…	…
Samoa	…	…	…	…	…	…	…	…	…	…	…	…
Singapore	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]
Thailand	86	89	85	90	87	91	85	89	84	88	86	90
SOUTH AND WEST ASIA												
Bangladesh	…	…	…	…	…	…	…	…	…	7	5	12
Bhutan	…	…	…	…	…	…	…	…	…	…	…	…
India	…	…	…	…	…	…	…	…	…	…	…	…
Iran (Islamic Republic of)	…	…	…	1 [a,f]	1 [a,f]	1 [a,f]	-	-	-	1 [a,f]	1 [a,f]	2 [a,f]
Maldives	3	…	…	…	…	…	3	…	…	…	…	…
Nepal	…	…	…	…	…	…	…	…	…	…	…	…
Sri Lanka	- [-1]	- [-1]	- [-1]	2 [a,f,-1]	1 [a,f,-1]	3 [a,f,-1]	- [-1]	- [-1]	- [-1]	7 [a,f,-1]	5 [a,f,-1]	8 [a,f,-1]

8.2 Teacher training on ICT and current practice | ISCED 1, 2 and 3 | 2012

REGION	Teachers trained to teach subject(s) using ICT facilities						Teachers currently teaching subject(s) using ICT facilities					
	(%)						(%)					
	Primary			Secondary			Primary			Secondary		
Country or Territory	MF	M	F	MF	M	F	MF	M	F	MF	M	F
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
CENTRAL ASIA												
Armenia	…	…	…	…	…	…	…	…	…	…	…	…
Azerbaijan	x[16]	…	…	73 [a,d]	…	…	…	…	…	…	…	…
Georgia	…	…	…	…	…	…	…	…	…	…	…	…
Kazakhstan	…	…	…	…	…	…	…	…	…	…	…	…
Kyrgyzstan	-	-	-	-	-	…	…	…	…	…	…	…
Mongolia	…	…	…	…	…	…	…	…	…	…	…	…
EAST ASIA AND THE PACIFIC												
Australia	…	…	…	…	…	…	…	…	…	…	…	…
Brunei Darussalam	…	…	…	…	…	…	…	…	…	…	…	…
Cambodia	…	…	…	…	…	…	…	…	…	…	…	…
China	35 [-1]	…	…	44 [-1]	…	…	…	…	…	…	…	…
China, Hong Kong Special Administrative Region	100	100	100	100	100	100	100	100	100	100	100	100
China, Macao Special Administrative Region	…	…	…	…	…	…	…	…	…	…	…	…
Indonesia	…	…	…	…	…	…	…	…	…	…	…	…
Japan	…	…	…	…	…	…	…	…	…	…	…	…
Lao People's Democratic Republic	…	…	…	…	…	…	…	…	…	…	…	…
Malaysia	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]	100 [-1]
Myanmar	2	…	…	2 [e]	…	…	…	…	…	…	…	…
New Zealand	…	…	…	…	…	…	…	…	…	…	…	…
Philippines	1 [*,a]	…	…	5 [*,a,e]	…	…	1 [*,a]	…	…	5 [*,a,e]	…	…
Republic of Korea	…	…	…	…	…	…	…	…	…	…	…	…
Samoa	…	…	…	…	…	…	…	…	…	…	…	…
Singapore	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]	100 [a,-1]
Thailand	77	79	75	81	79	82	77	81	75	81	80	82
SOUTH AND WEST ASIA												
Bangladesh	…	…	…	…	…	…	…	…	…	…	…	…
Bhutan	…	…	…	…	…	…	…	…	…	…	…	…
India	…	…	…	…	…	…	…	…	…	…	…	…
Iran (Islamic Republic of)	58 [a]	…	…	63 [a]	…	…	48 [a]	…	…	37 [a]	…	…
Maldives	…	…	…	…	…	…	…	…	…	…	…	…
Nepal	…	…	…	…	…	…	…	…	…	…	…	…
Sri Lanka	11 [a,-1]	15 [a,-1]	10 [a,-1]	50 [a,-1]	31 [a,-1]	60 [a,-1]	11 [a,-1]	15 [a,-1]	10 [a,-1]	50 [a,-1]	31 [a,-1]	60 [a,-1]