ICTs and Education Indicators:

(Suggested core indicators based on meta-analysis of selected International School Surveys)

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by

Communication Statistics Unit
UUNESCO Institute for Statistics
CP6128 Succursale Centreville
Montreal H3C 3J7, Québec, Canada

EXECUTIVE SUMMARY

This paper was initially prepared as a discussion document at the second phase of the World Summit on the Information Society, held in Tunis, November 2005. It was part of UIS contribution to the ongoing International Partnership for Measuring the Information society. As one of the outcomes of this process, UIS has recently launched ICT and Education scoping exercise survey to determine the nature of data holdings on this area and to collect some basic data from countries, if any. The results of this survey will be made available in 2007.

This paper discusses the information which is available from existing international school surveys with a view to identifying the most commonly used indicators on ICT use in formal education, which will provide the most comparable data to monitor the action plan proposed at the end of the second phase of the World Summit. Using existing surveys will maximise comparability and reliability of results while minimising the data collection burden on countries. The following indicators are proposed

Suggested Basic Core of Indicators for ICTs in Education

Basic Core	
ED-1	% of schools with electricity (by ISCED 1-3)
ED-2	% of schools with a radio set used for educational purposes (by ISCED level 0 to 4)
ED-3	% of schools with television set used for educational purposes (by ISCED level 0 to 4)
ED-4	Student to computer ratio (by ISCED level 0 to 4)
ED-5	% of schools with basic telecommunication infrastucture or telephone access (by ISCED 1-3)
ED-6	% of schools with an Internet connection (by ISCED 1-3)
ED-7	% of students who use the Internet at school (by ISCED level 0 to 4)
Extended Core	
ED-8	% of students enrolled by gender at the tertiary level in an ICT-related field (ISCED 5 to 6)
ED-9	% of ICT-qualified teachers in primary and secondary schools (of the total number of teachers)

Note: All indicators should be collected by sex, grade, and age

In addition to the core indicators UNESCO is conscious that countries will want to measure the benefits of ICT programmes in schools. The paper identifies a set of common items in the international surveys which could be used to collect data on.

- The frequency and the nature of the use of ICTs in education. It is important that computer are fully embedded in the learning process in schools
- The role of ICTs in teacher training. It is important that teachers are thoroughly trained in the use of technology

- The adequacy of school resources for ICTs. Inadequate resources for technology will limit the benefits obtained.

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1. **INTRODUCTION:**

a) **ICTs and Information Society:**

The perception of ICTs as fundamental development tools of the 21st Century rests on several assumptions. At the macro level, it assumes that the introduction and use of ICTs will improve the efficiency of developing countries' industrial infrastructure; enhance their overall economic performance; and strengthen their competitive capacities in the global market. At the micro level, it assumes that ICTs will contribute to improvements in the provision of basic social services, help to disseminate valuable information on production and conservation, improve the efficiency of governments; and enhance the provision of education and health. In other words, ICTs are expected to improve efficiency and increase access to knowledge and expertise. Thus it would appear that an inclusive information society will strengthen democracy, increase social participation, remove barriers to modernization, and empower populations who might have been left out of the development process.

The use of ICTs in the context of information society hinges largely upon having a population that can use them, which implies that all will need to acquire the skills needed to use them. That is, they should be educated and computer-literate. However, this poses a great challenge in the context of developing countries. Even in the contexts of some developing countries where there has been remarkable growth in the IT industry, there are large pockets of population that are as yet untouched by the computers, the Internet and other modern ICTs.

b) **The Partnership on Measuring Information and Communication Technologies for Development and the World Summit on the Information Society**

This paper was initially prepared as a discussion document at the second phase of the World Summit on the Information Society, held at Tunis, November 2005. It was part of UIS contribution to the ongoing International Partnership for Measuring the Information Society where UIS has played a key role in working on core indicators for measuring ICTs in Education.

Following the first phase of the World Summit on the Information Society, held at Geneva in December 2003, a number of key international stakeholders involved in the statistical measurement of information and communication technologies decided to create a global Partnership on Measuring Information and Communication Technologies for Development. The Partnership which was formally launched during the eleventh session of the United Nations Conference on Trade and Development (UNCTAD XI) in 2004, include the International Telecommunication Union (ITU), the Organization for Economic Cooperation and Development (OECD), the United Nations Conference on Trade and Development (UNCTAD), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the UNESCO Institute for Statistics (UIS), four regional commissions (Economic Commission for Africa (ECA), Economic Commission for Latin America and Caribbean (ECLAC), Economic and Social Commission for Asia and the Pacific (ESCAP), and Economic and Social Commission for Western Asia (ESCWA)), the ICT Task Force of

the United Nations System Chief Executives Board (CEB) and the World Bank. National Statistical Offices in statistically advanced countries are invited to contribute to Partnership activities and provide expertise and advice to offices in developing countries as well as transfer knowledge in such areas as methodologies and survey programmes.

The objectives of the Partnership are (a) to achieve a common set of core ICT indicators, to be harmonized and agreed upon internationally, which will constitute the basis for a database on ICT statistics; (b) to enhance the capacities of national statistical offices in developing countries and build competence to develop statistical compilation programmes on the information society, based on internationally agreed indicators; and (c) to develop a global database on ICT indicators and make it available on the Internet.

c) ICTs in Education

Achievement of universal primary education, which is one of the basic Millennium Development Goals, can be facilitated by emerging technologies, as well as the old ICTs such as radio and television. The main barriers to achieving universal primary education are issues such as lack of proper transport facilities, poor school meal programmes, lack of adequate teachers and gender sensitive education, but the introduction of ICTs can improve education provision. The usage and impact of ICTs needs to be carefully monitored to ensure that they are used effectively.

There is a growing need for cross-nationally comparable indicators in the area of information and communication technologies (ICTs) in education. The Plan of Action that was decided at the Geneva phase of the World Summit on the Information Society (WSIS)[1] in 2003, identified two targets which are directly related to education.

- to connect universities, colleges, secondary schools and primary schools with ICTs
- to adapt all primary and secondary school curricula to meet the challenges of the Information Society, taking into account national circumstances

The development of indicators that monitor such targets can facilitate policy makers to design and monitor need-based programmes targeted at improving the economic and social development of the country.

ICTs can be used in education to:
- improve administrative efficiency
- disseminate teaching and learning materials to teachers and students
- improve the ICT skills of teachers and students
- allow teachers and students access to sources of information from around the world
- share ideas on education and learning
- collaborate on joint projects
- conduct lessons from a remote location

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[1] See: www.itu.int/dms_pub/itu-s/md/ 03/**wsis**/doc/S03-WSIS-DOC-0005!!PDF-E.pdf

To the extent that countries aim to achieve these goals they need to measure their progress, successes and problems. In addition countries have committed themselves to international goals such as Education for All, the Millennium Development Goals and the WSIS Plan of Action which require international measures of progress. Achieving these aims requires consistent strategy of integrating ICTs into all sections of the education system.
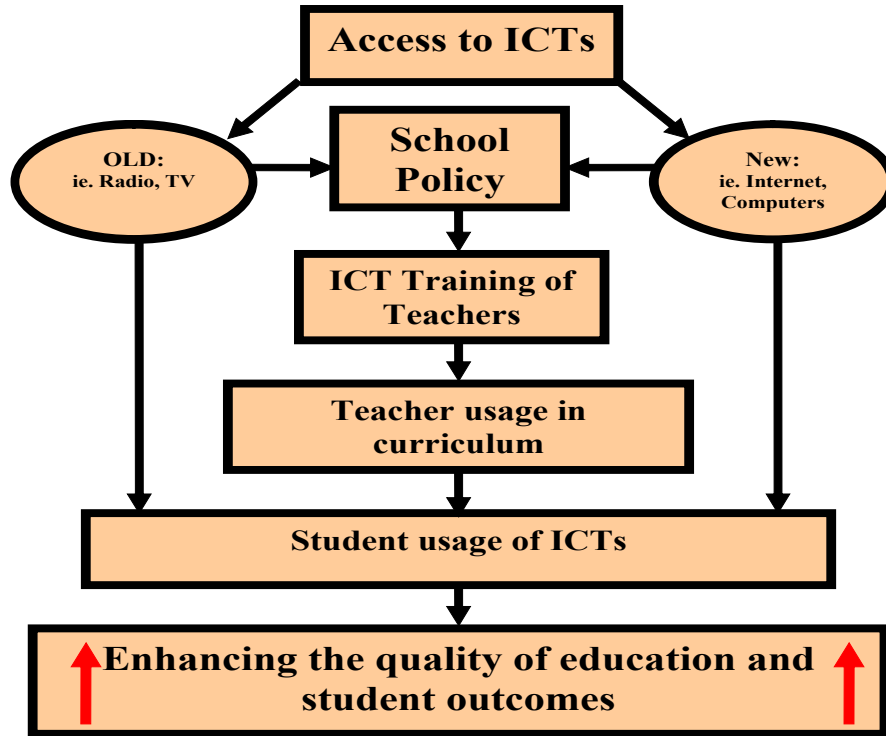
This report identifies indicators and model survey questions that countries might use to measure progress within the school, within the locality, at national and above all at the international level.

There exist a number of internationally sponsored and periodically administered surveys, each of which collect some limited information on ICTs within schools and provide a preliminary overview of the situation for many countries. However, there is a paucity of systematically collected data on the availability, access, use and impact of ICT in education at the national level. Although many countries do not conduct dedicated national school surveys, most national ministries of education or national statistical offices do collect some basic administrative data related to infrastructure and availability of ICTs within schools from which a core set of indicators can be built and analysed.

When countries take part in international school assessments they can be assured that the items concerned come from reliable studies, and if used in well designed surveys will in turn produce figures that may be compared with those in the original study (allowing for methodological differences and different years of administration). The report does not set out to analyze the results of these surveys, which can to some degree be found in sources listed in the bibliography. While indicators of access to relatively newer forms of ICTs (personal computers, mobile telephony, Internet, etc.) will be important, access to the "older" technologies such as transistor radios or analogue television cannot be ignored. In many developing countries these technologies still play a vital role such as providing access to education in remote areas.

Ultimately, where a country has high levels of ICT skills and expertise, society will be better placed to combat social exclusion and the information divide, as well as to identify opportunities for economic growth. From the individual standpoint, access to certain forms of ICTs may increase the choices available to individuals. With increased access to information, individuals are able to make more informed decisions. This is the very essence of empowerment. The access and use of technologies for education can be seen in various aspects of the education system and can be represented by the following diagram (*Figure 1*).

Figure 1: The Place of ICTs in the School System

2. <u>CLASSIFYING ICT RELATED SURVEY ITEMS FROM SCHOOL SURVEYS:</u>

This paper examines the measurement of ICTs within schools. Ten international school surveys have been used to:
- summarize ICT related survey items,
- identify synergies at the international level with questions or items in these surveys and the recent propositions of core lists of indicators by the international partnership
- propose a set of core indicators, and survey questions for measuring ICTs in education which could be adopted by developing countries.

Many of the school surveys vary in terms of the year of collection, target population and country coverage. Some surveys focus exclusively on monitoring the presence of ICTs in schools or classrooms; others focus on other aspects of formal education. The Second Information Technology in Education Study (SITES) and the UNESCO Asia Pacific Regional Survey (UAPRS) are the only international surveys that are specifically designed for the measurement of ICTs in Education.[2] In those surveys that only cover developing countries, there are few items devoted to the presence or use of ICTs in education.

The international school surveys used in this paper are:

- Latin American Laboratory for the Assessment of Quality in Education (LABORATORIO 1997)
- Monitoring Learning Achievement (MLA 1992-2003)
- Programme d'Analyse des Systèmes Educatifs des pays de la CONFEMEN (PASEC 1993-1998)
- Progress in International Reading Literacy Study (PIRLS 2001)
- Programme for International Student Assessment (PISA 2003)
- Southern and East Africa Consortium for Monitoring Educational Quality (SACMEQ 2000-2003)
- Trends in International Mathematics and Science Study (TIMSS 2003)
- World Education Indicators - Survey of Primary Schools (WEI-SPS 2004)
- UNESCO Bangkok: Asia-Pacific Regional Survey (UAPRS 2004)
- Second Information Technology in Education Study (SITES-M1 1997-1999, SITES-M2 1999-2002, SITES-M3 2006)

The school surveys[3] examined contained one or more of the following types of background survey components[4]:
- Student survey
- Teacher survey
- IT Coordinator survey[5]
- School survey (head of school, administrator, principal, etc.)
- Parent/guardian survey

In order to summarize the school surveys from the perspective of ICTs in education, a classification system was used to classify survey items that were directly related to ICTs. As many of the school surveys are based on student samples, the classification is very much student-centred. The

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[2] PISA has an Information and Communication Technology survey component
[3] The actual student assessment instruments are not discussed in this paper. Although certain school survey instruments are identified as background questionnaires, they will be uniformly characterized as surveys throughout this paper.
[4] The UAPRS Ministry survey has not been included.
[5] Only in SITES-1

classification covers two student contexts, the student's school environment and the student's external environment. Whereas the former addresses aspects of the school environment such as infrastructure, teacher use of ICTs, the school administrators and, most importantly, the students, the latter describes the home setting or a location other than home or school. Each of these categories is examined from the perspective of access to ICTs and the use of ICTs by students and teachers. Since many of these school surveys cover primary or secondary education, the various student populations should be taken into account. The classification of survey items assists the comparison of items across school surveys, which, in turn, facilitates the comparison of indicators across countries. The categories are depicted in *Table 1*.

Table 1: The Classification of ICT Related Items in International School Surveys

Contextual Category	Main Categories	Subcategories
School Environment	Infrastructure and Access	• Electricity Access
		• Radio Access
		• Television Access
		• Telephone Access
		• Computer Access
		• Internet Access
		• Access to other ICTs *(overhead projector, fax machine, multimedia equipment, etc)*
		• Location of ICTs
		• ICT Support (facilities, ICT coordinators, etc.)
	Students	• ICT skills *(self assement, direct test assessments, etc.)*
		• ICT usage *(frequency of usage at school, type/content of usage, etc.)*
		• Student perceptions toward ICTs (behavioural)
	Teachers	• ICT usage in classroom or as part of the curriculum
		• Teacher training in ICTs
	School Administration	• Financing or allocation of ICT resources
		• Curriculum policy (ICTs)
External Environment	Household Environment	• Electricity Access
		• Radio Access
		• Television Access
		• Telephone Access
		• Computer Access
		• Internet Access
		• Access to other ICTs *(overhead projector, fax machine, multimedia equipment, etc)*
		• Student ICT usage *(frequency of usage at home, type of usage, etc.)*
	Outside School/Home Environment	• Electricity Access
		• Radio Access
		• Television Access
		• Telephone Access
		• Computer Access
		• Internet Access
		• Access to other ICTs *(overhead projector, fax machine, multimedia equipment, etc)*
		• Student ICT usage *(frequency of usage, type of usage, location of usage, etc.)*

3. ICT ITEMS IN INTERNATIONAL SCHOOL SURVEYS[6]

a) The Latin American Laboratory for the Assessment of Quality in Education (LABORATORIO):

LABORATORIO is an internationally comparative assessment of grade 3 and 4 primary education students in the area of Language and Mathematics (UNESCO, 2002). The study is coordinated by the UNESCO Regional Office of Education for 13 countries in the Latin America and the Caribbean region. The first study was carried out in 1997.

The 1997 target population consisted of all boys and girls enrolled in the third and fourth grades of primary schools in Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Honduras, Mexico, Paraguay, Peru, the Dominican Republic, and Venezuela. Based on these target populations, data was collected from students, parents or guardians, teachers and school administrators through the background surveys.

LABORATORIO possesses some basic survey items related to the general presence of infrastructure and ICTs in schools that have grade 3 and 4 students in *Table 2*. LABORATORIO also has a parent/guardian survey, regardless of its low preponderance for ICT related items.

Table 2: LABORATORIO (1997) ICT Survey Items

Contextual Category	Main Categories	Subcategories	Survey Items / Questions*	Survey / Respondent
School Environment	Infrastructure & Access		The administration has the following equipment to its disposal:	School Survey
		Telephone Access	• *Telephone*	
		Other ICTs	• *Fax*	
		Computer Access	• *Computer*	
		ICT Support	• *Computer room*	
			What didactic materials are available in the school ?	
		Computer Access	• *Computer*	
		Television Access	• *Television*	
		Other ICTs	• *Video*	
			• *Retroprojector*	
			• *Overhead projector*	
			What didactic materials are available or accessible for use in your class ?	Teacher Survey
		Computer Access	• *Computer*	
		Television Access	• *Television*	
		Other ICTs	• *Video*	
			• *Retroprojector*	
			• *Overhead projector*	
	Teachers	ICT Usage	If you are the main teacher of this language course, answer the fllowing questions: (should refer to the last teaching class): What material did you use ? • *Computer*	Teacher Survey
			If you are the main teacher of this course of mathematics, answer the fllowing questions: (should refer to the last teaching class): What material did you use ? • *Computer*	

Translated from Spanish to English by UIS

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[6] It is important to note that many questions asked in these surveys may be regarded as copyright items. Any agency wishing to follow closely one of the surveys described in this section would be well advised to contact the relevant test designer.

Table 2 continued

Contextual Category	Main Categories	Subcategories	Survey Items / Questions*	Survey / Respondent
External Environment	Household Environment	ICT Usage	Do you watch TV or videos when you are out of school ? ▪ *Always* ▪ *Sometimes* ▪ *Hardly ever*	Student Survey
			What is your son/daughter doing when he comes back from school ? ▪ *He/She is watching TV* ▪ *He/She helps around the house* ▪ *He/She performs various tasks* ▪ *He/She plays alone or with a compnanion inside or outside the house*	Parent Survey

*Translated from Spanish to English by UIS

b) **Monitoring Learning Achievement** (**MLA**):

The joint UNESCO-UNICEF Monitoring Learning Achievement (MLA) project was made up of two phases of data collections between 1992 and 2003 in 72 countries (Chinapah, 2003). The first phase (MLA-1) targeted students at the grade 4 and 5 level of primary education whereas the second phase (MLA - 2) targeted students in grade 8 of junior secondary. Most of the countries covered in MLA are from the developing world.

Besides the contextual information that was collected through the school surveys, student surveys, teacher surveys and the parent/guardian surveys, the project measured life skills and basic competencies in literacy and numeracy in MLA-1. Life skills and student competencies in mathematics and science were measured in MLA-2.

The ICT related items from the MLA-2 survey contain information that describes access to ICTs both at the school environment level as well as the external environment (ie. household level) in *Table 3*. The MLA-2 school survey asked school administrators to make the distinction between the number of computers available to all students and the number of computers available for grade 8 mathematics and science students. The MLA-2 items make for a more comprehensive depiction of ICT access, as is the case in PISA and TIMSS.

Table 3: MLA-2 ICT Survey Items

Contextual Category	Main Categories	Subcategories	Survey Items / Questions*	Survey / Respondent
School Environment	Infrastructure & Access	Electricity Access	Do you have electricity produced by a generator or solar power in your classrooms?	School Survey
		Computer Access	What is the number of computers used by students for academic activities?	
			What is the number of computers reserved for 8th grade mathematics and science teachers for pedagogical activities?	
		Internet Access	Is your establishment connected to the internet?	
			If yes, is the connection used to achieve pedagogical objectives?	
External Environment	Household Environment		Do you have the following amenities or appliances in the home you live in?	Parent Survey
		Electricity Access	▪ *Electric supply*	
		Telephone Access	▪ *Telephone*	
		TV Access	▪ *TV*	
		Other ICTs	▪ *Video*	

*Translated from French to English by UIS

Table 3 continued

Contextual Category	Main Categories	Subcategories	Survey Items / Questions*	Survey / Respondent
External Environment	Household Environment		Do you have the following amenities or appliances in the home you live in?	Student Survey
		Electricity Access	▪ *Electricity*	
		Telephone Access	▪ *Telephone*	
		Radio Access	▪ *Radio*	
		TV Access	▪ *TV*	
		Other ICTs	▪ *Video*	
		Computer Access	▪ *Computer*	

*Translated from French to English by UIS

c) Programme d'Analyse des Systèmes Educatifs des pays de la CONFEMEN (PASEC):

The Programme d'Analyse des Systèmes Educatifs des pays de la CONFEMEN is the culmination of a partnership across countries in Francophone Africa that aims to identify models of efficient schooling and to develop sustainable mechanisms for the evaluation of educational systems (CONFEMEN, 2005). The programme has consisted of four phases that includes data collection in primary schools with students in grade 2 and grade 5 for between 1993 and 1998. There are presently 17 countries involved in PASEC.

Although items related to ICT access are minimal in *Table 4*, the hypothetical questions related to expenditure preferences and resource allocation asked of both the main school administrator and of teachers provides a quantifiable sense of priorities across schools for the target population in this region.

Table 4: PASEC ICT Survey Items

Contextual Category	Main Categories	Subcategories	Survey Items / Questions*	Survey / Respondent
School Environment	Infrastructure and Access	Electricity Access	Does your school have? ▪ *Electricity in the classrooms* ▪ *Electricity in the offices*	School Survey
	School Administration	Financing / Resources	If you suddenly received alot of money for your school, what priority areas would you address first? ▪ *Provide electrical access* ▪ *Purchase audio visual materials* ▪ *Purchase Information technology equipment*	
			If you suddenly received alot of money for your school, what priority areas would you address first? ▪ *Provide electrical access* ▪ *Purchase audio visual materials* ▪ *Purchase Information technology equipment*	Teacher Survey
External Environment	Household Environment	Electricity Access	Do you have the following at home? ▪ *electricity*	Student Survey
		Television Access	▪ *television*	
		Radio Acess	▪ *radio*	
		Other ICTs	▪ *video casette*	

*Translated from French to English by UIS

d) The Progress in International Reading Literacy Study (PIRLS):

PIRLS (2001) is an assessment of grade 4 primary school students conducted by the IEA in 35 countries (2005a). Of the 35 countries, 5 are transition countries while 7 are developing countries. The instruments used in the study consist of a school survey, a teacher survey, a student survey and a parent/guardian survey that all measure aspects of educational achievement and learning.

The surveys have several items that relate to the access and use of ICTs in both the school environment as well as the student's external environment in *Table 5*. In addition, the parent/guardian survey provides useful socio-economic information for the analysis of student access to ICTs and student usage of ICTs. The second cycle of PIRLS will occur in 2006.

Table 5: PIRLS (2001) ICT Survey Items

Contextual Category	Main Categories	Subcategories	Survey Items / Questions	Survey / Respondent
School Environment	Infrastructure & Access	Computer access	Are computers available for use by your class?	Teacher Survey
			Are one or more computers available in your classroom?	
			Are computers available elsewhere in the school?	
			What is the total number of computers that can be used for instructional purposes by <fourth-grade> students?	School Survey
		Internet access	Do any of the computers have access to the internet (email or World Wide Web)?	Teacher Survey
			How many of the computers (if more than 0) have access to the internet (e-mail or www) for instructional/educational purposes?	School Survey
	Students	ICT Usage	How often do you use a computer at school? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	Student Survey
			How often do you play games on the computer? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
			How often do you use the computer to write reports or stories? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
			How often do you use the computer to look up information (internet, CD-ROM)? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
			How often do you have students use computer technology to find information? *(Every day or almost evey day, Once or twice a week, Once or twice a month, Never or almost never)*	Teacher Survey
			How often do you have students use instructional software to develop reading skills and strategies? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
	Teachers	ICT Usage	When you have reading instruction and/or do reading activities with the students, how often do you use computer software for reading instruction (e.g.CD-ROM)? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
			When you have reading instruction and/or do reading activities with the students, how often do you use reading material on the Internet (Web pages)? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
			How often do you have students watch movies, videos, or television to obtain information? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	

Table 5 continued

Contextual Category	Main Categories	Subcategories	Survey Items / Questions	Survey / Respondent
School Environment	Teachers	ICT Usage	How often do you have students compare material presented in different media? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	Teacher Survey
			How often do you have students read stories or other texts on the computer? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
			How often do you have students use the computer to write stories or other texts? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
			How often do you have students use the computer to communicate with or do projects with students in other schools or countries? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
	School Administration	Financing / resources	How much is your school's capacity to provide instruction affected by a shortage or inadequacy of the following (computers, software, computer support staff, audio-visual resources)?	School Survey
External Environment	Household Environment	Computer access	Do you have a computer in your home?	Student Survey
		ICT Usage	How often do you watch television or videos outside of school? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
			How often do you read subtitles on the television outside of school? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
			How often do you use a computer at home? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	
			How often do you or someone else in your home play or work on the computer with your child?	Parent Survey
			Before your child began <ISCED Level 1>, how often did you or someone else in your home do reading activities on the computer?	
			Before your child began <ISCED Level 1>, how often did you or someone else in your home watch television programs that teach reading?	
	Outside School	ICT Usage	How often do you use a computer at some other places? *(Every day or almost everyday, Once or twice a week, Once or twice a month, Never or almost never)*	Student Survey

e) The Programme for International Student Assessment (PISA):

PISA is an internationally standardised assessment that was jointly developed by participating countries and administered to 15-year-olds in schools (OECD, 2005). PISA assesses how far students near the end of compulsory education have acquired some of the knowledge and skills that are essential for full participation in information society.

The survey was implemented in 43 countries in the first assessment in 2000, in 41 countries in the second assessment in 2003 and at least 58 countries will participate in the third assessment in 2006. Of the 41 countries in the 2003 assessment, 10 are non-OECD countries. The 2003 assessment consists of 4 background surveys and the student assessment instruments. This includes a student survey, a school survey, and an information and communication technology survey and an educational career survey. Above and beyond the survey items that relate to the access to ICTs, PISA (2003) has numerous survey items that relate to frequency of student ICT usage as well as self assessments (students) of ICT skills in *Table 6*.

Table 6: PISA (2003) ICT Survey Items

Contextual Category	Main Categories	Subcategories	Survey Items / Questions	Survey / Respondent
School Environment	Infrastructure & Access	Computer Access	In your school, about how many computers are available to 15-year-old students?	School Survey
			In your school about how many computers are available only to teachers?	
			In your school, about how many computers are available only to administrative staff?	
			In your school about how many computers are available altogether?	
		Internet Access	In your school, about how many computers are connected to the internet /World Wide Web?	
			In your school, about how many computers are connected to a local area network (LAN, Intranet)?	
	Students	ICT Usage	How often do you use a computer at school? *(Almost everyday; A few times a week; Between once a week and Once a month; Less than once a month, Never)*	Student ICT Survey
			How long have you been using computers? *(Less than one year, One to three years, Three to five years, More than five years)*	
			Is there a computer for you to use at school?	
			At your school, about how often do you use computers? *(Never or hardly ever; A few times a year; About once a month; Several times a month; Several times a week)*	
	School Administration	Financing / Resources	Is your school's capacity to provide instruction hindered by a shortage or inadequacy of computers for instruction?	School Survey
			Is your school's capacity to provide instruction hindered by a shortage or inadequacy of computer software for instruction?	
			Is your school's capacity to provide instruction hindered by a shortage or inadequacy of audio-visual resources for instruction?	
External Environment	Household Environment	Internet Access	In your home, do you have a link to internet?	Student Survey
		Telephone Access	How many of these do you have at your home (None, one, two, three or more)? • *Cellular phone*	
		Television Acess	• *Television*	
		Computer Access	• *Computer*	
			Is there a computer for you to use at home?	
		Software Aceess	In your home, do you have educational software?	
		ICT Usage	How often do you use a computer at home?	Student ICT Survey
	Outside School	Computer Acess	Is there a computer for you to use at other places?	
		ICT Usage	How often do you use a computer at other places?	
School Environment / External Environment	Students	Behavioural	To what extent do you agree with the following statements? *(Strongly agree, Agree, Disagree, Strongly disagree)* • *It is very important to me to work with a computer* • *I think playing or working with a computer is fun* • *I use a computer because I am very interested in this* • *I lose track of time when I am working with the computer*	Student ICT Survey

Table 6 continued:

Contextual Category	Main Categories	Subcategories	Survey Items / Questions	Survey / Respondent
School Environment / External Environment	Students	ICT skills	How well can you do each of these tasks on a computer? ▪ *Start a computer game* ▪ *Use software to find and get rid of computer viruses* ▪ *Open a file* ▪ *Create/edit a document* ▪ *Scroll a document up and down a screen* ▪ *Use a database to produce a list of addresses* ▪ *Copy a file from a floppy disk* ▪ *Save a computer document or file* ▪ *Print a computer document or file* ▪ *Delete a computer document or file* ▪ *Move files from one place to another on a computer* ▪ *Get on to the Internet* ▪ *Copy or download files from the Internet* ▪ *Attach a file to an e-mail message* ▪ *Create a computer program (e.g. in <Logo, Pascal, Basic>* ▪ *Use a spreadsheet to plot a graph* ▪ *Create a presentation (e.g. using <PowerPoint>* ▪ *Play computer games* ▪ *Download music from the Internet* ▪ *Create a multi-media presentation (with sound, pictures, video)* ▪ *Draw pictures using a mouse* ▪ *Write and send e-mails* ▪ *Construct a web page*	Student ICT Survey
			Who taught you most about how to use computers? *(My school, My friends, My family, I taught myself, Others)*	
			Who taught you most about how to use the Internet? *(My school, My friends, My family, I taught myself, Others)*	
		ICT Usage	Have you ever used a computer?	
			How often do you use the Internet to look up information about people, things, or ideas? *(Almost every day, A few times each week, Between once a week and once a month, Less than once a month, Never)*	
			How often do you use games on a computer?	
			How often do you use word processing (e.g. <Word ® or WordPerfect®>)?	
			How often do you use the Internet to collaborate with a group or team?	
			How often do you use spreadsheets (e.g. <Lotus 1 2 3 ® or Microsoft Excel®>)?	
			How often do you use the Internet to download software (including games)?	
			How often do you use drawing, painting or graphics programs on a computer?	
			How often do you use educational software such as Mathematics programs?	
			How often do you use the computer to help you learn school material?	
			How often do you use the Internet to down-load music?	
			How often do you use the computer for programming?	
			How often do you use a computer for electronic communication (e.g. e-mail or "chat rooms")?	
			How often do you read e-mails and web pages because you want to *(Never or hardly ever; A few times a year; About once a month; Several times a month; Several times a week)*?	Student Survey

f) The Southern and East Africa Consortium for Monitoring Educational Quality (SACMEQ):

The Southern and East Africa Consortium for Monitoring Educational Quality (SACMEQ) is a network of fifteen Ministries of Education that monitor and evaluate the quality of educational systems on a cross national basis. The SACMEQ network has completed two major cross-national studies of the quality of education in Southern and Eastern Africa. The SACMEQ I Project (1995-1999) was completed by seven Ministries of Education (Kenya, Malawi, Mauritius, Namibia, Tanzania (Zanzibar), Zambia, and Zimbabwe). The SACMEQ II Project (2000-2003) was completed by fourteen Ministries of Education (Botswana, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, United Republic of Tanzania (Mainland and Zanzibar), Uganda, and Zambia). The sample target population in the studies is comprised of pupils (students) at the grade 6 primary level . The major focus of the SACMEQ study is pupils' (and teachers') achievements in literacy and numeracy (SACMEQ, 2005).

The SACMEQ background instruments include 3 surveys - student, teacher and the school administrator. SACMEQ data are useful to understand the availability of basic infrastructure needed for introducing information technologies such as telephones and electricity. SACMEQ also provides data on the availability of various ICTs such as radio, television, VCR, cassette player and computer. However, it does not ask availability of internet connection at school. A section on the analysis of SACMEQ data is presented later in the paper which aims to illustrate the indicators that are produced from the ICT related items outlined in *Table 7* (See section 4).

Table 7: SACMEQ II ICT Survey Items

Contextual Category	Main Categories	Subcategories	Survey Items / Questions	Survey / Respondent
School Environment	Infrastructure & Access		Which of the following does your school have?	School Survey
		Electricity Access	• *Electricity*	
		Telephone Access	• *Telephone*	
		Radio Access	• *Radio*	
		Television Access	• *TV set*	
		Computer Access	• *Computer*	
		Other ICTs	• *Fax Machine*	
			• *Tape Recorder*	
			• *Overhead projector*	
			• *Film Projector*	
			• *Video casrtte recorder (VCR)*	
External Environment	Household Environment		Which of the following things can be found in the place where you stay during the school week?	Student Survey
		Electricity Access (Students)	• *Electricity*	
		Telephone Access (Students)	• *Telephone*	
		Radio Access (Students)	• *Radio*	
		Television Access (Students)	• *TV set*	
		Other ICTs (Students)	• *Casette player*	
			• *Video casette recorder (VCR)*	
			Which of the following do you have at home?	Teacher Survey
		Electricity Access (Teachers)	• *Electricity*	
		Telephone Access (Teachers)	• *Telephone*	
		Radio Access (Teachers)	• *Radio*	
		Television Access (Teachers)	• *TV set*	
		Other ICTs (Teachers)	• *Casette player*	
			• *Video casette recorder (VCR)*	

g) The Trends in International Mathematics and Science Study (TIMSS):

TIMSS (2003) is another study produced by IEA that measures student performance at the fourth and eighth grade levels of primary school in mathematics and science (IEA, 2005b). Approximately 50 countries have participated in this study.

For each of the TIMSS contextual background surveys, an instrument is adapted for both the grade 4 and grade 8 levels. They include a student survey, a teacher survey (general survey for grade 4 teachers and separate surveys for grade 8 mathematics and science teachers), a school survey and a curriculum survey.

In contrast to other student assessments such as PISA, both TIMSS and PIRLS possess several elements that examine ICT usage by teachers in the classroom as well as ICT related training of teachers in *Table 8*. Furthermore, TIMSS and PIRLS survey items that relate to students' activities outside of the school context provide a comprehensive portrait of student access to ICTs and student use of ICTs.

Table 8: TIMSS (2003) ICT Survey Items

Contextual Category	Main Categories	Subcategories	Survey Items / Questions	Survey / Respondent
School Environment	Infrastructure & Access	Computer Access	Do the students in the TIMSS class have computers available to use during their mathematics/science lessons?	Teacher Survey
			What is the total number of computers in your school that can be used for educational purposes by <eighth-grade> students?	School Survey
		Internet Access	Do any of the computers have access to the Internet?	Teacher Survey
			How many of these computers have access to the Internet (e-mail or World Wide Web) for educational purposes? *(All, Most, Some, None)*	School Survey
	School Administration	Finance / Resources	Is your school's capacity to provide instruction affected by a shortage or inadequacy of any of the following? *(Non, a little, some, a lot)* ▪ *Computers for mathematics instruction* ▪ *Computers for science instruction* ▪ *Computer software for science instruction* ▪ *Computer support staff*	
			In your view, to what extent do the following limit how you teach the TIMSS class? *(Not applicable, not at all, a little, some, a lot)* ▪ *Shortage of computer hardware* ▪ *Shortage of computer software* ▪ *Shortage of support for using computers*	Teacher Survey
		Curriculum Policy	Does the national curriculum contain statements/policies about the use of computers in <grade 8> mathematics? If YES, what are the statements/policies?	Curriculum Survey*
	Students	ICT Usage	How often do you do these things with a computer *(Every day, At least once a week, once or twice a month, A few times a year, Never)* ? ▪ *I look up ideas and information for mathematics* ▪ *I look up ideas and information for science* ▪ *I write reports for school* ▪ *I process and analyze data*	Student Survey
			Do you ever use a computer? (Do not include PlayStation®, GameCube®, XBox®, or other TV/video game computers).	
	Teachers	ICT Usage	In teaching mathematics/science to the TIMSS class, how often do you have students use a computer for the following activities? ▪ *Do scientific procedures or experiments* ▪ *Study natural phenomena through simulations* ▪ *Practice skills and procedures* ▪ *Look up ideas and information*	Teacher Survey

This item is responded by the National Research Coordinator

Table 8 continued:

Contextual Category	Main Categories	Subcategories	Survey Items / Questions	Survey / Respondent
School Environment	Teachers	Training	Is anyone available to help your teachers use information and communication technology for teaching and learning?	School Survey
			Which of the following statements best describes the person at this school who helps teachers use information and communication technology for teaching and learning? ▪ *A full-time school level coordinator (who has no other job responsibility)* ▪ *A library media specialist who also serves as computer coordinator* ▪ *A teacher who also has the title of this type of coordinator* ▪ *A teacher who provides leadership informally to other teachers* ▪ *A district-level coordinator* ▪ *The principal or another school administrator* ▪ *Other person*	
			During this school year, how often have your <eigth-grade> teachers been involved in professional development opportunities for mathematics and science targeted at the following *(by frequency: never, 1 to 2 times, 3 to 5 times, 6 to 10 times, more than 10 times)*? ▪ *Using information and communication technology for educational purposes*	
			In the past two years, have you participated in professional development in for the Integration of information technology into science?	Teacher Survey
External Environment	Household Environment	Computer Access	Do you have a computer (do not include PlayStation®, GameCube®, XBox®, or other TV/video game computers) at your home?	Student Survey
		ICT Usage	On a normal school day, how much time do you spend before or after school doing each of these things? *(No time, less than one hour, 1-2 hours, more than 2 but less than 4 hours)* ▪ *I watch television and videos* ▪ *I play computer games* ▪ *I use the Internet*	
		Outside School	Where do you use a computer? ▪ *At home* ▪ *At school (include under School Environment)* ▪ *At a library* ▪ *At a friend's home* ▪ *At an Internet café* ▪ *Elsewhere*	

h) The World Education Indicators - Survey of Primary Schools (WEI-SPS):

WEI-SPS is the outcome of collaboration between the UNESCO Institute for Statistics (UIS), the Organisation for Economic Co-operation and Development (OECD), the governments of 13 participating countries and a panel of international education and methodology experts (UIS, 2005).

The main objectives of WEI-SPS include examining how schools function, how teachers teach, what kinds of learning conditions students and teachers face and what kind of support is available to them from within the education system. The target population consists of all primary schools with students enrolled in grades 1 through 6, and of all teachers within these schools that are responsible for a grade 4 class. The survey results will be published in global, thematic and national reports in 2006.

In terms of the design of ICT related survey items in *Table 9*, there are similarities with SACMEQ items concerning general accessibility to infrastructure in the school context. However, the WEI-SPS school survey distinguishes between the availability of computers with internet access,

computers without internet access and computers solely for administrative use. In addition to the school survey, the teacher survey contains some items that give us a general sense of ICT usage by teachers and ICT training of teachers.

Table 9: WEI-SPS ICT-related Survey Items

Contextual Category	Main Categories	Subcategories	Survey Items / Questions	Survey / Respondent
School Environment	Infrastructure & Access		Which of the following resources does your school have? *(Yes but not always in working order OR Yes and in working order)*	School Survey
		Electricity Access	▪ *Electricity*	
		Telephone Access	▪ *Telephone*	
		Radio Access	▪ *Radio*	
		Television Access	▪ *TV set*	
		Computer Access	▪ *Computer for administrative use*	
			▪ *Computers for students to use without access to the Internet*	
		Internet Access	▪ *Computers for students to use with access to the Internet*	
		Other ICTs	▪ *Audio-visual room*	
			▪ *Tape recorder*	
			▪ *Overhead projector*	
			▪ *Video Cassette Recorder (VCR)*	
			▪ *Fax machine*	
			▪ *Duplicator or Photocopier*	
	School Administration	Financing / Resources	In your school, are there shortages or inadequacies in any of the following domains? *(Not at all a problem, Not a serious problem, A problem, A serious problem)*	School Survey
			▪ *Lack, shortage or inadequacy of computers for instruction*	
			▪ *Lack of or inadequate computer software for instruction*	
			▪ *Insufficient audio-visual resources*	
	Teachers	ICT Usage	How often do you perform each of the following activities in your lessons? Please circle one answer for each activity. *(Never or almost never, In some lessons, In most lessons)* ▪ *I use teaching aids in my teaching (overhead projector, slides, computers)*	Teacher Survey
		Training	Consider the last school year. Did any of the personnel classified as <classroom teachers> in <primary grades> participate in the following kinds of professional development activities? ▪ *Course/workshops on Information and Communication Technology - ICT*	School Survey
			During the last school year, did you participate in any of the following kinds of professional development activities? (Please circle one answer for each type of professional development.) ▪ *Course/workshops on Information and Communication Technology - ICT*	Teacher Survey

i) UNESCO Asia-Pacific Regional Survey:

The Asia-Pacific Regional Survey (UAPRS) is an initiative that aims to develop performance indicators on ICTs in education. The project was developed by UNESCO (Bangkok) in consultation with experts from the UNESCO Institute for Information Technology in Education based in Moscow, Australia's NSW Department of Education and Training, United Kingdom's Advisory Unit: Computers in Education, ESCAP's Social Development Division and the World Bank's World Links and e-readiness project. The countries represented in the project include Australia, India, Indonesia, Malaysia, Philippines, Republic of Korea, Thailand, Viet Nam and Uzbekistan (UNESCO, 2005).

Unlike several of the other surveys reviewed in this paper, the UAPRS is a specialized survey in the area of ICTs in education[7]. The UAPRS serves as a model for other school surveys wishing to specialize in ICTs. Although the UAPRS has only had a pilot phase, the ICT related survey items are extremely exhaustive and cover such valuable areas as the quality of a school's ICT infrastructure, the ICT skills of students and the training of teachers. The project covers four surveys (student survey, teacher survey, school survey, ministry survey) with several target populations. The following levels of education are included in the UAPRS framework:
- Primary
- Lower secondary
- Upper secondary
- Post-secondary non-tertiary
- First stage of tertiary

j) The Second Information Technology in Education Study (SITES):

Like the Asia Pacific Regional Survey, SITES is a specialized survey that is very comprehensive in its treatment of ICTs in education.

SITES comprised three modules. The aim of the first module (SITES–M1[8]) was to examine the relative position of countries in the educational use of ICTs. Respondents to the surveys consisted of school administrators/principals and technology coordinators. The sample for this survey was drawn from computer-using or ICT-using schools (IEA, 2005c).

The survey examined aspects of overall penetration of ICTs in schools (student to computer ratio, internet connectivity, etc.), including school policies and the perceptions of principals concerning the role of ICTs.

SITES-M2 took place during 1999-2002 and it was qualitative study of innovative pedagogical practices that use ICTs. Many case studies were collected across the several participating countries (IEA, 2005d).

SITES-M3[9] represents one of the most advanced school surveys specializing in ICTs in education. The survey tries to address the following research questions:

- What are the pedagogical practices adopted in schools and how is ICT used in them?
- What and how is ICT used in specific situations where ICT has been used relatively extensively within the pedagogical practice?

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[7] See survey items: http://www.unescobkk.org/index.php?id=1109
[8] See: http://www.iea.nl/sites-m1.html
[9] See: http://www.sites2006.net/exponent/index.php?section=1

- What are the teacher, school, community and system factors that are associated with different pedagogical approaches and ICT use, and can an explanatory model be identified?

The survey sample is based on a target population of schools with grade 8 students. The SITES-M3 surveys include questions (survey items) that elicit the perception of respondents concerning appropriate pedagogical practices and the current role of ICT. Data collection will commence in 2006 (IEA, 2005e).

4. THE STATE OF ICT IN AFRICAN SCHOOLS: SOME RESULTS FROM SACMEQ DATA

The objective of this section is to briefly describe the presence of ICTs in a school setting for several African countries with indicators that are produced from the SACMEQ data archive (SACMEQ, 2004). The countries from SACMEQ-II include Botswana, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, United Republic of Tanzania (Mainland and Zanzibar), Uganda, and Zambia. Data collection for these countries occurred between 2000 and 2003. Since there are very few international school surveys that exist for African countries, it is useful to highlight the presence of ICTs in schools for these regions.

In many economically developed countries, computers have been a compulsory component of the school curriculum since the late 1980s. In Africa, the introduction of computers into primary and secondary education is a recent phenomenon. The high subscription and ICT infrastructure costs coupled with the poor quality of service by service providers and the lack of basic infrastructure such as electricity can act as barriers to the use of ICT in education in many African countries. Whilst there are calls for a new kind of learning in which students deal with knowledge in an active and self directed way through use of computers and Internet, it must be noted that that the older technologies such as radio and television play a significant role in education especially in many LDCs.

a) ICTs in Southern and Eastern African Schools: what does the SACMEQ data reveal?

In reading this section, the limited scope of the data should be taken into account. That is, the data only covers schools with grade 6 pupils[10]. Furthermore, the indicators in this section demonstrate no link to the nature of use of ICTs in a school setting.
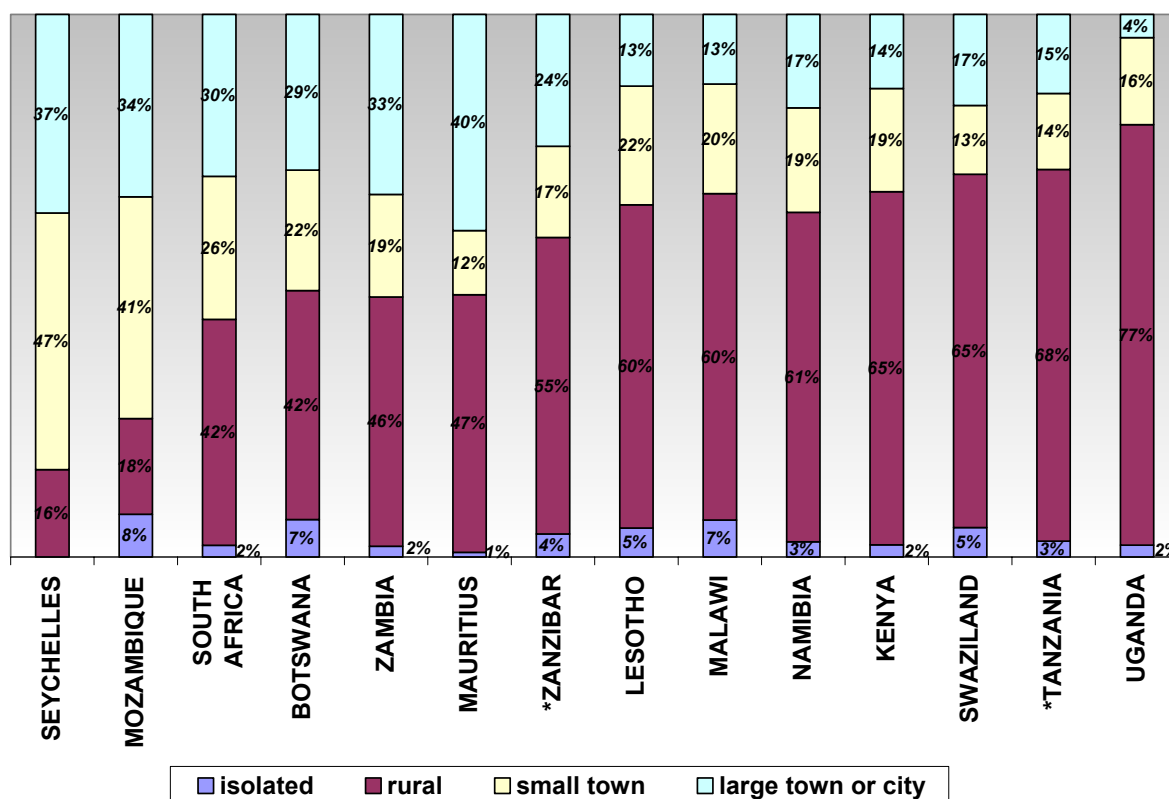
The SACMEQ data on ICTs demonstrates that basic infrastructure is one of the major hurdles in bringing ICTs into education in Africa[11]. The data reveals the poor access to electricity and telephones in many SACMEQ countries in schools located in rural areas. Radio and television are still more widespread in many developing countries compared to modern ICTs due to the mass communication potential of these older media. SACMEQ also demonstrates that radio can be effective in rural and remote schools where there is no access to electricity or acute power shortages.

The location of a school can be an important issue in a developing country context where poor communication such as bad roads, lack of transport act as a barrier to access schools especially by children attending primary school. *Figure 2* describes the breakdown of all schools by location attended by grade 6 pupils. The figure shows that in many countries such as Uganda (77%), Tanzania (68%), Swaziland (65%), Namibia (61%), Malawi (60%), Lesotho (60%) and Zanzibar (55%) over half of the schools are located in rural areas. On average, 55% of all schools that grade 6 pupils attend are located in rural areas.

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[10] The SACMEQ-II study uses pupil as terminology. This is synonymous with students as seen previously in this paper.
[11] Shafika Isaacs, the executive director of SchoolNet Africa notes that "One of the biggest obstacles to bringing technology to schools in Africa is a lack of sufficient infrastructure, such as phone lines and electricity," (Education Week, 2004).
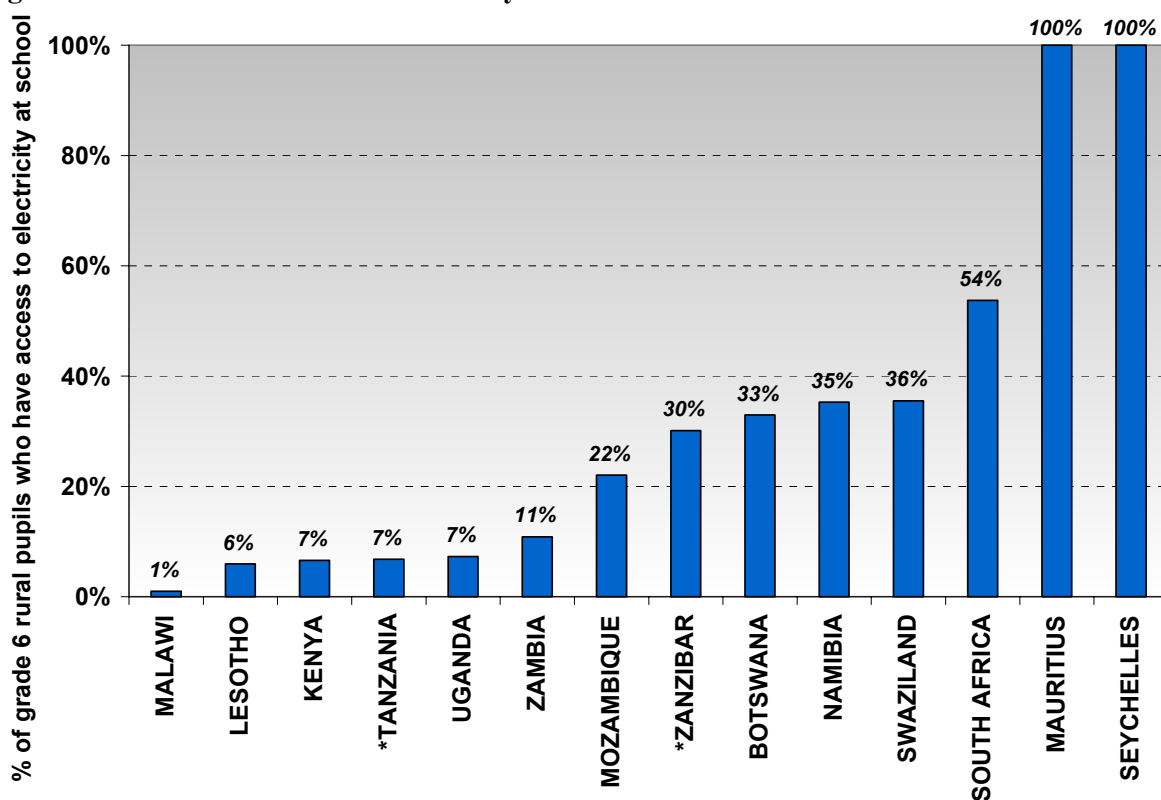
Figure 2: Grade 6 Pupils by School Location

*United Republic of Tanzania
Source: SACMEQ (2004)

b) Access to Electricity in Rural Schools

In many developing countries, schools located in rural areas suffer from poor infrastructure ranging from access to water, lack of building, furniture or electricity. Only a small proportion of grade 6 pupils attend rural schools with electricity (*Figure 3*). In Malawi only 1% of rural grade 6 pupils were in schools that had access to electricity. Considering that 60% of pupils attended schools in rural areas, this translates into a large overall proportion of pupils in schools without electricity. While a large proportion (77%) of all Ugandan grade 6 pupils attended schools in rural areas, only 7% of pupils attended rural schools with electricity. Electricity, which is almost a given factor in schools for many developed and transition countries is still lacking in many African schools making it almost impossible to use ICTs in schools particularly located in rural areas[12].

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[12] O'Sullivan, K. and Hamaide, M., (2001*) in Calculation Sheet of Access to Electricity by count, World Bank, Washington DC, notes that only* 3 of the 14 countries studied have access to electricity significantly above the average for Sub Saharan Africa which is 17%, Mauritius, South Africa and Zimbabwe. Note that four SACMEQ countries (Uganda, Kenya, Zanzibar and Seychelles) do not feature in this study.

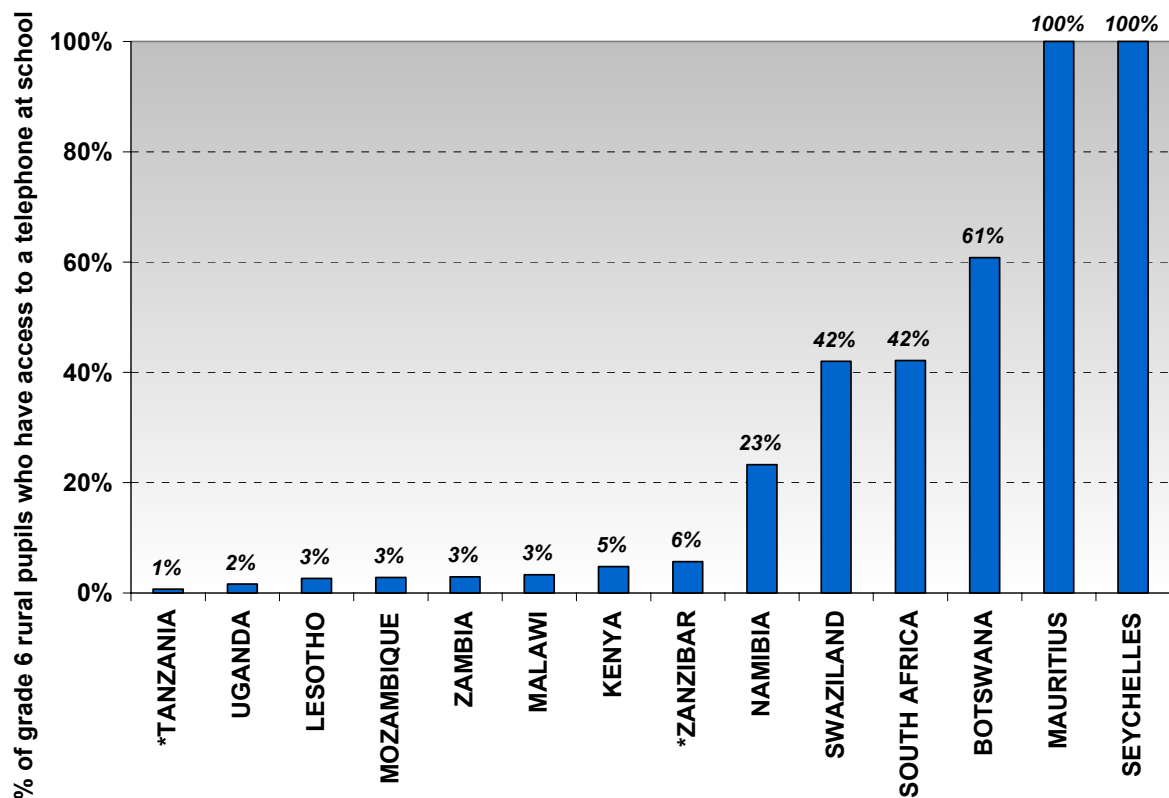**Figure 3: Do rural schools have electricity?**

*United Republic of Tanzania
Source: SACMEQ (2004)

c) Access to Telephone in Rural Schools:

Countries such as Tanzania (1%), Zanzibar (6%), Uganda (2%), Zambia (3%), Lesotho (3%), Malawi (3%), Kenya (5%) and Mozambique (3%) have poor telephone access in schools located in rural areas (*Figure 4*). Less that 5% of all pupils who attended rural schools had access to a telephone. Lack of access to a telephone is both a problem for telecommunications and a barrier in the use of the Internet.

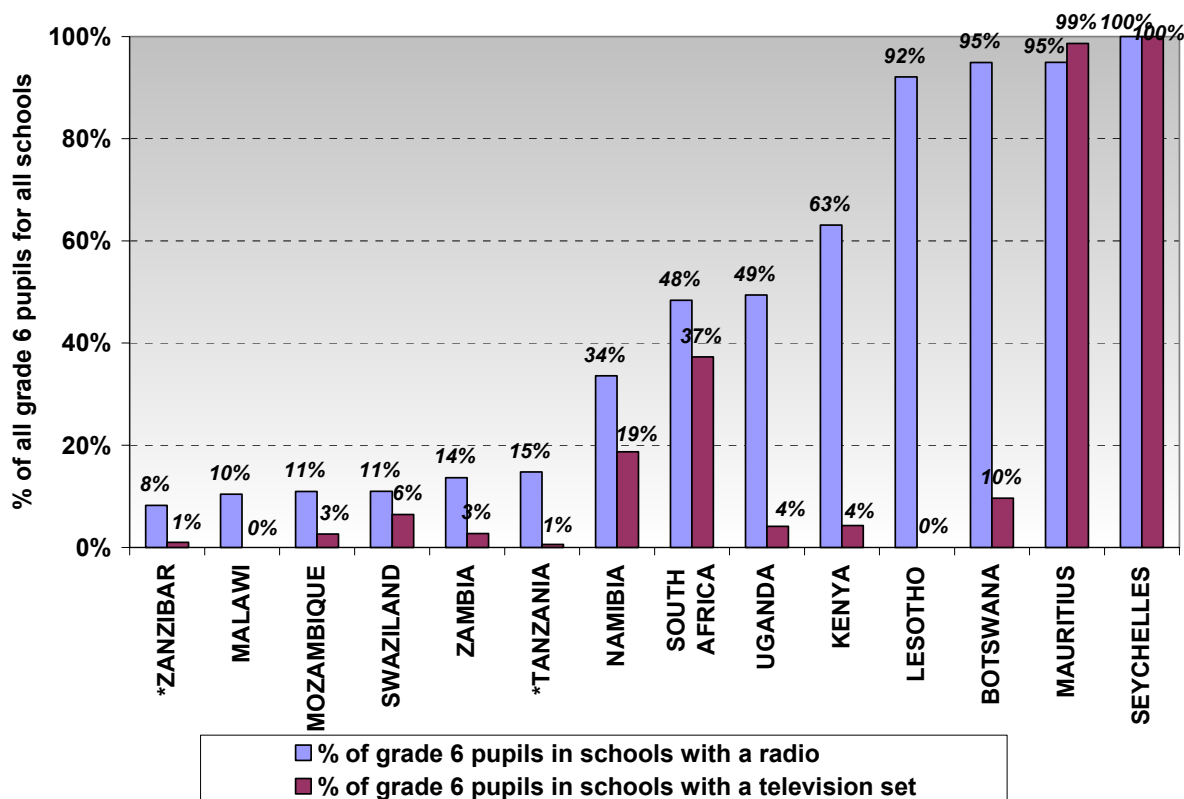**Figure 4: Do rural schools have a telephone?**

United Republic of Tanzania
Source: SACMEQ (2004)

d)   Role of Radio and Television in Schools in Africa:

Radio is particularly attractive for many of the Least Developed countries because it can reach a large number of learners over distance and cheaply without the need for infrastructure such as electricity, as it can be used in any separate space/room within a school. The rarity of electricity and telephone in rural schools makes alternative communication technologies more attractive. Radio has an added advantage of mobility and facility if operation when alternate sources such as battery power is used; especially to provide education in remote rural areas. However, the lack of interactivity, particularly in the case of radio, and the lack of visuals significantly limit the instructional support that can be provided to students. In contrast to previous figures, figure 5 on the availability of radio and television in rural schools illustrates the greater prevalence of radio than television. While almost half of all (both urban and rural) pupils attend schools (on average) that have radio, only 1 in 5 pupils attend a school with television.

Figure 5: Proportion of all Grade 6 Pupils in all Schools that have Access to Radio or Television

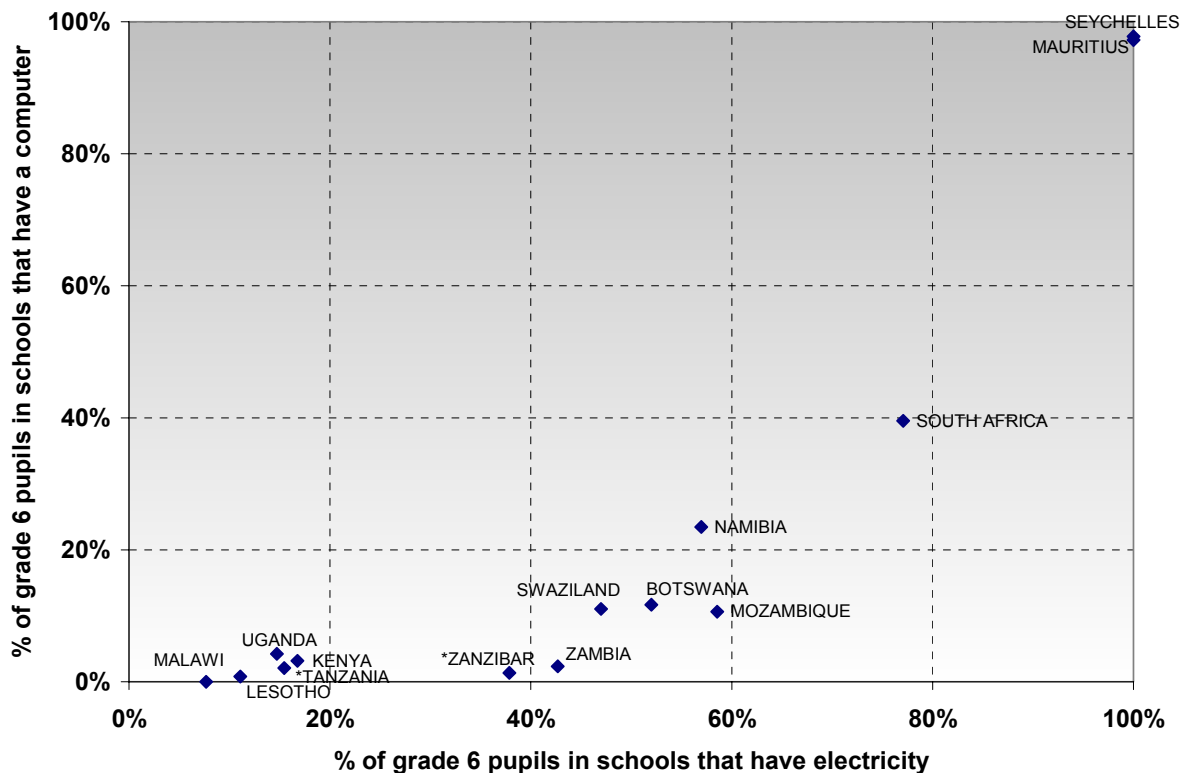*United Republic of Tanzania
Source: SACMEQ (2004)

The relative predominance of radio over other selected ICTs such as televisions and computers is evident in all schools. It is interesting to note that the two small island countries of Seychelles (100%, 100%) and Mauritius (95% radio, 99% TV) seem to have full access to both radio and television in their schools, while countries such as Lesotho (92% radio, 0% TV), Kenya (63%, 4%) and Uganda (49%, 4%) have a significant disparity in access between radio and television in schools. On the other hand, countries such as South Africa have a more equal distribution in access to radio (48%) and television (37%) in schools.

e) Computers in Schools:

SACMEQ does not collect data on the access to the Internet at school, but it does collect the availability of computers. There are no specific questions regarding the use of computers in the student survey or the teacher survey.

In general, electricity may be regarded as an obvious determinant for overall access to conventional ICTs in the context of SACMEQ countries. *Figure 6* describes the relationship between the presence of electricity and the presence of computers in all schools. Malawi (8%) and Lesotho (11%) with low percentage of electricity available in schools also had virtually no computer availability (Malawi 0% and Lesotho 1%) in their schools. An increase in computer accessibility can be observed as access to electricity intensifies in schools for certain countries. This is evident for countries such as South Africa where 40% of all grade 6 pupils attended schools that had a computer and 77% of all grade 6 pupils attended schools which had electricity. Seychelles and Mauritius had full access to electricity and computers in their schools.

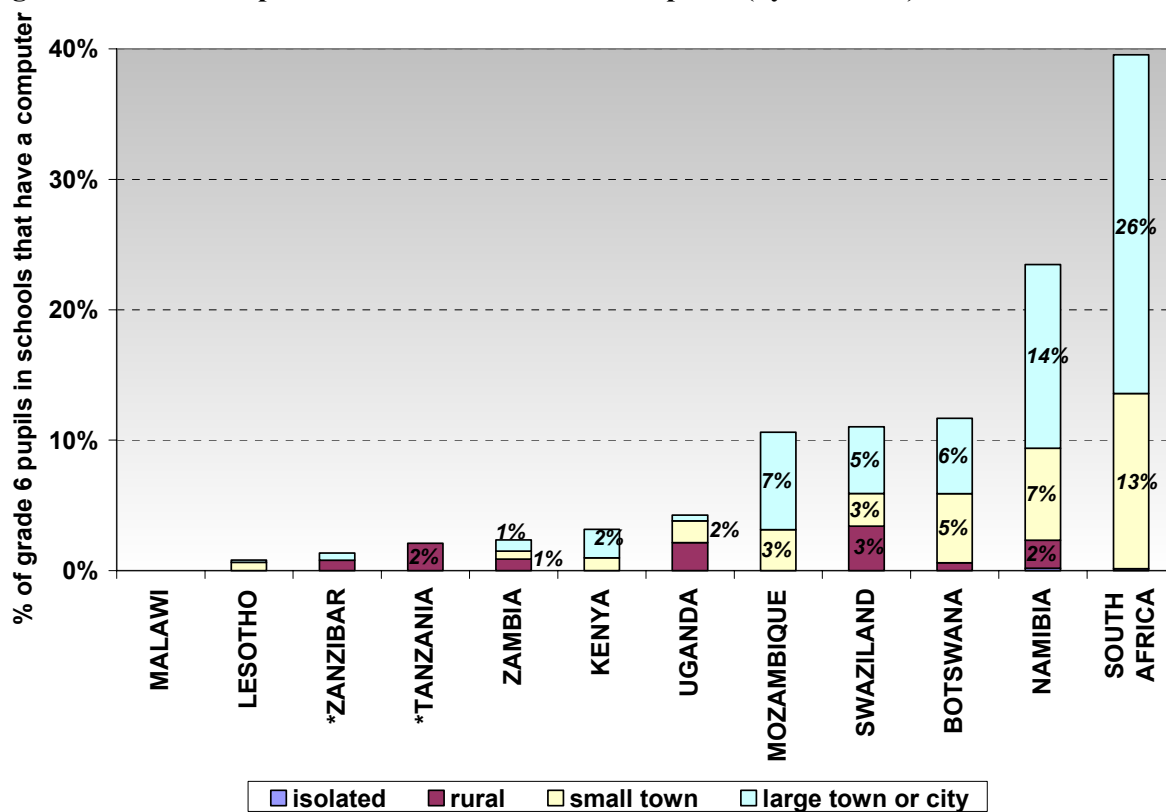**Figure 6: Access to Electricity and Computers in All Schools**

*United Republic of Tanzania
Source: SACMEQ (2004)

On average[13], 1 in 10 of all pupils attended a school that had a computer. Figure 7 illustrates that only South Africa (13% small town, 26% large town/city) and Namibia (7 % small town, 14 % large town/city) had over 20% of pupils in schools that had computers. It is interesting to note that Swaziland (3%) had the highest percentage of pupils in schools located in rural areas and with computer, followed by Tanzania (Mainland), Uganda and Namibia all had 2% of their pupils in schools located in rural areas with computer. However, the availability of computer in schools is generally higher in urban areas (small town, large town or city) than rural or isolated areas.

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[13] This approximated average does not include the island countries of Seychelles and Mauritius.

Figure 7: Grade 6 Pupils in Schools that Have a Computer (by Location)

*United Republic of Tanzania
Source: SACMEQ (2004)

5. <u>COMMON INDICATORS FROM THE SCHOOL SURVEYS</u>

The reasons for identifying commonalities in survey items and indicators are:

1. Searching for common items permits the development and analysis of indicators from different international school surveys on a more extensive scale. More specifically, this entails the analysis of comparable indicators across a wide range of countries and regions.

2. Although the school surveys are administered at the international level by international organizations, the development of survey items is conducted in tandem with national governments. In achieving international comparability, it is important to minimize the burden of data collection on countries by using the most common ICT survey items.

3. By integrating items from international surveys into national surveys, countries may compare themselves in a wider context, and benchmark themselves against the relevant studies (having in mind that the original studies are several years old and may use specific methodologies).

a) Common Indicators on Access and Use of ICTs in Education

In the broadest sense, the identification of commonalities between school surveys is based on four criteria. However, the first criterion (commonalities in items across surveys) is of primary importance.

- Commonalities in items across surveys
- Commonalities across target populations
- Commonalities in the year of collection
- Commonalities in the type of respondent (i.e. student, teacher, school administrator, etc.)

As discussed earlier, there are several differences across school surveys, which include the overall coverage of ICT survey items, the target population, the year of collection or the type of respondents. For the most part, ICT items related to infrastructure and access display the greatest degree of commonality. The respondent to these types of items are usually school administrators and involve headcounts or tallies of such physical assets as the number of computers in use, the number of audiovisual materials, etc. However, the school surveys that are not specialized in ICTs display no indication of the quality of a school's infrastructure.

Computer Access:
School surveys that ask for the number of computers in use allow for the construction of indicators such as the ***student to pc ratio*** as seen in PISA, MLA-2, UAPRS and SITES-1 surveys irrespective of target populations. Several surveys have items that ask for the number of computers devoted to a specific age range or grade (**i.e. *percentage of grade 8 students with access to a computer***). These surveys include PISA, MLA-2 and TIMSS.

Surveys that ask school administrators about the existence of computers in their schools give some sense of access. However, responses to this type of item provide no indication of the number of computers in schools or their overall availability to students. A school administrator who has one computer in his/her school responds in the same way as an administrator who has several computers. Nevertheless, these types of questions reduce the burden on respondents (in contrast to tallied responses) and represent a step forward in terms of measuring computer access in schools (in the developing world). These surveys include WEI-SPS, LABORATORIO, SACMEQ and the resulting indicator would be ***percentage of students in schools with a computer(s) (percentage of schools with a computer(s))***.

Internet Access:
Items that go beyond a tally of computers in a school ask for the number of computers that have internet access. This type of item can be found in PIRLS, SITES-1, UAPRS and PISA. The indicators on the *ratio of students to computers with Internet access* or *percentage of computers with Internet access* can be calculated.

Like percentage of schools with a computer(s), the indicator *percentage of schools (or percentage of students) with Internet access* can be calculated from many school surveys including PISA, MLA-2, APRS, WEI-SPS, SITES-1, TIMSS and PIRLS. However, it does not indicate the extent that pupils and teachers use the Internet or what they use it for.

Access to old ICTs (Radio and Television):
Only UAPRS asks for the total number of radios and televisions in schools. PISA, on the other hand, requests the total number of television sets in a student's home in the student survey. Likewise, PASEC and MLA-2 ask whether students have access to a radio and television at home.

LABORATORIO, SACMEQ and WEI-SPS possess items that permit the construction of: *percentage of schools (or students in schools) with radio(s) or television(s)*. Although surveys such as TIMSS or PIRLS have survey items related to television usage, there are no items directly related to the access (or the number) to television and radio.

ICT Usage Indicators:
In contrast to items related to Infrastructure and Access, ICT survey items that relate to *student or teacher usage of ICTs* display less harmony. This is because the diction used for the frequency of ICT usage (i.e. time spent on a computer) and the purpose of ICT usage vary across certain school surveys. Furthermore, there are no ICT usage survey items in MLA-2, SACMEQ, LABORATORIO and PASEC. The different types of survey question/item are outlined in *Table 10*. Nevertheless, these types of indicators are among the most important in understanding the full impact of ICTs in an educational setting. As stated, these items serve as benchmarks that will permit national governments to define their national collections in these areas. Survey items that enable the development of these types of indicators go beyond the basic core and will be described later in section 7.

Table 10: Student ICT Usage Items

School Surveys	Survey Items / Questions	Frequency Items				
PIRLS	How often do you use a computer at school?	Every day or almost evey day	Once or twice a week	Once or twice a month	Never or almost never	
PISA	How often do you use a computer at school? *(Almost everyday; A few times a week; Between once a week and Once a month; Less than once a month, Never)*	Almost everyday	A few times a week	Between once a week and Once a month	Less than once a month	Never
TIMSS	How often do you do these things with a computer? ▪ *I look up ideas and information for mathematics* ▪ *I look up ideas and information for science* ▪ *I write reports for school* ▪ *I process and analyze data*	Every day	At least once a week	once or twice a month	A few times a year	Never
UAPRS	If you are using computers and related ICTs, how many hours on the average per week of normal school hours are you able to use these computers and related ICTs to do your studies?	Specify number of hours				
SITES-1	If you are using computers and related ICTs, how many hours on the average per week of normal school hours are you able to use these computers and related ICTs to do your studies?	Specify number of hours				

b) Regional Perspectives on Selected School Surveys

TIMSS 2003:
Although surveys such as PISA and SITES offer some of the most innovative survey items and questions that measure aspects of ICT usage, the coverage of developing countries or developing regions in these surveys is limited. Among all the school surveys, TIMSS has the most potential for developing countries. There are many ICT-related items that go beyond the basic core of infrastructure and access items. Other items address the issue of ICT usage by students and teachers, frequency and content used, as well as ICT training of teachers. In addition, the survey has comprehensive coverage of geographical regions across the world with a substantial number of countries representing the developing countries or transition countries. Several of these countries are listed in *Table 11*:

Table 11: TIMSS 2003 Coverage of Selected Transition Countries and Developing Countries

CONTINENT	UN REGIONAL GROUPING	COUNTRIES	
Africa	Northern Africa	Egypt	*
		Morocco	
		Tunisia	
	Southern Africa	Botswana	*
		South Africa	*
	Western Africa	Ghana	*
Asia	Eastern Asia	Republic of Korea	*
	South-Eastern Asia	Indonesia	*
		Malaysia	*
		Philippines	
		Singapore	
	Southern Asia	Iran (Islamic Republic of)	
	Western Asia	Armenia	
		Bahrain	*
		Cyprus	
		Israel	*
		Jordan	*
		Lebanon	*
		Palestinian Autonomous Territories	*
		Saudi Arabia	*
		Syrian Arab Republic	*
		Yemen	**
Europe	Eastern Europe	Bulgaria	*
		Republic of Moldova	
		Romania	*
		Russian Federation	
	Southern Europe	Serbia and Montenegro	*
		The former Yugoslav Republic of Macedonia	*
Latin America and the Caribbean	South America	Argentina	*
		Chile	*

*only grade 8, **only grade 4*

MLA-2, SACMEQ, LABORATORIO and PASEC:
In comparison to TIMSS, a survey such as MLA-2 has some of the greatest coverage of the African continent. Although the survey is confined to items such as ***the number of computers available to grade 8 students*** or ***the number of computers connected to the Internet***, MLA-2 leads the surveys in terms of African coverage with over 40 countries.

Surveys that are specialized in a specific region such as SACMEQ (Southern and Eastern Africa) or LABORATORIO (South America) have a limited number of ICT-related items. Both surveys display some similarities in items that relate to basic infrastructure. In terms of the types of ICT-related items, the same may be said of PASEC which covers a number of CONFEMEN countries. However, as we have noted earlier, none of these studies measure ICT penetration or usage in schools as a primary focus.

6. UN REGIONAL COMMISSIONS: PROPOSALS OF INDICATORS TO MONITOR ICTs IN EDUCATION

Lists of core indicators have been proposed as a result of the stocktaking exercise that was carried out in 2004 by the UN Regional Commissions (ECA, ECLAC, ESCAP, ESCWA and UNCTAD (on behalf of ECE)) within the context of the "Partnership on Measuring ICT for Development", (UNCTAD, 2005). The indicators summarized in this section are complementary to those indicators we have reviewed in the sections related to school surveys. Africa (ECA) and Western Asia (ESCWA) are two of the regions that have included education in their core list of ICT indicators in *Table 12*.

Table 12: Regional Lists of Core Indicators

ICTs in Education: Regional lists of core indicators			
Categories	**Subcategories**	**Africa (indicators)**	**Western Asia (indicators)**
Infrastructure and Access	Computer Access	Enrolled Student to PC ratio (in primary, secondary schools and tertiary education)	Enrolled Student to PC ratio in primary and secondary schools
	Internet Access	Percentage of primary and secondary schools having Internet access for students for study purposes	Percentage of primary and secondary schools having Internet access for students for study purposes
		Percentage of students enrolled in tertiary education having Internet access for students for study purposes	
Students/Teachers	ICT Usage	For what purpose do students/teachers use computers/Internet (% for E-mail, research, employment opportunities, application software, etc.)	
Teachers	Training	Percentage of ICT-qualified teachers in primary and secondary schools (of the total number of teachers)	Percentage of ICT-qualified teachers in primary and secondary schools (of the total number of teachers)
School Administration	Curriculum Policy	Percentage of tertiary education institutions with e-learning courses (of the total number of tertiary education institutions)	Percentage of tertiary education institutions with e-learning courses (of the total number of tertiary education institutions)
		*Percentage of students enrolled in tertiary education in an ICT field or an ICT- dominated field (of the total number of students) (by gender)	*Percentage of students enrolled in tertiary education in an ICT field or an ICT- dominated field (of the total number of students by gender)

This indicator may also fall under the category "Students"

Infrastructure and Access:
The "Infrastructure and Access" indicators suggested resemble the types of indicators discussed earlier. The indicators proposed by the two UN regional commissions broaden the scope of access to ICTs to all levels of education. "Infrastructure and Access" indicators are likely to be the easiest statistics to collect from national administrative sources such as a Ministry of Education. Although these types of indicators (i.e. percentage of schools with internet access) represent a first step in measuring ICT access in education on a cross national basis, there is also a need to collect data on the quality of access (dial-up, broadband).

Students/Teachers: ICT Usage
In the proposed African list of core indicators, "*for what purpose do students/teachers use computers/internet*" is one of the most illuminating and useful indicators. It is also one of the most difficult to collect through administrative sources at the international level. Such data would have to be collected through two types of sample surveys at the national level (i.e. teacher survey and

student survey). While such an indicator is deemed as instrumental in understanding the nature of use within an educational setting, a cross-national consensus still needs to be reached on the issue of what constitutes appropriate items for "purpose of use".

Teachers: Training
Under this category, the African and Western Asian regional commissions propose the indicator "*percentage of ICT-qualified teachers*". Despite its usefulness as a proxy for ICT skills, methodological work in defining ICT qualifications (internationally comparable) warrant further methodological work.

Percentage of tertiary education institutions with e-learning courses:
Similarly to the "teacher training" category (ICT qualifications), methodological development is needed in defining what constitutes an e-learning course. Since "older" technologies (such as audio-visual cassettes) still play an important role in the delivery of educational programmes in the developing world, definitions should be able to capture this as well. Hence, the term e-learning should be broadened to include other technological solutions for distance education programmes.

Discussions on the joint UNESCO/OECD/Eurostat education survey have also discussed issues surrounding the collection of data. Data on education is normally collected from the country in which the student is resident. This provides some difficulties for international distance learning, as a student's country of residence may not be aware that he is registered with an education institution, while education institutions do not necessarily hold records of a distance student's residential status.

Percentage of students enrolled in tertiary education in an ICT-related field:
This indicator already exists at the international level. The UIS already collects data on *Enrolment by fields of education (by gender) and Graduates by fields of education (by gender)* through their annual Questionnaire on Statistics of Tertiary Education. National Ministries of Education are required to comply with international classifications in the questionnaire. The fields of study include 'Computing' though this category does not cover all ICT-related studies.[14]

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[14] Computing is defined as: *Computer sciences: system design, computer programming, data processing, networks, operating systems – software development only (hardware development should be classified with engineering fields)*

7. UNESCO INSTITUTE FOR STATISTICS RECOMMENDATIONS

a) Recommendations for a Basic Core of Indicators

In order to propose a basic core of indicators for measuring the use and impact of ICTs in education effectively across developing countries, in the context of the WSIS Plan of Action, the following three areas must be taken into consideration- national circumstances, survey items that are internationally comparable and the most commonly used indicators.

National circumstances:
A country's educational infrastructure is crucial, especially from a developing country perspective. Information on the availability of electricity or the presence of basic infrastructure can be vital to understand the extent to which ICTs are being utilised among the socio-economic groups and across geographical locations within a country.

Indicators that describe the presence of "older" technologies must be given serious consideration. Surveys like SACMEQ reveal that a school may not have computers with internet connections, but may have a radio, television or other audio visual technologies. Such alternatives can deliver information effectively and in a cost-effective manner.

Adapting survey items at international level:
This paper forms an important resource of survey topics and questions that have been tried and tested in international research. Adapting such questions in national surveys can allow comparison for better understanding of how countries progress towards their goal of becoming an information rich society.

While precise comparison with past international work may prove difficult, successful adaptation to national contexts will depend on careful adoption to suit local contexts. Such approach towards using international survey items can allow some benchmarking to major international studies.

The most commonly used indicators:
The goal of many international efforts on measuring information society is to achieve cross-national comparisons. Monitoring and evaluation are needed to understand how countries are performing in order to achieve the goals outlined in the WSIS plan of action. Since, data collection represent a substantial financial burden for developing countries, simple efforts such as embedding items in already existing instruments can be effective. Internationally comparable indicators that are easy to collect, that address the issue at hand and that cover the largest spectrum of countries should be the underlying logic behind any proposal of any indicator development.

The following recommendation for "basic set of core" indicators in *Table 13* is an attempt to encapsulate the points that have been discussed above based on various proposals and existing international school surveys. Further work is still required to define an appropriate methodology for the collection of internationally comparable data in this highly complex and challenging area of ICTs and Education.

Table 13: The Basic Core of Indicators for ICTs in Education

	Basic Core
ED-1	% of schools with electricity (by ISCED 1-3)
ED-2	% of schools with a radio set used for educational purposes (by ISCED level 0 to 4)
ED-3	% of schools with television set used for educational purposes (by ISCED level 0 to 4)
ED-4	Student to computer ratio (by ISCED level 0 to 4)
ED-5	% of schools with basic telecommunication infrastucture or telephone access (by ISCED 1-3)
ED-6	% of schools with an Internet connection (by ISCED 1-3)
ED-7	% of students who use the Internet at school (by ISCED level 0 to 4)
	Extended Core
ED-8	% of students enrolled by gender at the tertiary level in an ICT-related field (ISCED 5 to 6)
ED-9	% of ICT-qualified teachers in primary and secondary schools (of the total number of teachers)

Note: All indicators should be collected by sex, grade, and age

b) Recommendations for survey items on Student and Teacher Usage of ICTs and ICT Finance

In the previous section the goal was to recommend a common set of core indicators that are comparable across the largest spectrum of countries. In this section, instead of indicators we outline potential survey questions that countries might use to go beyond the basic core. They relate to the use of content (i.e. web sites), the frequency of ICT use and the nature of ICT use from the perspective of both teachers and students (*Table 14*). They measure the critical part that teacher training has to play in ensuring that ICTS are effectively used in schools (*Table 15*). They examine the financial resources spent on ICTs to help judge whether such resources have been used effectively (*Table 16*).

As in the case of the recommended core indicator set, these questions have been identified on the basis of commonalities in existing school surveys. They will require adaptations to national circumstances, but should ensure some comparability with existing data sets.

Table 14: ICT Use by Students and Teachers

Survey Items / Questions	Source
How often do you use computers/Internet?	PISA, PIRLS, TIMSS
Do you use computer/Internet at home?	PIRLS, TIMSS
What types of software are used and what is the frequency of use?	PISA, SITES
Are computers used to… ▪ *write stories* ▪ *read stories* ▪ *look up information on the internet* *etc.*	PISA, PIRLS, TIMSS
Are computers used in… ▪ *Earth science* ▪ *Biology* ▪ *Chemistry* ▪ *Physics* ▪ *Maths* *etc.*	TIMSS, UAPRS
Are computers used in…. ▪ *Experiments, Simulations, Practical, Procedures research* ▪ *Functional, Communications, Creating* ▪ *Use email to work with students in other schools* ▪ *Do students use video conference?*	TIMSS UAPRS UAPRS, SITES SITES

Table 15: ICT Training for Teachers

Survey Items / Questions	Source
During the school year how often have your teachers been involved in professional development opportunities related to the use of information and communication technology for educational purposes?	TIMSS
Did you receive any training on ICTs before you joined the teaching profession, in the past few years, etc.? ▪ *Title of training* ▪ *Level of training* ▪ *Number of hours*	UAPRS
What are your reasons for attending computer training? ▪ *Financial* ▪ *Prestige* ▪ *Career enhancement* ▪ *Personal growth* ▪ *Training is required* *etc.*	UAPRS
Please rate your (teachers) expertise in the use of the following …. ▪ *Word processing* ▪ *Spreadsheets* ▪ *Internet browsing* ▪ *Presentation tools (powerpoint)* ▪ *Programming* *etc.*	UAPRS
Which of the following training courses are available for teachers… ▪ *Introductory courses (hardware, software, Internet use)* ▪ *Advanced courses (Technical maintenance, applications development, website design)* ▪ *Courses on Didactical/pedagogical principles of computer use* *etc.*	SITES

Table 15 continued

Survey Items / Questions	Source
Is it obligatory for: ▪ *All teachers to take at least some basic computer courses* ▪ *All teachers to regularly take courses to update their ICT-knowledge and skills* ▪ *Have a substantial number of teachers…* ▪ *Attend at least some basic computer courses* ▪ *Regularly attend courses to update their ICT-knowledge and skills*	SITES

Table 16: ICT Resources and Finance

Survey Items / Questions	Source
Is your school's capacity to provide instruction affected by a shortage or inadequacy of any of the following…. ▪ *computers for instruction* ▪ *software (ie. language of software)* ▪ *Internet (unreliable network performance)* ▪ *ICT support services* etc.	PIRLS, PISA, TIMSS, SITES
Is there a school budget for the implementation of the school ICT plan? ▪ *If yes, how much?* ▪ *If no, what are the other sources of funds?*	UAPRS
Do you (school administration) collect fees for: ▪ *Computer fee in general* ▪ *Computer courses* ▪ *Use of computers after class by students?* ▪ *Use of Internet after class by students?* ▪ *Use of computers by non-formal classes?*	UAPRS

Table 16 continued

Survey Items / Questions	Source
Who pays for the Internet connection in your school? ▪ *the school via tuition fee collections* ▪ *local government units through the school board* ▪ *the national government as included in the budget appropriations* ▪ *Parent-teacher association* ▪ *others (please specify)*	UAPRS

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