INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT) IN EDUCATION IN LATIN AMERICA AND THE CARIBBEAN:

THE ROLE OF THE UNESCO INSTITUTE FOR STATISTICS (UIS) IN MEASURING GLOBAL AND REGIONAL STATISTICS RELATED TO E-READINESS IN SCHOOLS

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INTRODUCTION

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

THE ROLE OF THE UNESCO INSTITUTE FOR STATISTICS (UIS)

The Unesco Institute for Statistics (UIS), which is the United Nation's repository for social statistics on education, science and technology, and culture and communications, is internationally mandated to administer statistical data collections on the availability, use

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and impacts of ICT in education. Through the establishment of internationally comparable policy-relevant indicators, the UIS therefore contributes significantly towards international benchmarking and monitoring of the integration of and access to ICT in education, which are fundamental for country level policymakers to select priorities and adopt policies related to ICT. For instance, policymakers may use UIS data to inform decisions related to i) national capacity and/or infrastructure levels for integrating new ICT instructional strategies in schools (e.g., electricity, Internet, broadband); ii) the types of ICT currently being neglected and/or emphasized (e.g. computer assisted instruction); iii) whether ICT-assisted strategies are evenly distributed across the country; iv) whether girls and boys are equally exposed to ICT in education; v) the types of support mechanisms currently in place or the lack thereof; and vi) the relative level of teacher training provided in relation to the demands placed on them to teach and/or use ICT in the classroom.

In 2010/2011, the UIS conducted a data collection campaign in Latin America and the Caribbean as part of its regional demand-driven survey rollout strategy. The regional survey was successfully completed by 38 countries. The questionnaire collected data in the following areas: a) policy and curriculum, b) ICT integration in schools, c) enrolment in programmes using ICT, and d) teachers and ICT. This paper is a brief summary of the findings generated by this survey. For a more complete analysis, please refer to the UIS website, which contains a more elaborated version of the report and Data Tables.

GLOBAL AND REGIONAL COMMITMENTS IN LATIN AMERICA AND THE CARIBBEAN TOWARDS THE INTEGRATION OF ICT IN EDUCATION

For about four decades, education policymakers have been formalizing all-inclusive ICT policies as part of educational renewal and reform. At the global level, targets for the integration of ICT in education have been formulated by both the *Millennium Development Goals* to "make available the benefits of new technologies, especially information and communications" (UN, 2000; UN, 2012), as well as by the World Summit on the Information Society (WSIS), resulting in a clear commitment by governments to foster the achievement of an inclusive information society (PARTNERSHIP ON MEASURING ICT FOR DEVELOPMENT, 2011).

As a region, Latin American and Caribbean countries have also been defining successive action plans and policy frameworks with a special focus on the use of ICT for development, whereupon they call upon schools to take a leadership role in broadening access to, training in and usage of new technologies to compensate for existing social inequalities (ECOSOC, 2011). The Plan of Action on the Information Society in Latin America and the Caribbean (eLAC2015) makes it a priority to incorporate ICT in education and, particularly, to provide universal access and inclusive education in support of achieving equality, equity and overall development (ECLAC, 2010).

FORMALLY INTEGRATING ICT IN EDUCATION POLICY

Educational policymakers are in a unique position to bring about change as illustrated in a study of 174 ICT-supported innovative classrooms in 28 countries (KOZMA, 2003). In the majority of cases, there was an explicit connection between innovation and national policies that promoted the use of ICT (JONES, 2003). However, while the introduction of ICT policy is necessary for change, it is not sufficient to result in its implementation or impact (TYACK; CUBAN, 1995). Policies can fail to succeed and this happens when i) they are viewed as mere symbolic gestures; ii) when teachers actively resist policy-based change that they see as imposed from the outside without their input or participation (TYACK; CUBAN, 1995); iii) when they do not have explicit connections to instructional practice; iv) when they do not provide teachers with an opportunity to learn the policies and their instructional implications, and v) when there is a lack of programme and resource alignment to the policies' intentions (COHEN; HILL, 2001).

While some policies may fail, identifying those countries that have current active ICT in education policies and/or other types of formal commitments, including plans, regulatory provisions or a regulatory institution or body, is nevertheless important for assessing a country's effort to implement ICT in education and embark on educational reform. In Latin America and the Caribbean, most countries (31 of 38, or 82 per cent) have at least one kind of formal definition of their ICT in education initiatives, while nine (24%) have all formal definitions including Anguilla, Bahamas, Barbados, Chile, Ecuador, Guatemala, Saint Vincent and the Grenadines, Uruguay and Venezuela. Nevertheless, some countries have yet to adopt any kind of formal policy or formal commitment to ICT in education including Curaçao, Dominica, Montserrat and Suriname.

BUILDING ICT INFRASTRUCTURE TO SUPPORT ICT-ASSISTED INSTRUCTION

Integrating various ICT (e.g. radios, televisions and computers, tablets, mobile devices) into schools requires that electricity and/or the Internet is regularly and readily available. While this is not always strictly the case for radios, which can be operated solely using batteries, the use of televisions and various forms of computers requires a much more stable energy source, with the latter also requiring Internet connectivity to support Internet-assisted instruction (IAI), also known as web-based learning.

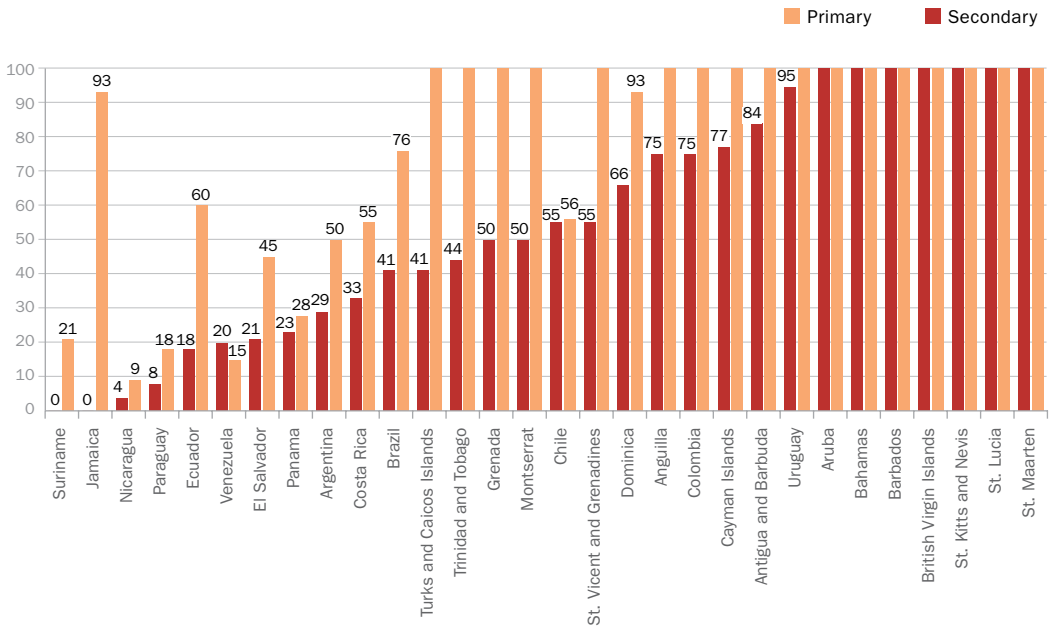
In Latin America and the Caribbean, electricity is available in most primary and secondary schools. This is more or less universally the situation in Caribbean countries, with the exception of the Dominican Republic[2], where challenges remain. The situation is however somewhat different in some South and Central American countries where many schools lack a basic electrical supply. For example, fewer than 80% of primary schools have electricity in

[2] Data for the Dominican Republic only reflect public institutions and also include schools from the lower secondary level.

Ecuador, Guyana[3], Panama and Venezuela. In Nicaragua, only the minority (24%) of primary schools have electricity. In countries where full electrical access is not available to all schools, secondary schools are more likely to have access than primary schools in general — a factor that typically determines the deployment of most forms of ICT across schools.

One of the regional goals of eLAC2015 is to connect all public educational institutions to the Internet via broadband connections. Chart 1 shows the proportion of primary and secondary educational institutions with any type of Internet connection. Similar patterns emerge revealing an advanced state of infrastructure in a number of Caribbean countries, where all primary and secondary schools in many countries have Internet connections, while relatively fewer schools in a number of South and Central American countries have Internet connections, including Nicaragua, Paraguay, Suriname and Venezuela, where 20% or fewer of primary and secondary schools are connected. Supported by strong policies at the central government level, Venezuela has however experienced one of the fastest Internet growth rates in the regionand the world as the proportion of Internet users increased by 62% between 2011 and 2012 to represent 41% of the national population largely through government-established *Infocenters* (ROBERTSON, 2012). In summary, access to the Internet in schools is currently lagging behind access for the general population.

CHART 1
PROPORTION OF PRIMARY AND SECONDARY EDUCATIONS INSTITUTIONS WITH INTERNET CONNECTIVITY, 2010



Notes: Data for Anguilla, Bahamas, Barbados and Trinidad and Tobago reflect public educational institutions only. Data for Argentina, Bahamas, Barbados, Chile, El Salvador, Montserrat, Suriname, Trinidad and Tobago and Uruguay reflect 2009.

Source: Unesco Institute for Statistics database.

[3] Data only include public institutions.

Internet connectivity is primordial to support web-based learning; however, not all schools across the region provide sufficient bandwidth to adequately support much online activity, such as streaming video, two-way synchronous video conferencing, etc. While fixed broadband Internet will vary in upload and download speed between and within countries, the UIS collects data on proportions of schools with broadband Internet — albeit from a smaller number of countries.

Fixed broadband Internet is universally available in all schools regardless of level in some small Caribbean countries with small and relatively concentrated populations such as Barbados, British Virgin Islands, Saint Kitts and Nevis, Saint Lucia and Sint Maarten, while in Dominica and Saint Vincent and the Grenadines a mixture of fixed broadband and narrowband Internet coexists amongst its schools. Fixed broadband connectivity represents a challenge for a number of relatively large South American countries with a substantial urban-rural digital divide and varying population density. Chile and Argentina for instance, where Internet is yet to be universal, have both types of Internet connectivity amongst schools. Finally, Uruguay, which has a very strong policy orientation regarding ICT and education, has been able to provide fixed broadband to 95% of primary and 100% of secondary schools, including both urban and rural regions, under the auspices of its ambitious *El Ceibal* project (UNESCO, 2011).

Some of the most underserved countries in the region provide evidence of a leapfrogging phenomenon in the integration of Internet connectivity. In Nicaragua, approximately 4% of primary schools and 9% of secondary schools have Internet connections, while in El Salvador the figures are 21% and 45%, respectively. However, it is noteworthy that all connections are fixed broadband and there are no data to support the existence of narrowband or other types of Internet connectivity.

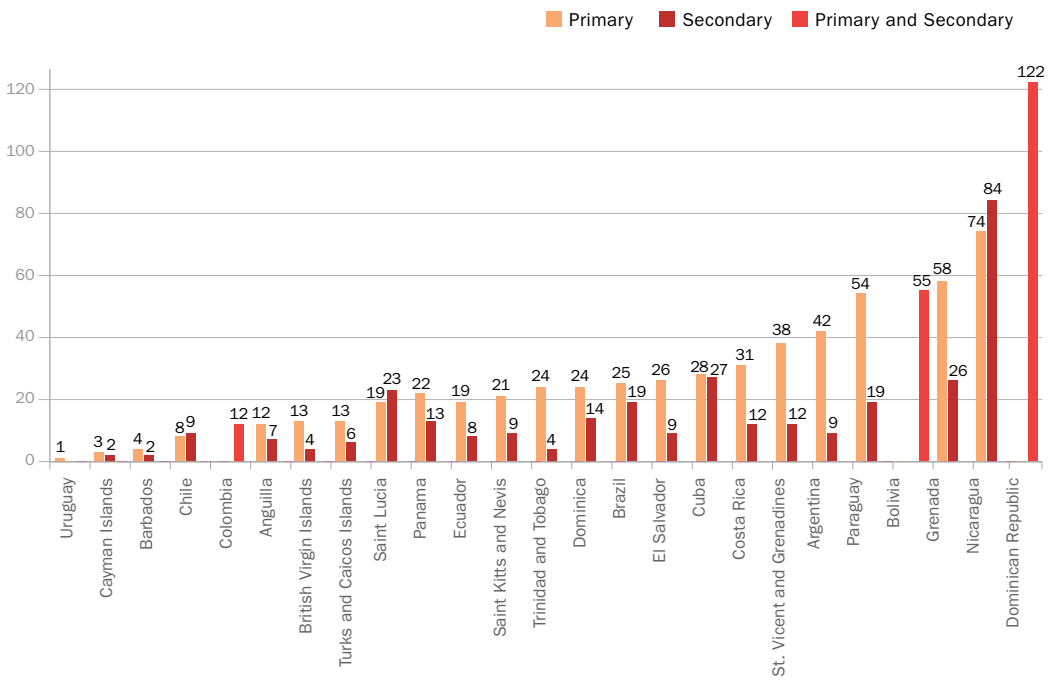
MAKING COMPUTERS AVAILABLE: ACCESS TO ADVANCED FORMS OF ICT-ASSISTED INSTRUCTION

There are various forms of ICT-assisted instruction available to policymakers in their efforts to revitalize and modernize education in Latin American countries. Older forms of radio-assisted instruction (RAI) and interactive radio instruction (IRI, such as the "I Play and Learn" programme (*Juego y Aprendo*) in Honduras, and the "Early Childhood IRI Math Program" in Paraguay), which are currently operating and have shown varying levels of success (EDC, 2012). Likewise, television-assisted instruction (TAI) is also currently used. The best known example in Latin America and the Caribbean is probably Mexico's *Telesecundaria*, which was launched as a means of using television to extend lower secondary school learning to remote and small communities at a lower cost than establishing conventional secondary schools (HINOSTROZA *et al*, 2011; UNESCO, 2012).

Keeping up with the evolution of ICT themselves and supported by advancements in basic infrastructure, including the spread of fixed broadband Internet, data from the UIS suggest the main emphasis for most countries in Latin America is on implementing various forms of computer-assisted instruction (CAI) and web-based learning/Internet-assisted instruction (IAI). However, in order to provide advanced forms of ICT-assisted instruction, adequate computer

resources must be acquired, keeping pace with demand based on enrolment. The learner-to-computer ratio (LCR) refers to the average number of learners per computer available for pedagogical use and measures the national level of computer access in aggregate education systems. While there is no international target, a high LCR indicates substantially less computer access per learner than a low LCR, since more students are required to share the same device. Moreover, this indicator measures the national level of computer availability and access in the education system; it does not provide information on the range of LCRs among all schools.

CHART 2
LEARNER-TO-COMPUTER RATIO IN PRIMARY AND SECONDARY EDUCATION, 2010



Notes: In Argentina, Barbados, Bolivia (Plurinational State of), Chile, El Salvador, Trinidad and Tobago, and Uruguay, data are for 2009. In Anguilla, secondary education data reflect the public sector only. In the Dominican Republic, Nicaragua, Saint Lucia, and Trinidad and Tobago, primary- and secondary-level data reflect the public sector only. In Uruguay, secondary-level data are missing. In Turks and Caicos, primary-level data include the lower secondary level.

Source: Unesco Institute for Statistics database.

Chart 2 shows that in countries where electrical infrastructure is lacking, such as the Dominican Republic (LCR of 122:1) and Nicaragua (LCR of 74:1), available computer resources are greatly overstretched. In Grenada where electricity is universally available in primary schools the lack of computer availability, as demonstrated by a primary level LCR of 58:1, can be attributed to relatively larger financial constraints faced by the country compared to some of its Caribbean neighbours such as Cayman Islands and Barbados where the primary LCR is 3 and 4:1, respectively.

At the other end of the continuum, each child has his or her own computer (1:1) in Uruguay, where it is national policy – through its El Ceibal project – to provide a free laptop computer to every child and teacher. In fact, Uruguay was the first country in the world to adopt the proposal of the One Laptop per Child (OLPC) Foundation, which manufactures the durable, low-cost XO computer specifically designed for children in developing countries. Having moved ahead with plans to similarly equip all secondary level students (MARTÍNEZ; DÍAZ; ALONSO, 2009), El Ceibal inspired several other countries in the region, which are cooperating with the OLPC Foundation to increase the availability of computers, including Argentina (42:1), Brazil (25:1), Colombia (12:1), Costa Rica (31:1), Guatemala, Jamaica, Mexico, Nicaragua (74:1) and Paraguay (54:1) (OLPC, 2013).

Seeking to address the educational inequity suffered in rural and remote areas, Peru's MOE targeted the first XO deployments to areas suffering from poverty, illiteracy and social exclusion. By 2009, Peru had more than 300,000 XOs deployed in more than four thousand schools, and is currently the world's leader in OLPC deployment (OLPC, 2013). Meanwhile, Venezuela has also been promoting rapid progress towards making computers available to primary pupils through strong financial investments to purchase almost 2 million *Canaima* laptops since 2009 to incorporate CAI in the classroom (REARDON, 2010; ROBERTSON, 2012).

In contrast to Uruguay, where emphasis has been on primary education, in most countries LCRs are lower for secondary education, suggesting that priority has generally been given to making computers available in secondary schools. For example, in Trinidad and Tobago the secondary level LCR (4:1) is approximately five times lower than the primary LCR (24:1), and in Argentina it is four times lower (9:1 versus 42:1).

PARTICIPATION IN AND USAGE OF CAI IN PRIMARY EDUCATION: ROLE OF GENDER

There are three aspects to the digital divide in Latin America and the Caribbean (LAC): i) the divide between LAC as a whole versus other regions; ii) the divide across states (e.g. large, predominantly rural countries versus small island countries); and iii) the divide within countries according to demographics, including socio-economic status, location (e.g. urban versus rural), culture and ethnicity. While the integration of ICT in education may help to bridge the digital divide, it may also exacerbate it in some contexts, for example, if particular groups tend to be systematically excluded from educational opportunities.

Gender may also have an impact on access to, participation in, retention and completion of education (UIS, 2010). If girls are to leave school ready to participate equally in the economy, then they too will require the benefits of ICT-assisted instruction, including the knowledge, skills and attitudes imparted by them. However, research in developed and developing countries shows a gap indicating that boys have more experience with technology than girls and are less apprehensive about its use (BLACKMORE *et al*, 2003; ITU, 2013). Fortunately, research also shows that greater experience with computers results in improved attitudes among girls, including those in developing countries (KOZMA *et al*, 2004; LINDEN *et al*, 2003). Meanwhile, other researchers have focused on differences in the manner in which girls and boys access and use ICT to learn and experience the world around them (SUTTON, 1991; VOLMAN; VAN ECK,

2001; VOLMAN *et al*, 2005). From this perspective, it is important to assess participation in programmes offering ICT as it provides a proxy measure of usage by both girls and boys. Based on enrolments in programmes offering CAI, data show that in most countries in Latin America and the Caribbean, girls are just as likely to be enrolled in programmes offering ICT as boys. Moreover, results do not shed light on potential differences in the intensity of use, nor on how the technology is being used.

Where enrolment differences based on gender do exist, national ICT resources tend to be less than universal or in some cases scarce. Most countries that demonstrate gender differences show enrolment rates in programmes offering CAI that favor males, suggesting a competition for resources. For example, in Grenada, 71% of males are enrolled in primary programmes offering CAI, compared to 62% of females, while in Nicaragua the proportions are 21% of males versus 13% of females. Saint Lucia provides an example of a country where primary level females have a slight advantage – 53 % of females are enrolled in programmes with CAI compared to 49% of boys.

WAY FORWARD

This paper has provided a general regional overview of e-readiness in Latin America and the Caribbean to integrate ICT across education systems. The paper begins by stressing the need for strong national commitment through policy development, as evidence shows a link between policy and the evolution of ICT integration. Most of Latin America and the Caribbean have adopted formal commitments towards reinvigorating education systems through the use of ICT; however, a few countries have not formally done so.

While policy development is essential, it is not sufficient for ensuring e-readiness in schools. While there are significant differences between countries, the region still struggles with infrastructure, particularly in rural areas. Nevertheless, many countries are making significant progress in establishing infrastructure and acquiring the hardware required to promote ICT-assisted instruction, particularly computer-assisted instruction. Nevertheless, challenges remain including establishing broadband Internet universally amongst schools in line with ELAC2015 goals, and decreasing learner-to-computer ratios, which are too high in many countries to allow sufficient time on task to enhance education through ICT

The current statistical framework aims to collect data on a wide ranging number of issues; however, at present much of the available data reflects infrastructure resulting in an *"inventory taking"* approach to the analysis of ICT in education. The UIS collects data on enrolment in ICT-assisted programmes; however, these data are a better measure of participation and are only proxies of ICT usage since they do not provide insight on intensity of usage nor how ICT are being used. Similar concerns arise in terms of the teacher data, which were not discussed in this paper but are vital to a fuller understanding of how ICT are being used in classrooms.

More data are needed on usage and on student outcomes, which should be sex-disaggregated; however, data have been difficult to obtain as they are not systematically collected by countries in their school censuses. While international student achievement studies including the OECD's PISA study, and IEA's TIMSS and PIRLS studies (covering mathematics and science and literacy), which apply scientific methods to monitor and evaluate the conditions of schooling

and the quality of education and their relationship to student achievement, include data on a few Latin American and the Caribbean countries, more national level data shedding light on usage and outcomes are needed. A recent study evaluating the impact of the *One Laptop per Child* (OLPC) program on children in Peru failed to conclusively demonstrate positive effects of computer usage on learning achievement. While computer usage increased substantially at school and at home for children with a LCR of 1:1, their learning achievement in maths and language were not different from children where the LCR was much greater than 1:1. While some positive effects were found regarding children's general cognitive skills, this investigation is still in its embryonic form; therefore additional efforts are greatly needed to shed light on the role that ICT may play in learning achievement and other student outcomes (CRISTIA; IBARRARAN; CUETO; SANTIAGO; SEVERIN, 2012).

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