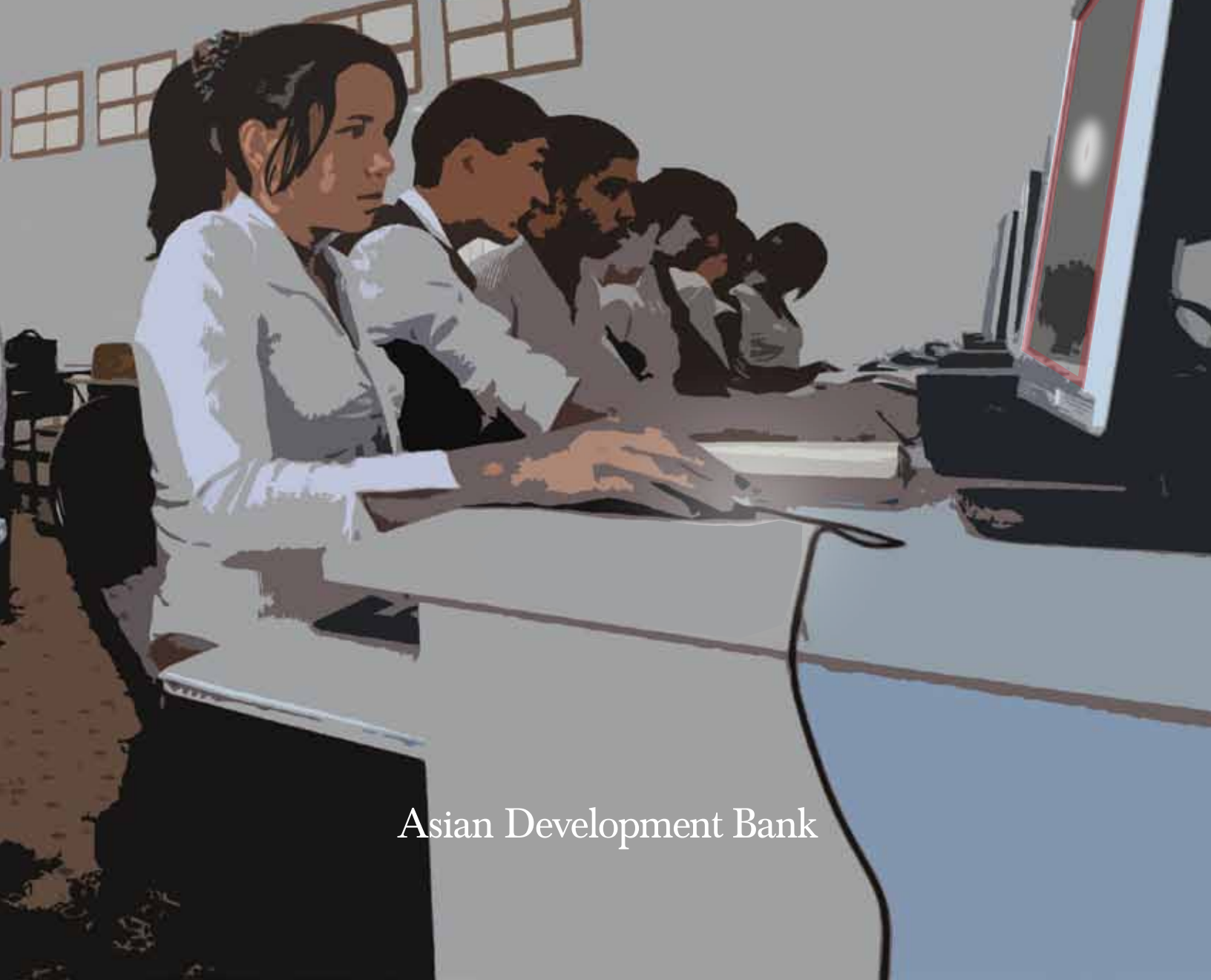


ADB

ICT IN EDUCATION IN CENTRAL AND WEST ASIA

Executive Summary

EDUCATION / CENTRAL AND WEST ASIA / 2012



Asian Development Bank

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Contents

Foreword.	iv
Executive Summary	1
ICT Use Still in Its Infancy	3
Different ICT Ambitions	3
Varying Connectivity	4
Budget and Financing	4
Curriculum and Syllabuses.	5
E-Course Materials Development	6
Teacher Training	6
Technical and Vocational Education and Training.	7
Impact of ICT in Education	8
Computer Provision	8
Problems Managing ICT Resources	9
Conclusions and Recommendations	10
Box: The Study Design.	2



Foreword

Within the past 10–15 years, countries in the Central and West Asia region have accepted that information and communications technology (ICT) will be a fundamental requirement for work in the 21st century. In response, governments have adopted ICT development policies for education systems with generally strong support from parents and students, who believe that mastery of some level of ICT knowledge will enhance future employment potential.

Despite some stand-out cases in a few countries, however, ICT use in schools in the region remains in its infancy and experience varies significantly from country to country.

This report takes a critical overview of the effectiveness of ICT policies and strategies in basic education in Central and West Asia. It presents individual country studies looking at Azerbaijan, Kazakhstan, the Kyrgyz Republic, Tajikistan, and Uzbekistan (participating countries), with shorter studies in Afghanistan, Armenia, Georgia, and Pakistan.

The report reveals different ICT ambitions: at one end of the spectrum Kazakhstan aims for sophisticated ICT packages in every school, with ICT used as a teaching and learning tool for all curriculum subjects, 100% school connectivity, and the effective removal of the domestic digital divide. At the other, Tajikistan aims to provide ICT to all schools, but recognizes that it does not have the funding to develop it as a teaching and learning tool used across all curriculum subjects.

It reveals an emphasis in most systems on hardware provision—amid the unfortunate but widespread assumption that provision of the hardware by itself is the solution to a range of educational problems.

And it reveals varying levels of school Internet connectivity, from virtually 100% in Kazakhstan to around 60% in Uzbekistan, 7% in Tajikistan, and 3%–5% in the Kyrgyz Republic. This variation is the result of a number of factors, including difficult mountainous terrain, the unwillingness of Internet service providers to operate in unprofitable rural areas, and limited affordability, with many examples of schools in each of the participating countries voluntarily cutting Internet access, even where there are good connections, because of the high costs.

Yet, few countries have attempted estimating the total cost of ownership for their national ICT for education strategies, and most governments have no clear idea of the costs involved in sustaining effective ICT use in schools.

The report briefly compares ICT developments in education in developed countries with less developed countries and concludes that the digital divide between them is widening dramatically, which makes it increasingly difficult to identify practices in the former that are replicable in the latter.

Nonetheless, identifying best practices that can be realistically incorporated into the limited financial frameworks applicable to most developing or transitional economies remains the current, urgent need. Even within participating countries the domestic digital divide between urban and rural areas is widening.

This research attempts to address this and many other issues in the participating countries. It identifies critical gaps in the policies, strategies, and approaches; provides basic information on key issues for national policy makers and development partners to help improve decision making and develop more effective national policies and strategies; and makes recommendations arising from the research.

There is still little conclusive evidence that ICT has significantly improved student performance, even in developed countries with the most substantial ICT-related investments. But this does not necessarily mean that ICT has little impact on performance—the challenge lies in knowing how to apply ICT effectively to learning and teaching processes and knowing how to measure and isolate its impact.

This report is a tribute to the hard work of many individuals, especially the consultants at IE Partners who researched and compiled the studies, staff in the Asian Development Bank's (ADB) resident missions in the participating countries for their support in reviewing drafts and liaising with the relevant governments, and the Community of Practice in Education at ADB for guidance and review. The report would not have been completed without the efforts of Asadullah Sumbal and Florence Teves in the Public Management, Financial Sector, and Trade Division of the Central and West Asia Department at ADB.

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Executive Summary

This study, conducted under regional technical assistance grants from the Asian Development Bank, presents a critical overview of the effectiveness of recent and current policies and strategies for providing ICT in basic education in Azerbaijan, Kazakhstan, the Kyrgyz Republic, Tajikistan, and Uzbekistan. Shorter studies were done for Afghanistan, Armenia, Georgia, and Pakistan (the participating countries).¹ The short ICT country studies confirmed the findings of the main studies and also provided some interesting case studies, which have been incorporated into the main text, including the extremely high costs of connectivity in Afghanistan, the problems of individual schools financing the costs of ICT provision after project investment has ceased, the difficulties experienced in attracting qualified ICT teachers into rural areas in all countries, and the difficulties in operating ICT in schools in regions where power supply is a major problem.

The study identifies critical gaps and unresolved issues in the policies, strategies, and approaches to ICT for education. It provides basic information on key issues for national policy makers and development partners to help improve decision making, and develop more effective national policies and strategies and focused and appropriate external support. Recommendations arising from the research are also provided.²

In addition, the study reviews experiences in other developing or transitional economies outside the study region to decide whether the approaches and experiences of the participating countries are typical.³

The latest research evidence and literature on ICT use in education, with a particular emphasis on ICT provision and use in developing and transitional economies, was reviewed. The study identified common themes, constraints, and problems in effective ICT use, and assessed current outcomes from the relatively substantial investments made to date. National hardware profiles, usage patterns, connectivity policies and outcomes, energy, and maintenance issues were reviewed, and conclusions were drawn on the impact on use and effectiveness in the classroom.

The study analyzes the design of curriculums and syllabuses as vehicles for the use of ICT in education, the provision of teacher training, the development of e-materials and supporting print materials in local languages, and the impact and effectiveness of assessment, monitoring, and evaluation.

The management of ICT at national, district, and school levels was considered and a number of issues that have been widely neglected, such as health and safety, green computing, the impact and disposal of e-waste, and the calculation of the total costs of ownership associated with ICT provision, were identified and analyzed.

¹The Central and West Asia region comprises Afghanistan, Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan.

²For more details about each country and other issues, including references used to compile the study, please see ICT in Education in Central and West Asia at <http://ict4e.adb.org>, <http://adb.org/projects/45132-001/main>

³Desk research provided data and examples from Australia, Canada, the European Union, the Republic of Korea, and the United States, among developed countries. Other data was derived from Egypt, Ethiopia, Ghana, Jordan, Kenya, Nepal, Peru, Rwanda, the Russian Federation, Tuvalu, Uganda, Ukraine, and Uruguay. This report was prepared by Tony Read based on research undertaken by the consultants at IE Partners.



The Study Design

The study is based on detailed research into the policies, strategies, financing, and implementation of ICT in the basic and senior secondary education sectors in Afghanistan, Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Pakistan, Tajikistan, and Uzbekistan.

In December 2005, ADB approved a regional technical assistance grant¹ (RETA) to help countries in Central Asia improve their policies on ICT investment in basic education.

In October 2010, the scope of the study was expanded to cover technical and vocational education and training (TVET), supported by the European Training Foundation's research into the use of ICT in TVET in Central Asia.²

An inception workshop in June 2006 reviewed the objectives of the research study, developed a detailed working methodology, an agreed approach to research, a timetable to completion, a list of common problems and issues for review, and an agreed set of outputs.

National specialist consultants carried out the individual national country studies with the full cooperation of the relevant ministries of education. The ministries nominated national steering committees to oversee and support the research and data collection. These committees comprised senior representatives from education ministries as well as ministries of finance, telecommunications, and energy to provide a wider perspective on the issues affecting the provision of ICT in education. Each ministry of education scrutinized each final national country study, verifying its accuracy.

The inception workshop was followed in August, October, and November 2006 by national workshops in each of the participating countries with senior officials from ministries of education, finance, telecommunications, and energy. Representatives from development partners, higher education, teacher training, private hardware and software producers, and e-material publishers from each country also attended.

The main conclusions from the research were presented at an ADB international ICT conference in Manila in October 2007, with a regional workshop taking place at the same time. National policy and strategy workshops took place in each of the participating countries during November and December 2007 and the outputs were completed in January 2008. Further research to update the national country studies was undertaken from October 2010 through August 2012.

The Asian Development Bank and Uzbekistan's Ministry of Public Education then hosted a final workshop in October 2011 in Tashkent to discuss best practices for ICT in education. Officials from the participating countries represented ministries of education and finance.

¹RETA 6275: Subregional Cooperation for Information and Communications Technology in Basic Education. Another grant was approved in June 2011: RETA 7818: Promotion of Good Practices in Information and Communications Technology for Education in Central and West Asia Region.

²Research and writing took place from June 2006 to February 2008, with further data updating and rewriting from October 2010 through August 2012.

Finally, the study looks at the likely impact of a new generation of low-cost tablets.

ICT Use Still in Its Infancy

The use of ICT in education is still in its infancy and its role and impact in the delivery of education and student achievement need to be fully analyzed and assessed. Within the past 10–15 years, participating countries have accepted that ICT will be a fundamental requirement for work and leisure in the 21st century. They have also created ICT development policies for their education systems backed by relatively substantial investments in ICT provision, predominantly hardware-led.

Generally, parents and students have strongly supported these investments, recognizing that the mastery of some level of ICT knowledge and skill will enhance future employment possibilities. But teachers in other curriculum subjects have often been less enthusiastic supporters of the ICT revolution in education, particularly in those countries where the teaching workforce is aging and underpaid, and where there has been inadequate teacher training and preparation. As a result, the motivation to learn new skills and new teaching and learning methodologies is less pronounced. In these circumstances, the study recognizes that many teachers feel threatened by new ICT and that their students will understand it better than they do.

The participating countries have policy decrees setting out national targets and objectives for ICT in the formal school system. Within the framework of these national policies, there are strategy papers and investment programs, decrees, and regulations that establish ICT school development programs with short- to medium-term targets (usually 5–10-year plans) on the way to the longer-term policy objectives. There are significant differences in ambition, however, usually based on the available financial resources.

Different ICT Ambitions

Kazakhstan aims to provide sophisticated ICT packages to every school, to see ICT used as a teaching and learning tool for all curriculum subjects, 100% school connectivity, the effective removal of the domestic digital divide, and the development of e-learning and teaching materials for every subject at every grade level.

Tajikistan, at the other end of the financial resources scale, also aims for the provision of ICT to all schools, but recognizes that it does not have the funding to develop it as a teaching and learning tool used across all curriculum subjects. It therefore limits ICT use in schools to the teaching of informatics and computer skills only and has limited ambition for the development of e-materials in the Tajik language. It prioritizes grades 7–11 for ICT use in schools.

Uzbekistan also aims for ICT provision in 100% of schools and the use of ICT as a teaching and learning tool across the curriculum, but has more gradual connectivity aims and focuses ICT development for the next 10 years on grades 7 and above.

The emphasis in most national ICT for education strategies is on hardware, with the priority government ICT goal in the participating countries to provide computers to schools. This has been characterized as providing hardware in the hope that it will be put to effective use. This is widely perceived as a worst practice in the development of ICT in schools because it ignores all of the support mechanisms needed to make ICT use effective.

In the participating countries, hardware profiles vary from a basic 10–12-computer classroom with one color printer, up to multiple desktop computers, laptops for teachers, data projectors in every classroom, scanners/printers and digital cameras, and the use of interactive whiteboards.

Embedded in the policy statements of the participating countries are target computer–student ratios:

- Azerbaijan targets a medium-term ratio of 1:33, and in 2010 estimated that it had achieved around 1:29, although school survey results suggest that 1:50 was probably more realistic.
- Kazakhstan targets one computer to 10–15 students and is estimated to have achieved 1:18 in 2010.
- The Kyrgyz Republic's stated target in 2008 was 1:100, and the overall computer–student ratio in the school system was estimated at 1:76 in 2010, a significant improvement over a ratio of 1:249 in 2001. However, the ratio for *modern* computers was only 1:240.
- In Uzbekistan, the target ratio was 1:40 by 2010, with an effective ratio of 1:20 for priority grades 7–12.

None of the policy declarations quoted in the individual country reports attempts to provide the rationale for the specified target computer–student ratios. None of the policy papers suggests what these ratios are intended to achieve in curriculum outcomes, student performance, skills development, classroom methodologies, levels of use, and so on. There is no information on why these target ratios were selected over others.

Indeed, there is a strong feeling that the target ratios do not result from a clear vision of the learning or pedagogic benefits or possibilities of ICT provision to schools, but rather represent the likely outcome of current financial allocations.

Most countries also have a wide variety of computers in school classrooms, ranging from Soviet Zeniths, to IBM 386s and 486s, and through to Pentium 1–4s. As a result, basic operating system compatibility is often difficult to achieve, even within the same school.

Varying Connectivity

The study also found great variation in connectivity, from virtually 100% in Kazakhstan to around 60% in Uzbekistan, 7% in Tajikistan, and 3% in the Kyrgyz Republic. These variations may be the result of a lack of technical access to the Internet. For example, Tajikistan has developed effective and relatively affordable school connectivity pilot projects in very remote mountainous areas using satellite and diesel generators. These have benefitted not just schools but also entire rural communities in mountainous areas, where landline connections are impractical. In other countries, Internet service providers are unwilling to serve unprofitable rural areas, while many schools cannot afford Internet connectivity.

A more common problem is the lack of adequate financial resources in school budgets. There were many examples of schools in each of the participating countries that voluntarily ceased to access the Internet, even when good connections were available, because they could not afford the costs. Once again this tends to be more of a rural than an urban problem because a dial-up connection in a rural area can be more expensive (and less effective) than a broadband connection in an urban area.

Internet connectivity issues also tend to widen the domestic digital divide. Rural areas still often use old analogue telephone lines and have slow data transmission speeds, and, thus, poor traffic levels and difficult connections unsuited to the transfer of

multimedia and high-quality graphics. It is in this context that the concept of “effective connectivity” has developed.

Simply noting the percentage of schools that have Internet connections to enable basic e-mail traffic is an insufficient measure of connectivity. The key measurement should be the percentage of schools with connectivity that permits data transfer of core e-materials required by school learning objectives and specified learning outcomes. This is particularly important for equitable education in those countries where the rural–urban digital divide is pronounced and where the delivery of e-materials by disk transfer is likely to be both slow and relatively expensive. In mountainous terrains, the delivery of disks by land is often impossible on a regular and reliable basis during the winter months.

Budget and Financing

Five of the participating countries (except Uzbekistan) have never attempted to estimate the total cost of ownership for their national ICT for education strategies, and governments therefore have no clear idea of the recurring costs involved in sustaining effective ICT use in schools.

Once again, this is not just a problem in the Central and West Asia region. The majority of the country ICT strategies reviewed for the study outside the region also had no clear idea of the forward-cost implications of their ICT-related investments and the likely impact of ICT funding on other critical education budget heads. It is also clear from the studies that many governments do not consider the lost opportunity costs of ICT investment.

As noted, governments provide funding predominantly for hardware procurement, often through special funding programs. In most countries, development partner and nongovernment organization (NGO) funding, commercial sponsorship, and private contributions are also encouraged.

At the same time, the recurrent operational funding for ICT use in schools is widely ignored. The participating countries, and many countries in other regions, appear to be seriously underfunding the ongoing recurrent costs of ICT use in schools. In most cases, schools become dependent on parental contributions for ICT operational costs. This tends to widen the domestic digital divide because richer urban parents are more likely to be able to provide

additional contributions for ICT, while poor rural parents are less likely to be able to provide support and the support will be less in real terms.

The main school-based operational costs were common to the participating countries and to the majority of developing countries reviewed outside the region. These included electricity costs, connectivity-related costs, maintenance and servicing costs, and consumables, which can be high in relation to available school funding.

Schools in participating countries find it hard to fund the additional operating costs from their recurrent operational budgets, where salaries and utility costs take up most of the available operational funding. Some development partners and NGOs have provided financial support for operational costs to a limited number of schools. It is therefore, perhaps, not surprising that development partner- and NGO-funded ICT projects tend to report higher levels of equipment use and more impact on classroom dynamics and student and teacher motivation than schools where additional financial support for recurrent operational costs is not available.

Among its recommendations, the study notes the urgent need for governments to adequately fund school ICT operational costs and avoid under-use, misuse, or even non-use of the hardware provided and the widespread waste of scarce investment resources.

In the Kyrgyz Republic, for example, 25%–30% of computers supplied to schools were non-operational when surveyed in 2008. Participating countries reported high levels of non-operational hardware, also a common finding in developing countries outside the region; in some cases, more than 50% of computers in surveyed schools were reported to be non-operational. This is usually caused by difficulties in affording, or even accessing, reliable maintenance services. Difficulties in accessing maintenance services tend to be greater in rural and remote areas and this also widens the domestic digital divide.

Curriculums and Syllabuses

The curriculums in the participating countries contain the standard professional vocabulary associated with student-centred and activity-based learning. Thus, they are generally oriented to the development of skills and competencies, in pursuit of problem solving and higher-order thinking skills, oriented toward student-centered and independent learning, and concerned with students' responsibility for their own learning.

It is clear, however, that despite these conceptual statements, most curriculums and syllabuses in the participating countries remain seriously overloaded by subject content and have tended to proliferate new subjects, often with the allocation of only one or two periods per week per new subject. As a result, curriculums in the participating countries remain strongly oriented toward the acquisition of knowledge through factual recall. There is insufficient time and space for the use and development of ICT skills across most curriculum subjects.

As a result, ICT use in schools tends to be restricted to the teaching of informatics and computer skills. Its use as a teaching and learning tool tends to be limited to a few subjects where specific e-course materials have been developed (such as English-language learning in Kazakhstan) or to elite schools with the funding, facilities, equipment, and experienced teaching staff to deliver effective ICT use in curriculum subjects.

Perhaps the most significant constraint on the development of new curriculums and syllabuses to provide an operating platform for ICT skills across a range of curriculum subjects is inexperience. It is a simple fact that few syllabus designers, or indeed few working teachers, have had any significant experience in the use of ICT as part of teaching and learning in individual curriculum subjects.

Pre-independence curriculums usually perceived “informatics” largely as the preserve of physicists and mathematicians; a considerable part of the ICT syllabus was concerned with algorithms and programming skills, which did not necessarily require the use of computers at all. The use of the computer in the classroom as a learning and teaching tool outside the informatics syllabus was largely unknown until extensive new school computerization programs were launched, generally around 2003/2004.

It is therefore not surprising that many syllabus developers in the participating countries (and in many other developing countries and transitional economies) have had problems conceiving how to use ICT effectively within their own subject specialist areas and their own unique educational infrastructure. The educational benefits and expected outcomes of ICT in education have not therefore been clearly identified in most participating countries and are rarely clearly stated in curriculum and syllabus documents, except in very broad terms. As a result, the majority of teachers are unclear as to what they should be doing with ICT.

More work on curriculum and syllabus development and reform to provide a practical framework and clear goals for the effective use of ICT in schools is urgently needed.

The participating countries are multilingual, each with more than one official language of instruction, making the development of e-course materials in local languages an issue of critical concern.

E-Course Materials Development

Participating countries had radically different policies toward e-course materials development in national languages. Azerbaijan, Kazakhstan, and Uzbekistan were committed to major programs of e-course materials development, whereas the Kyrgyz Republic and Tajikistan were largely inactive as a result of financial constraints.

Despite its efforts, Kazakhstan recognizes that the efficiency of e-course materials use in most schools remains poor and that this results from hardware and connectivity problems, particularly in rural areas, as well as from poorly trained teachers and continued teacher resistance to the use of e-course materials.

Teacher resistance in the participating countries is thought to result from the high proportion of teachers who are in the last quarter of their teaching careers, leaving them unwilling to accept new methodological approaches and new technologies.

Additionally, the development of local-language e-course materials in the region often seems to be proceeding without adequate research into teacher acceptance and usability or even, at the most basic level, the role and function of ICT within the school curriculum. There seems to be a widespread

assumption that ICT specialists and academics have a better insight into learning and teaching needs than practicing classroom subject teachers.

Overall, in participating countries where e-course materials development has been funded, there has been a tendency to invest in larger e-textbook-type packages rather than in smaller, more flexible topic-based software (learning objects), which are often more accessible to teachers.

Distribution is also a significant issue. The problem of effective connectivity referred to above means that online e-course materials delivery is not a practical option for the majority of schools, particularly those in rural and remote areas. Unfortunately, the costs of the development of regular and reliable surface systems for delivering disks to reach schools in rural and remote locations has not been included in many education ministry budgets, perpetuating problems in the supply of relevant e-course materials to schools.

Research studies also report low efficiency levels of local e-course materials. The quality of the e-course materials is cited as the major reason, alongside teachers' preference to use textbooks rather than e-course materials.

Teacher Training

The participating countries consider effective teacher training in ICT skills to be one of the most important determining factors in achieving effective use in schools of the hardware and software provided. Lack of widespread teacher training is seen as a major constraint on ICT development and use in schools.

Yet, there is evidence of wide underinvestment in the teacher training required. For example, Kazakhstan, with 350,000 teachers, managed to train just 11,000 in ICT skills over a 5-year period. Despite recognizing the constraints of poor teacher training in the participating countries, significantly increased budgets to support the critical inputs were not forthcoming until recently, and then only in a minority.

In Tajikistan, the development of regional education centers to provide continuous professional upgrading of teachers' ICT skills and technical support groups to provide maintenance support to schools, have lagged behind the investment program in school hardware. This is true even though school

hardware, for effective operations—surely the most fundamental rationale for its procurement—depends on well-trained teachers and good maintenance and servicing.

Kazakhstan has a significant training requirement because of the high level of subject-based activity in e-course materials development and the sophisticated hardware profiles of some schools specified by the Ministry of Education. Kazakhstan recognizes that its advanced ICT activity means that its training requirements are more complex and need to be upgraded, intensified, and widened as rapidly as possible.

This means that teachers need to be trained in ICT use on a subject basis using basic teaching and learning methodologies. Informatics teachers need to be trained to cope with the new informatics curriculum. Teachers need to be trained in the use of distance education for ICT skills and in software applications, the potential use of open-source software, multimedia use, multimedia language labs, network management, basic hardware maintenance, and so on. There is also a need to train or at least sensitize school directors to the need for providing enabling environments for the rapid development and effective use of ICT in schools.

Yet, even though the need for teacher training has been recognized, it is clear that the scale of investment required has not yet come on stream in any of the participating countries or in most of the countries in other regions reviewed for this study.

The lack of any perceived connection within education ministries between the hardware investment budget and the budget for essential support services, such as teacher training, has a serious impact on the effective use of supplied hardware and leads, typically, to a negation of the hardware investment. This is a serious situation in countries where education systems are already underfunded. Most of the participating countries are not providing sufficient training to give teachers across the curriculum the knowledge and skills to use ICT to the best effect. In some cases, under the current scale of in-service teacher training, it will take many years to train the existing workforce. Pre-service teacher training in the use of ICT as a learning and teaching tool is widely constrained by lack of funding, facilities, equipment, software, and adequately trained trainers.

The overwhelming conclusion is that current teacher training provision—both pre-service and in-service—is inadequate to support the current scale of investment in hardware and software development in the participating countries. The widespread assumption is that teachers should be using ICT as a teaching and learning tool across a range of curriculum subjects despite the relatively low levels of hardware and software provision, inadequate budgets, and the lack of clear curriculum guidance.

None of the participating countries has made significant progress on ICT-related assessment issues, and examinations remain largely focused on pen and paper factual recall tests. Large discrepancies in hardware provision and effective connectivity and in the effectiveness of ICT use from school to school make the impact of ICT on student performance difficult to isolate and quantify.

Neither the Kyrgyz Republic nor Tajikistan has yet developed an approach to the assessment of ICT on student performance across subjects and has no effective monitoring of ICT use in schools.

Kazakhstan is confident of the beneficial impact of ICT, both in informatics and across curriculum subjects, and has produced case studies of innovative approaches after intensive research into ICT use and impact in the classroom. But there is a lack of rigorous, subject-based, performance-related research. The country recognizes that performance-related results are limited to a relatively few well-supported schools with innovative ICT regimes, rather than to all schools. Much of the assessment seems to be self-fulfilling, for example, confirming that heavy investment in ICT makes students better at ICT. Kazakhstan also correctly identifies that the provision of digital education resources increases pedagogic labor, that is, when ICT is introduced into schools teachers are required to work harder if they wish to make use of it effectively.

Technical and Vocational Education and Training

Technical and vocational education and training (TVET) in the region was neglected for many years after independence, following a different path from secondary education. Investments generally have focused on general and senior secondary schools and much less on technical and professional schools, although there are exceptions. In Uzbekistan, for instance, 85% of professional colleges are Internet

connected compared with 63% of general secondary schools. Nevertheless, the general neglect of TVET institutions has resulted in outdated systems and curriculums, and low attractiveness of TVET to students in the region.

ICT could have a high impact on TVET provision and access to learning opportunities, especially in the framework of life-long learning policies. ICT is an area of investment as well as a field of study for countries in the region. The technology applied to different sectors of the economy and the use of ICT for services and industries make this field of study potentially attractive for young people and adults. But in reality, developments have mostly been at the low level and, in most cases, confined to simple ICT skills rather than supporting more specialized technical training that could help develop industries and services in the region.

In general, all of the problems related to effective ICT use in general education in the participating countries also apply to most TVET schools. In particular, there are significant differences between schools in rural and urban areas. The use of the Internet in teaching and learning is largely absent from TVET classes even where institutions are Internet connected. Most ICT use in TVET schools is directly related to the teaching of basic ICT skills and, specifically, to the use of basic software applications. The majority of participating countries made little use of ICT in the teaching of technical subjects and skills under TVET programs, where it has obvious applications. Similarly, the development of ICT-based distance education in technical and vocational subjects has been limited to date.

Impact of ICT in Education

Much of the quoted evidence of the beneficial ICT impact on education outcomes is based on the largely subjective assessment of student attitudes and behavior.⁴ Thus, ICT is often claimed to be popular with students and welcomed by parents. There are claims that school attendance has improved because there are computers in schools. ICT use is also claimed to have changed teacher–pupil working relationships and teaching–learning dynamics in the classroom. Many apologists for ICT in schools—and particularly hardware companies selling computers—use this kind of non-specific, unproven argument to support more computers in

schools, even when it is clear that many schools cannot cope with what they already have.

This is almost certainly true in developed countries with high levels of ICT investment and use. But it is less certain in many developing and transitional economies, where equipment and facilities are poorer, ICT-trained and motivated teachers are fewer, and access to and use of the hardware and software is more constrained. There is less current evidence of the impact on student performance; it is even scarce in basic learning areas such as literacy and numeracy. A large part of the problem of impact assessment arises from the difficulty of isolating the impact of ICT on learning outcomes from the large number of other potential factors.

Computer Provision

In the participating countries, computer provision is concentrated on computer classrooms. This is also true of most ICT strategies in developing countries outside the region.

The most significant differences between developed and developing countries seem to lie in the targetting of ICT. In many developed countries computer provision and location in schools are more varied. Computer classrooms have a much lower profile than the use of interactive whiteboards and LED projectors in classrooms, of computers connected to the Internet in school libraries, and connected computers conveniently placed around the school for the easy access of students and teachers.

Scheduling time in computer classrooms for use in other school subjects is a common problem, particularly where single-period classes are concerned. The loss of time and the disruption involved in moving from a general classroom to the computer classroom, getting the computers set up and in use, and then getting back to class at the end of the single period can be time-consuming. The use of mobile computers and projectors, which can be taken by teachers to classrooms for occasional use, is not widely reported in the participating countries, outside of Kazakhstan, and then only on a limited scale in a relatively few favored schools, although Kazakhstan plans to extend the use of classroom-based ICT.

⁴See ICT in Education in Central and West Asia for more information (footnote 2).

Scheduling problems can reduce access to and use of the hardware when it is located in specialist computer classrooms. The concentration of school computer provision in computer classrooms in most developing or transitional country ICT strategies seems to arise from the following factors:

- the perceived need to provide security for expensive computer hardware, which leads to the computers being concentrated in one secure location in the school;
- the perception that ICT should have a specialist use similar to science labs, which would be fine and sensible if five of the participating country ICT strategies did not also specify that ICT be used as a learning and teaching tool for a wide range of subjects across the curriculum; and
- the perception among many subject teachers in Central and West Asia that computers are for use by specialists and not by ordinary subject teachers and students.

Access to school computers and other peripheral hardware outside school hours is widely perceived to be another critical factor in developing ICT use, particularly for teachers who want to practice their skills privately and to build their confidence before launching into ICT use in the classroom. Unfortunately, the majority of comments from the participating countries and from other developing or transitional countries suggest that out-of-hours access is typically limited and that computer classrooms are often locked when not in use for computer classes. Curiously, the available data suggests that out-of-hours access to ICT facilities might be better in TVET schools than in general education schools.

Problems Managing ICT Resources

There was little evidence in any of the participating countries of effective management of the ICT resources in schools. Only in Kazakhstan and Uzbekistan was there evidence of attempts to provide effective school ICT management guidelines. Problems included the following:

- The duties and responsibilities of a school ICT manager were not adequately defined.
- Many schools did not have effective uninterruptible power supply facilities and many schools were without antivirus software.

- There were few schools with policies on the use of student-owned USB flash drives, which tend to increase school virus risk.
- Most of the basic software applications available in schools were pirated and few schools had attempted to establish school networks for their computers.
- In those schools with operational Internet connections there was no sign of effective scrutiny of students' Internet use by teachers, and almost no schools were screening websites used by students.
- Student access to the Internet generally was limited. Staff Internet access was generally much better than student access.
- Few schools had student folder systems in place to securely store the work of individual students.
- Basic maintenance and housekeeping activities were rarely defined and basic health and safety standards were not specified. As a result, the proper care, location, and use of the ICT facilities was, more often than not, substandard.
- None of the participating countries had a defined policy for e-waste and there were no guidelines for schools on the dangers and risks of e-waste or suggestions for the management and disposal of e-waste.
- Energy-reduction strategies were virtually unknown in any of the schools in the participating countries.
- District-level ICT support and monitoring services of ICT use in schools were either lacking or schools widely considered them substandard.

There was a remarkable unanimity in the identified constraints on ICT development and effective use in basic education. The following list of problems was confirmed in all of the participating countries and in the majority of developing country reports from other regions.

- The socioeconomic divide between rich and poor, urban and rural leads to big differences in the quality of education provided and specifically to differences in the ability to use and apply ICT to the education process.
- Underdeveloped telecommunications, in particular the problem of the "last kilometer" and the differential costs of Internet provision in rural and urban areas, which are the major causes of a widening domestic digital divide.

- Power problems are ongoing; that a school is connected to the national grid does not mean that it is receiving electricity during school hours. Power surges, brownouts, unreliable and unpredictable power supply, inadequate UPS and the additional costs of inflated power bills without compensatory additional budget funding are common issues.
- School environments are poor, lacking security, weatherproofing, and air-conditioning. They have inadequate furniture with poor ergonomic design, poor computer room design and layout, poor quality ICT installations and antique wiring, and so on.
- Financing is inadequate, particularly for operational costs at the school level but also for teacher training, supervision, inspection, and other support services.
- There is a lack of trained teachers and the problems of teacher resistance to ICT in an aging profession heavily dominated by women who are not well catered for in the type and nature of in-service training offered.
- E-materials in local languages are lacking. In most countries there is a simple lack of e-materials oriented for educational use in the national languages.
- Methodological certainty—and clarity in national curriculum and syllabus documents—on how best to use ICT in schools and the expected learning outcomes from its use, is lacking.
- Curriculum, syllabus, and assessment policies and strategies are not yet well adjusted to current ICT needs and requirements.
- The effectiveness of ICT use in schools is not monitored.

The study briefly compares ICT developments in education in developed countries with ICT developments in less developed countries and concludes that the digital divide between them is widening dramatically. As a result, it is increasingly difficult to identify many good practices from developed countries that are potentially replicable in developing countries.

The key constraints on effective ICT use in developing countries are concerned with power supplies, the availability and cost of connectivity, good maintenance services, and the costs of consumables and teacher training—all of which are more or less directly related to funding and infrastructure. Of even greater concern is the widening domestic digital divide between urban and rural areas within developing countries.

The study concludes that it is likely that ICT used for teaching informatics and computer skills and ICT for use in school management is currently more effective than the use of ICT as a teaching and learning tool across other curriculum subjects.

The advent of a new generation of ultra-low-cost tablet computers could well change the current situation dramatically in the next few years, but it will almost certainly generate as many problems as solutions. The need for clear planning and assessment tools will become more necessary and urgent as a result.

Conclusions and Recommendations

The demand for national ICT policies and provision comes from parents and students, who perceive access to computers and computer skills as fundamental to better employment possibilities, a good job, and a better life. However, it is also clear that the provision of hardware (and software) is not the same thing as its effective educational use. As a result, scarce resources are increasingly allocated to hardware that is, widely, poorly maintained, under-used, badly used, or even, in the worst cases, not used at all because the most basic and essential support services have not been made available to schools and teachers. These include

- financial support from adequate operational budgets at the school level to support the hardware provided;
- teacher training, both pre-and in-service, to ensure that all teachers have sufficient ICT skills and confidence and a genuine operational grasp of the possibilities for ICT use in the classroom;
- reliable power supply;
- connectivity to the Internet;
- access to good, professional, and affordable maintenance and support services;
- a curriculum and subject syllabuses that clearly define the roles and possibilities of ICT at different levels and in different subjects, and that provide the framework for syllabus space and time to gradually develop ICT as a subject and as a teaching and learning tool in other subjects;
- an assessment system that recognizes and identifies the required ICT-based skills and outcomes and knows how to measure them;

- appropriate software and educational learning environments that provide the right kind of teacher and user-friendly e-materials in local languages; and
- clear guidelines for the effective management of ICT in schools.

The study also concludes that the two overriding requirements for any country to achieve effective ICT use in its school system are

- a national ICT for education development strategy that takes into full account all of the policy strands listed above, and
- a realistic assessment of the costs involved in any strategy.

ICT in Education in Central and West Asia Executive Summary

This publication presents and analyzes the major conclusions of research conducted in Central and West Asia in 2006 through 2011 to ascertain the impact of information and communications technology (ICT) investments on education. It presents a critical overview of the effectiveness of ICT policies and strategies in basic education in Azerbaijan, Kazakhstan, the Kyrgyz Republic, Tajikistan, and Uzbekistan, with shorter studies on Afghanistan, Armenia, Georgia, and Pakistan.

Among its many important findings, the research shows that while the importance of ICT in education has been recognized widely, it is still in its infancy in most of the region and its role and impact have yet to be fully determined or realized. The study has determined that the digital divide between education systems in developing and developed countries is widening dramatically. It stresses that while all the participating countries consider effective teacher training in ICT skills to be among the key determining factors in its effective ICT use, most are not providing sufficient training to use ICT to best effect. In the area of budgeting, the study shows that there is an urgent need for governments to adequately fund school ICT operational costs.

To help policy makers in the region, the study identifies critical gaps or issues in policies, strategies, and approaches to ICT in education; provides information on key issues to help improve decision and policy making; and gives clear recommendations arising from the research.

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