SERIE

ISSN 1564-4162

políticas sociales

New information and communications technologies for education in Latin America: Risks and opportunities

Guillermo Sunkel
Daniela Trucco

NACIONES UNIDAS

CEPAL

@LIS2 - Alliance for the Information Society in Latin America and the Caribbean, phase 2

inclusion innovation development

Programme financed by the European Union

SERIE

167

políticas sociales

New information and communications technologies for education in Latin America: risks and opportunities

Guillermo Sunkel

Daniela Trucco

Social Development Division

Santiago de Chile, April 2011

NACIONES UNIDAS

CEPAL

European Union

@LIS

EUROPEAID CO-OPERATION OFFICE

This document was prepared by Guillermo Sunkel and Daniela Trucco of the Social Development Division of the Economic Commission for Latin America and the Caribbean (ECLAC), as part of a project financed by the European Union, Alliance for the Information Society, phase 2 (@LIS2), "Inclusive policy dialogue and sharing of experiences", Education component (CEC/08/003).

The authors are grateful for the valuable comments provided by Ignacio Jara, Enrique Hinostroza, Rubén Kaztman, Martín Hopenhayn, Magdalena Claro and Claudia Robles.

United Nations publication
ISSN: 1564-4162
ISBN: 978-92-1-121750-6
LC/L.3266-P
ORIGINAL: SPANISH
Sales No.: E.10.II.G.72

Printed in United Nations, Santiago, Chile

Contents

Tables

Figures

Executive summary

Over the last two decades, new information and communications technologies (ICT) have been incorporated into education systems around the world, as a way of enhancing the learning experience. Latin American countries have over this time made great efforts not to be left behind in this global trend. The first school-oriented ICT policies and programmes began to emerge in the late 1980s and early 1990s.

This process has been guided by the notion that ICT have the potential to alter the scenario in which they are introduced, and that they can facilitate the review and reformulation of prevailing practices, by promoting change and improvement in the structural conditions of education. The expectation has been that ICT would help meet the most important challenges that countries of the region face in the field of education. Those challenges include ensuring a high-quality education, improving the efficiency of education systems and guaranteeing equity in the different dimensions of those systems.

The main purpose of this paper is to present, in summary form, the process by which ICT are integrated and used in Latin American schools, taking an approach that has two distinctive traits. First, it views ICT as instruments for addressing the needs of the region's education systems. The point here is ICT for education and for development: ICT are not an end in themselves.

Second, this perspective highlights both the opportunities and the risks that ICT pose for education. It does not attempt to prejudge the meaning or the direction of the change that ICT make when they are introduced in schools.

It thus seeks to avoid an excessively optimistic view of the roles that ICT can play in education, and to introduce a more balanced view that pays attention to the risks inherent in the process.

The paper is organized as follows. The first section summarizes the educational scenario in the region, with particular reference to the challenges present in this sphere. This is followed by a survey of the state of the art —the findings from research and the principal topics of discussion— with respect to the contribution that ICT have made in addressing challenges relating to the quality, effectiveness and equity of education. The third section looks at the current status of ICT in terms of education policies and strategies. This is followed by an analysis of educational progress with ICT, based on a model that distinguishes access, use, appropriation and outcomes. The paper concludes with some suggestions for making more effective use of ICT in education.

I. The scenario

There is now widespread recognition of the contribution that education can make to the ethical, social, productive, cultural and political dimensions of the development of individuals. In this sense, ECLAC and UNESCO have for nearly two decades argued that education is the best way to achieve a dynamic economy with social equity, to build bridges of communication in multicultural societies, and to strengthen democracy through the full and unrestricted exercise of citizenship.

Although the central contribution of education for development is not new, it has acquired new force in recent decades, with the changes that globalization has brought to the patterns of production and the increased emphasis on information and knowledge, as well as the need to train citizens in the ethics of human rights and democratic participation. Hence the importance of preparing human beings for new ways of producing, participating and living together in society (ECLAC/UNESCO, 2004).

A. The key role of education in development [1]

Education constitutes a fundamental lever in the development approach proposed by ECLAC, which centres on equality. Universal access to education is the principal foundation for democratizing human capacity development and guaranteeing access to opportunities.

[1] The educational scenario presented here summarizes proposals that ECLAC has formulated in various documents, including ECLAC/UNESCO (2004), ECLAC/OIJ (2008), ECLAC (2009), ECLAC (2010), and ECLAC/OEI (2010).

If governed in accordance with the principles of equity and quality, education is the most important mechanism for social inclusion in the transition from one generation to the next. Conversely, greater social inclusion is also essential for making education supply and demand more egalitarian. Societies that offer a sound education for all have more equitable income structures. From an economic viewpoint, a society with high levels of education will increase its productivity and diversify its output, thus fostering a leap in technological development and adding ever more value to its products (ECLAC/OIJ, 2008).

The region has made undeniable progress since the early 1990s in the field of education. Monitoring of the Millennium Development Goals shows that the region is on track towards meeting the main education targets for 2015, with some differences between countries (ECLAC 2010d). Nearly all children of school age have benefited from at least some aspects of this progress.

Enrolment has increased at all education levels. This is due in large part to rising degrees of success in primary education, an essential step for promotion to the higher grades. Access to primary education is now almost universal. There have also been significant increases in net enrolment in the first and second cycles of secondary education.

B. Educational challenges

Nevertheless, progress in terms of access, advancement and graduation has not been uniform. ECLAC has demonstrated that, despite such progress, there remain great challenges in terms of educational equality (ECLAC, 2010). Among the most important challenges that countries of the region face are to ensure a high quality education, improve the efficiency of education systems and guarantee equity in all the dimensions of those systems.

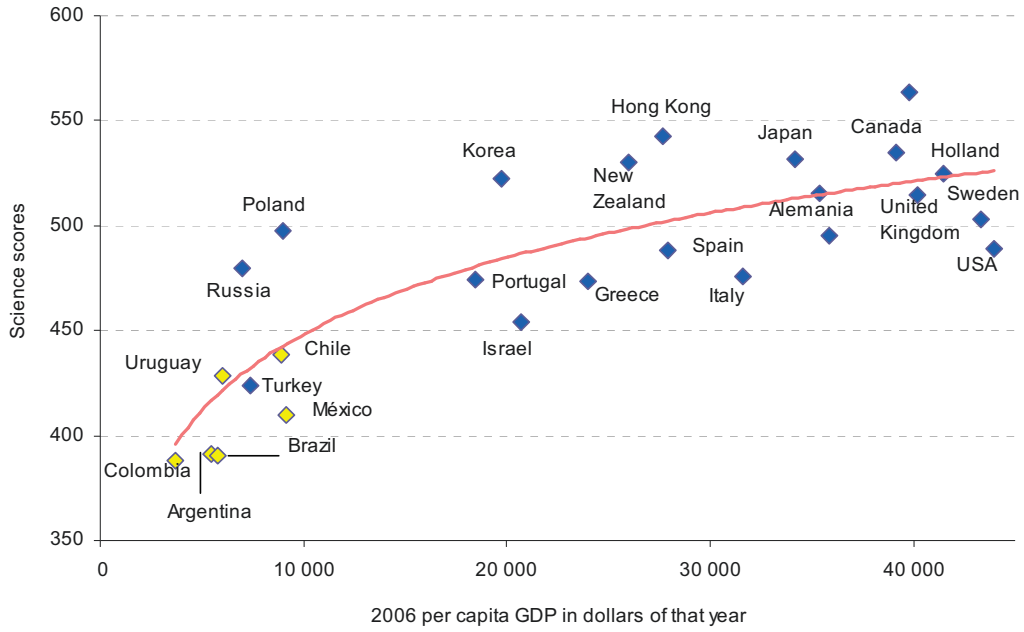
1. Ensuring a high-quality education

Governments in Latin America have committed themselves to improving the quality of education. A quality education must address students' many needs and be seen as relevant to their lives, while at the same time ensuring a common core of learning in order to build basic capacities for all citizens.

Educational quality is difficult to measure. In general, education research and policy decisions have focused on measuring quality through student performance in standardized national and international tests. Normally such measurements are confined to evaluating basic learning outcomes, such as language development, mathematics and in some cases scientific knowledge. Although measurement of this kind covers only a portion of the range of skills that children should acquire in school, the standardized measurements that have been conducted internationally have shown students in the region to have an alarming learning deficit in basic mathematics, science and language skills. Figure 1 presents the outcomes from the Programme for International Student Assessment (PISA) science test in 2006.[2]

[2] The Programme for International Student Assessment (PISA) was developed by the Directorate for Education of the Organization for Economic Cooperation and Development (OECD) to assess the extent to which students near the end of compulsory education have acquired some of the knowledge and skills that are essential for full participation in society. To date PISA has conducted three cycles of data collection, and at least three more cycles are planned to the year 2015. The 2000, 2003 and 2006 cycles focused on reading, mathematical and scientific literacy, respectively. Source: http://www.pisa.oecd.org.

FIGURE 1
LATIN AMERICA (SIX COUNTRIES) AND OTHER COUNTRIES PARTICIPATING IN PISA 2006 (18 COUNTRIES): AVERAGE POINTS SCORED ON THE PISA 2006 SCIENCE TEST FOR 15-YEAR-OLD STUDENTS, BY 2006 PER CAPITA GDP



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of PISA 2006 data and World Development Indicators of the World Bank.

The challenge that countries in the region face is to ensure that all the efforts they are making to increase levels of public education will be reflected in learning outcomes. This will require an in-depth review of the critical factors that limit the quality of teaching, as well as strategies to enhance the cultural relevance of learning and to develop the skills needed to live in an increasingly complex world.

2. Improving the efficiency of education systems

Educational efficiency is measured in terms of the optimal use of resources to raise public education levels. High repetition, late-entry and dropout rates are sure signs of inefficiency. Despite a slight drop in repetition rates, many countries of the region still have serious problems in moving students through the system. Students who fall behind and remain in the system beyond the prescribed age constrict the resources available for those students who progress normally for their age. Grade repetition has a considerable cost for education systems (ECLAC/UNESCO, 2004).

The challenge, then, is to eliminate what has become a "culture of repetition". This means reducing late entry to zero, correcting over-age problems, and facilitating the flow of students through the different grades. To this end, it will be necessary to consider new teaching strategies to replace policies of automatic grade promotion, the effects of which merely mask the real situation of low performance (ECLAC/UNESCO, 2004).

On the other hand, optimizing the use of resources to raise public education levels, and to improve the efficiency of the education system, will require better "school management", including the management of economic and human resources. This entails, among other aspects, improving the collection and processing of data on such aspects as student dropout and repetition rates.

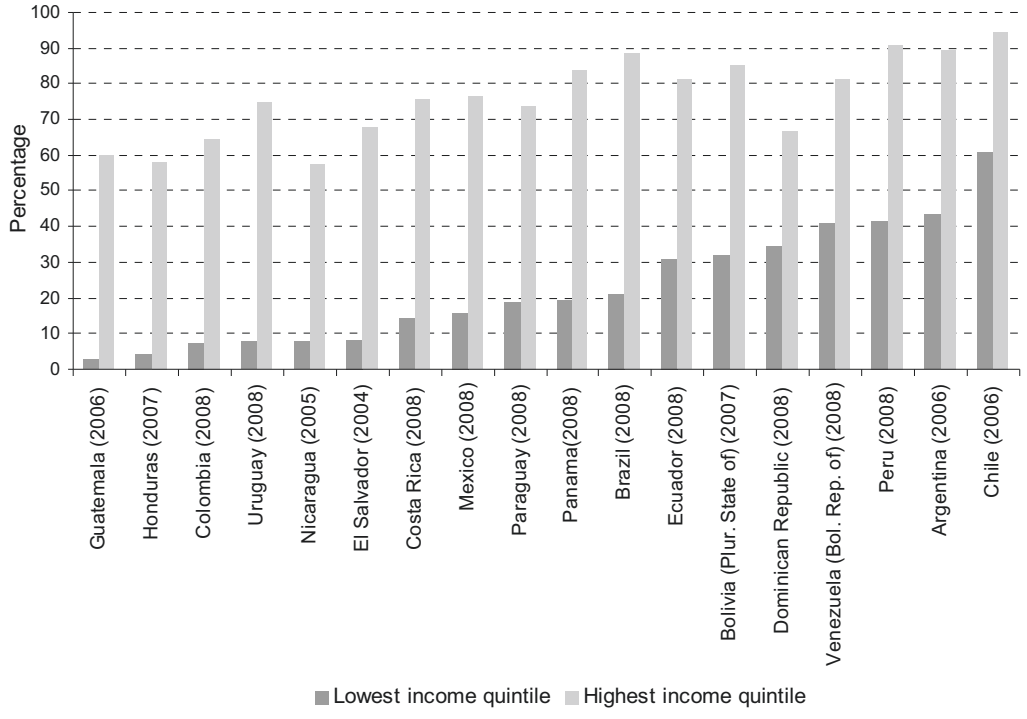
3. Guaranteeing educational equity in its different dimensions

The great challenge for a region with high levels of inequality is to ensure that educational opportunities are distributed equitably to the entire population. Equity remains a distant goal: there is a persistent social divide in educational access, participation and outcomes.

Social differences in access to and graduation from the education system still represent fundamental problems in the region. "Although in most countries the lower cycle of secondary education is compulsory, there are a number of factors that conspire against efforts to keep low-income youth in school: these include the shortage, poor quality or inappropriateness of the education offered, late entry, and the need to join the workforce. (...) This situation is even more pronounced in graduation data for upper secondary school. This is the level where students are supposed to develop more specialized skills, normally intended to take them on to higher education or, less frequently, to allow them to join the workforce immediately. For low-income youth, this lack of any meaningful connection between educational contents and their socioeconomic reality is an additional disincentive to completing secondary school" (ECLAC/OIJ/SEGIB, 2008).

ECLAC has repeatedly proposed that a completed secondary education is the minimum educational threshold for lifting people out of poverty. In other words, students need 12 years (or 11 years, depending on the country) of formal education if they are to succeed in joining the labour market and secure a minimum standard of living in the future. Consequently, secondary education deserves close attention in terms of its coverage, accessibility and quality, especially in its upper cycle, which is precisely where dropout rates are now the highest (see figure 2).

FIGURE 2
LATIN AMERICA (18 COUNTRIES): GRADUATION FROM UPPER SECONDARY SCHOOL, BY LOWEST AND HIGHEST PER CAPITA INCOME QUINTILES



Source: Economic Commission for Latin America and the Caribbean (ECLAC), based on special tabulations from household surveys conducted in the respective countries.

The significant stratification and segregation of Latin American education systems is also reflected in sharp divides in terms of academic outcomes and the skills acquired by students from different socioeconomic levels. Instead of overcoming inequalities of origin, the school system frequently ends up reproducing them. Educational performance measurements consistently show that students in private institutions achieve better academic results than those in public institutions, reflecting the fact that segmentation in education is associated with parents' ability to pay for private schooling.[3]

As a result, policymakers in the region face major challenges in making education a real lever for development with equality. The concern for equity implies a dual challenge for policymakers. On one hand, it demands efforts to transform the system from within in order to make it less segmented in terms of quality and outcomes. On the other hand, it means boosting demand for education among the more disadvantaged social groups so that they can complete the years of schooling needed to overcome inequalities of origin.

C. ICT for education

ICT have been incorporated into the educational environment on the assumption that they are tools that will help address the major challenges that countries of the region face in this field. In fact, the region's very first efforts to incorporate ICT into education, in the late 1980s, treated these new technologies as a priority for reducing the digital divide, modernizing the learning process, and developing students' information processing skills and cognitive abilities. ICT were also expected to bring greater efficiency to the institutional and academic management of schools (Hilbert, Bustos and Ferraz, 2005).

The notion that incorporating digital technologies into education would help resolve the great challenges in this area is part of the approach that, in debates about ICT and development, has been called "development with ICT". In contrast to the sectoral perspective of "development of ICT", which stresses the industrial aspect and views technological development as an end in itself, the "development with ICT" perspective conceives technology as a way of fostering more inclusive social, human and economic development, and as an approach that takes the different aspects of development into account in the transition to information societies. This second perspective represents the current trend, which seeks to use the potential of these technologies to address the great challenges on the development agenda. ECLAC has proposed that policies should move toward the second perspective, with a focus on "ICT for development" (Peres and Hilbert, 2009).

The concept of "ICT for development", which takes ICT as tools that enable sectoral developments, can be found in the principal international references on policies for using ICT in education: the World Summit on the Information Society, which was held in two stages (Geneva in 2003 and Tunis in 2005), and the two regional ministerial conferences of Latin America and the Caribbean, which called for efforts to create a regional perspective on the development of

[3] According to ECLAC (2007), educational segregation is one of the factors associated with differences in educational outcomes. "One of the common problems in education systems is the socioeconomic and geographic segmentation of service quality. Wealthier parents prefer to send their children to schools with more resources, and those schools usually favour the entry of pupils from families with higher levels of well-being. Those from lower-income backgrounds, on the other hand, often have a very small number of educational options. The schools that take low-income pupils tend to have shortcomings in terms of infrastructure, educational inputs and the number and training level of teachers. These are almost always public schools in low-income or rural areas, where they are practically the only school available for nearby students. Broadly speaking, education systems have schools for the poor and schools for the rich. This "self selection" process, which tends to be concentrated at the two ends of the social spectrum, can turn schools into "ghettos", with both high-income and low-income school communities (educational segregation). This results in some schools having environments conducive to learning and skill-building, while in others difficulties are more likely to be generated. There are also considerable differences in the quality of educational supply." ECLAC (2007) *Social Panorama*, p. 178.

information societies.[4] The first regional ministerial conference was held in Rio de Janeiro in 2005, and resulted in the Rio de Janeiro Commitment which instituted the action plan known as eLAC 2007. The second regional ministerial conference took place in El Salvador in 2008, and adopted the San Salvador Commitment, which gave rise to the second plan of action, eLAC2010.[5]

Here, it is important to note that in eLAC2010, which calls for a set of strategies to promote the use of ICT for development, education has been identified as the first priority. This reflects the thrust of the programme in favour of a more comprehensive human and social development, or development *with ICT*, in which education plays a fundamental role. It has also served to mark out space on political agendas in the region and to instil the concept that *education is a strategic space in the transition to the information society as well as a path for achieving equity*. In particular, the notion of "inclusive education" has become a priority for fulfilling the Millennium Development Goals.

[4] Beyond the Declaration of Principles and Plan of Action adopted at the World Summit on the Information Society, the Millennium Development Goals have also been taken as a strategic guide in the preparation of regional plans.

[5] The eLAC2010 action plan, which was agreed by its 33 member countries, is a step towards achieving the targets of the Millennium Development Goals and the World Summit on the Information Society.

II. The state of the art

Incorporating digital technologies into education is not a new issue in Latin America. Some countries in the region have had projects under way for two decades to promote ICT for education. For example, Costa Rica's National Programme of Educational Informatics was launched in 1988 to improve the quality and equity of educational opportunities for low-income students, introducing new learning environments into schools through the use of digital technologies. It adopted a novel conception of education as developing the skills necessary for lifelong learning. Some years later, in 1992, Chile launched its Enlaces programme, which was also intended to improve the quality and equity of education. Several other countries —Argentina, Brazil, Colombia and Mexico— also undertook initiatives in this direction during the 1990s. Most of the remaining countries in the region have joined the process since the year 2000.

It is appropriate to ask, now that these programmes have been in place for some time, to what extent ICT have fulfilled their promise of helping to address the region's great educational challenges. What have they contributed in fact? This section reviews the state of the art with respect to the contribution of ICT in addressing major educational challenges. It presents the main research findings and the issues that are currently the subject of international debate.

A. ICT and the quality of education

With the incorporation of ICT into the region's schools, the expectation was that they would help improve the quality of education. Educational quality commonly refers to the characteristics of the educational services offered. However, quality assessments focus on educational outcomes and, in particular, on academic performance.

There is an important line of research that seeks to assess the impact of ICT on students' learning.[6] While there is evidence that this impact is positive, it is not sufficient as yet to draw firm conclusions. The findings are often mutually contradictory and are obtained in very particular circumstances that do not lend themselves to generalizations. Two exceptions, however, are worthy of note. First, one of the most consistent research findings is the impact of ICT on intermediate variables such as student motivation and concentration. This is associated with the dynamic and interactive possibilities that ICT offer for presenting concepts (such as animation or simulation). Second, the use of ICT has a direct effect on "digital literacy", i.e., learning the skills needed to work with those technologies. This means essentially the capacity to master the most relevant ICT applications. Learning these skills is an important factor for equity in policies to promote ICT in education, especially in developing countries where only a few homes have access to the new technologies.

On the other hand, with large-scale studies —which are based on standardized national and international tests and are analysed at a single point in time— it is generally not possible to isolate the net effect of ICT use.

Above all, research to date shows that the relationship between the use of ICT and the learning of academic subjects is not linear, and more complex models must be explored to consider the various dimensions that are concealed within that relationship. There appear to be at least three dimensions requiring more in-depth study.[7]

The first dimension has to do with the relationship between types of ICT use and the outcomes in terms of learning subject matter. On this point, it has been shown that positive outcomes are normally associated with particular uses of ICT that facilitate the learning of specific concepts. Consequently, when conducting large-scale comparative studies it is important to ensure that the tests are designed and based on a thorough knowledge of the uses that students make of ICT, and the probable impact of those uses on the student's learning and thinking process (Cox and Marshall, 2007).

A second dimension refers to the academic and teaching conditions in which ICT are used. It is very important that conditions of access should be adequate, that the teachers should have the capacities, attitudes and vision for integrating ICT into the curriculum, and that the school administration should show the leadership that will facilitate the use of ICT in all disciplines. It is also important to have an institutional and political context that will generate the conditions and provide the guidance that are needed for the use of ICT in schools.

Lastly, a third dimension refers to the role of social characteristics (cultural, social and economic capital) and individual characteristics (gender, cognitive capacity and attitudes) of students in the appropriation and use of technologies. This dimension implies a different approach to the impact of ICT on student learning by effectively inverting the question to ask, how prepared are students for using ICT in ways that will benefit their learning?

[6] For further information on the state of the art with respect to this issue, see Claro (2010).

[7] The state of the art concerning this important aspect has a certain bias towards research in English-speaking countries, where it has been the most relevant and influential. Studies in this area have begun only recently in Latin America. See for example Barrera-Osorio and Linden (2009). The use and misuse of computers in education: evidence from a randomized experiment in Colombia. The World Bank, Washington.

Associated with this last dimension is the concept of the "second digital divide", which raises the need to consider differences not only in terms of access to ICT and the development of skills for working with them, but also in terms of the capacities of students in different sociocultural contexts and with individual characteristics to make effective use of technology for learning. The idea emerged from analysis of the PISA 2006 results, and is cast as follows: "The first digital divide has faded in schools but a second one is emerging. In nearly every OECD country, all students attend schools equipped with computers, 88% of which are connected to the Internet. However, there is still a digital gap related to home access. In the light of the results of this study, it can be concluded that the importance of the digital divide in education goes beyond the issue of access to technology. A second form of digital divide has been identified between those who have the necessary competences and skills to benefit from computer use and those who do not. These competences and skills are closely linked to the students' economic, cultural and social capital" (Pedró 2009, p.13).

On the other hand, another current of research suggests that the difficulty in finding learning effects can be explained by the fact that exposure to ICT affects students' learning in ways which may not be reflected in standardized achievement tests but which are nevertheless essential for developing effective learners in the knowledge society (McFarlane and others, 2000). These other kinds of learning refer essentially to the skills needed to cope with the enormous volume of information that ICT offer —skills for managing, organizing and evaluating information and for participating in present-day society, in which knowledge creation is central.

These are what have been called "twenty-first century competencies" (or ICT competencies for learning). On this point it has been noted that "today, and in the context of debate over curricular reform for the 21st century, functional ICT competencies are considered insufficient. First, because the competencies and skills that citizens require to be successful cannot depend on the functional characteristics of technologies, which are constantly evolving and changing. And second, because if people are to participate actively and contribute to the knowledge society they must not only master ICT applications but must also be able to resolve problems and be creative in using these tools. Consequently, there is a new focus for defining and evaluating ICT competencies, called 'ICT competencies for learning', which goes beyond the functional definition of working with ICT applications and embraces a broader definition that considers skills relating to the thoughtful and creative use of those technologies" (Claro and others, 2010).

From this perspective, the challenge is to design new instruments for measuring skills of this kind, as today's standardized tests are for the most part designed to measure the level of factual knowledge of a given subject matter. A number of national and international initiatives have sought to promote the design and implementation of new evaluation instruments. Internationally, there are initiatives such as the Partnership for 21st Century Skills (www.21stcenturyskills.org), the Intel, Cisco and Microsoft Initiative "Transforming Education: Assessing and Teaching the Skills needed in the 21st century (www.atc21s.org), or the "International Study of Computer and Information Literacy" (ICILS) sponsored by the International Association for the Evaluation of Educational Achievement (IEA). At the national level various initiatives are found such as the ICT Literacy programme in Australia (www.curriculum.edu.au) and the project developed as part of the Enlaces programme by the Ministry of Education of Chile, called "ICT Skills for Learning".

Lastly, another current of research that is gaining importance looks at what students are learning as a result of informal use of ICT outside the classroom. It has been found that many students today make more intensive use of ICT outside school than within it, and consequently new generations are learning things in unintended ways that are just as important to study (McFarlane and Kirriemuir, 2006; Pedró, 2008; Rosas and others, 2002; Squire, 2003; New Millennium Learners Project, at www.oecd.org/edu/nml.

To sum up, research has placed us today in a better position to understand the diversity of the potential impacts of ICT. To differing degrees, for some of those impacts, research is also being carried out into when, where and under what conditions the impact of ICT on student learning may be manifested. As noted earlier, research has shown that the relationship between ICT use and the learning of subject matter is not linear, and therefore different dimensions of that relationship have been considered. How ICT affect the learning of other skills that are required for the knowledge society is another current topic.

B. ICT and educational efficiency

The expectation with the incorporation of ICT into schools in the region was that this would make education systems more efficient. Educational efficiency is measured in terms of the way resources are used to raise public education levels, by reducing repetition, late-entry and dropout rates. In turn, this presupposes improved "school management", which includes the management of economic and human resources (teachers, principals, administrators, etc.), students (enrolment, grades, teachers' remarks), parents and guardians (background, communications), subjects (timetable planning) and teaching (curriculum planning, monitoring compliance with the curriculum, classroom plans).

There is a line of research, albeit less developed than the one focused on student learning, which offers an overview of the impact of ICT on the way education is processed, administered and organized.[8] The evidence points to the need for a more in-depth study of education management at different levels.[9]

The first level refers to the education system itself. In fact, one of the most important impacts of digital technologies has been to induce greater transparency in the education system at the national and local levels. As tools that allow the collection and processing of data as well as the dissemination of results, they have made it possible to monitor the system more effectively. Specifically, they allow the collection of data on enrolment, student attendance, basic information on teachers, and basic data on schools, thereby giving a better idea of the size of the education system, student dropout and repetition rates, and the number of students per teacher, among other aspects (Carnoy, 2002). On the other hand, ICT offer tools such as the Educational Management Information System (EMIS) which provides information not only on inputs into the system but also on processes, educational outcomes, resource use and the effectiveness of learning techniques.[10]

Carnoy (2002) argues that this advantage of ICT for collecting and processing data as well as for disseminating results has been used mainly from the top down as a tool of control and encouragement to obtain greater efforts in the different parts of the system, but not to improve its "productivity" (i.e., student performance), as has occurred in private enterprise. He notes that ICT are an ideal tool for systematically monitoring how much each student is learning or tracking how closely the teacher is following the curriculum, by analysing test results. He suggests that while some good administrators use these data to improve student performance, this is far from being a widespread practice. According to Carnoy, the main reason for the limited use of ICT-facilitated information for improving results is that administrators and teachers lack the necessary analytical skills and abilities. Few secondary school principals or teachers are trained in using basic tools such as Excel and Edusoft and in applying them to assess student performance. Data analysis is highly centralized, and does not reach down to the local or school level. Carnoy recommends that

[8] The following discussion is a summary of the report prepared by Claro (2009) for the education component of the @LIS2 project.

[9] The state of the art with respect to the impact of ICT on school management, as well as the issue of student learning, is biased towards research in English-speaking countries.

[10] EMIS is a system that provides analysts and decision makers with information not only on inputs into the system but also on processes, educational outcomes, resource use and the effectiveness of learning techniques.

teachers should learn to use ICT-based administrative tools and to perform rudimentary statistical analysis as part of their initial training (Carnoy, 2002, pp. 9-11).

As well, from the viewpoint of education systems, "what is most important is the amount of resources and time required to establish a fully operational EMIS in the developing world. Unless adequate levels of resources are provided it is impossible to establish the systems and procedures necessary to ensure that a sustainable demand exists for EMIS outputs. Unlike countries in North America or Western Europe, those in the developing world often lack the institutional structures and capacity that help generate a demand for EMIS data [...]. The links between institutional building, capacity development and data utilization cannot be underestimated and [to construct them will require] time, significant resources and political commitment, without which EMIS will continue to experience difficulties and not be sustainable over the medium term" (Powell, 2006, p. 37).

A second level refers to management of individual schools. Evidence thus far suggests that digital technologies have gone some way to enhancing the efficiency and openness of schools and to developing greater collaboration within and outside the school. The impact of ICT on school management can be seen in the drive for more teamwork among teachers.[11] more efficient daily classroom planning and preparation by teachers,[12] and support for a series of administrative activities within the school, including attendance and evaluation records, reporting to parents, financial administration and the sharing of information among the team —and to a lesser extent, greater communication between the school and the student's family.[13]

A third level refers to curriculum management in the classroom. Here, ICT have produced some changes in the way the curriculum is organized and imparted. Of particular note is the emergence of "virtual collaborative learning environments". The importance of connectivity, intranets and networks in schools and other education institutions has helped to build recognition that digital technologies can support virtual learning environments that replace or complement classroom work. The developers of these environments have created products for exploiting this, known as Virtual Learning Environments (VLE), Learning Management Systems (LMS), virtual campuses and online learning platforms. In general, VLE or LMS are Internet-based systems designed to support teaching and learning in educational environments and they provide tools that facilitate the management and organization of the teaching/learning process, such as evaluation tools (in particular the kind that can be automatically marked, such as multiple choice tests), communication tools, uploading contents, returning work to students, peer evaluation, administration of student groups, gathering and organizing students' grades, questionnaires, and student monitoring tools.

In short, current research presents an overview of the possible impacts of ICT on the ways education is processed, administered and organized on three different levels. However, there is little evidence as to the real impact of technologies on school management. At the same time, taking advantage of ICT in this dimension clearly requires the capacity to use information systems, as well as cultural changes (more complex) which typically go beyond the players in the education system. Consequently, these are systemic changes that are complicated to implement.

[11] Broadband is a major factor in increasing collaboration between teachers. Teachers benefit from broadband in several ways (Balanskat and others, 2006). These include new ways of communicating between staff, and between staff and pupils, better and faster access to learning resources, and so forth.

[12] The Empirica study (Empirica, 2006) provides evidence that the great majority of teachers in Europe (90%) are already using ICT to prepare their lessons, and that ICT can equip teachers to cooperate more and to share teaching plans with their colleagues and administrators, which saves time in class preparation.

[13] Research into ICT-facilitated home-school links has found that these can foster the development of effective relationships between schools and parents, through e-mail communication, resulting for example in greater parental involvement in their childrens' education in general (Becta, 2003, quoted in Condie and Monroe, 2007, p. 72). Work can be transferred more readily between school and home and pupils can receive tuition when absent from school, accessing a range of curriculum resources via the school's website (Condie and others, 2005; Livingstone and others, 2005 in Condie and Munro, 2007, p. 72).

C. The social impact of ICT

Another key expectation surrounding the incorporation of ICT in the education system in the region was that it would have a social impact. Social impact is understand to mean the contribution of the education system to narrowing the digital divide and providing access to computers and the Internet for the most disadvantaged segments of the population. In other words, the expectation has been that efforts to use ICT in education will contribute to social integration, forestalling the social polarization that would result if large segments of the population were denied access to the new opportunities offered by technology. Hence the strategic importance accorded to the education sector in the region, treating it as a key forum for reducing the digital divide.

This concept of the social impact of ICT programmes for education takes on particular relevance in the context of the current digital revolution, which holds enormous possibilities for activating either virtuous or vicious synergies from the viewpoint of social equity and integration. As Kaztman notes, the ongoing digital revolution can facilitate social inclusion and universalization of civil rights or, on the contrary, it can lead to more polarized and more fragmented societies. Unless guided by public policy, the mass dissemination of ICT will be handed over entirely to the market, reproducing existing social divides and creating new and rapidly growing differences. The education system is expected to fulfil an essential role in this respect, as the main State institution capable of disassociating social origins from outcomes in those areas of ICT that enhance opportunities for full participation in the mainstream of society (Kaztman, 2010).

Current research indicates that students' social and individual traits influence not only their access to technological equipment but also the way they use that equipment and the benefits they derive from it. In more developed countries, where access to digital infrastructure is not a central problem, there is now concern over the so-called "second digital divide" (Pedró, 2009). As noted earlier, this concept suggests that the importance of the digital divide in education goes beyond access to the technology and refers as well to differences in the capacities of students from different sociocultural backgrounds and with individual characteristics to make effective use of the technologies for learning.

Although, despite efforts in the education field, the region has yet to overcome disparities in access to digital technology, the concept of the second digital divide is nonetheless relevant. Yet, in contrast to the prevailing "evolving" model of ICT adoption, in Latin America this refers rather to divides that operate simultaneously. The access gap, which is still substantial, is now compounded by a second gap of use and appropriation. Consequently, the concept is relevant in Latin America since it indicates the risk that the mass dissemination of ICT could be generating new and rapidly growing differences.

One important approach to research on the social impact of the incorporation of ICT into the school system is "pro-equity", which is associated with the notion of inclusive education and the Millennium Development Goals. This approach looks at the contribution of ICT projects in the education sector in terms of reducing the digital divide among disadvantaged social groups (Wagner, 2005). The approach is consistent with the Millennium Development Goals, which are very clear as to the need to promote equity between social groups and, in particular, gender equity, equity for disabled persons (with special education needs) and equity for "marginalized" population groups (primarily ethnolinguistic groups).

In the first place, there has been little research into the impact on indigenous and marginalized groups of ICT in education. Although ICT are being used increasingly in pilot projects in support of education for ethnolinguistic groups in developing countries, there are few studies on the impact of those programmes and on the lessons learned (World Bank, 2008).

However, it is clear that ICT interventions in education targeted at indigenous peoples must be placed within the social and cultural context that frames the education of those groups. In this respect, language appears to be a key factor of marginalization in the digital age (Wagner, 2005).[14]

Second, there is an important line of research into the issue of gender in relation to ICT for education, primarily in OECD countries.[15] The topic has been posed in terms of the "gender digital divide" in the sense that women have more limited access than men to ICT in education settings. Yet, regardless of access, research also tends to show that female students' motivation and learning in ICT programmes for education tend to equal or exceed that of male students. Moreover, there are differences between male and female students as to their attitudes, preferences and uses of ICT, both in school and in other settings (Tomte, 2008). It has been pointed out that male students spend more time in front of the computer and make greater use of it for playing games, while women use it more frequently to communicate (Huyer, 2003). On the other hand, while there is general recognition of the need to systematize lessons learned in order to guide educational practices, little progress has been made in this respect.

Third, in the more developed countries the new technologies have long been considered a special tool to help people suffering from some physical or psychological disability and who therefore have "special education needs". The central question here is whether people with "special education needs" require particular technological devices adapted to their needs (and therefore different from the "ordinary" devices used in educational contexts), which have been called assistive technologies, for example, voice recognition technologies for the blind (Wagner, 2005). It should be noted that while assistive technologies for learning have been in use for a long time in industrialized countries, in Latin America they are just beginning to receive the attention they warrant.

Generally speaking, research in this area has focused on issues of ICT access as it relates to equity. However, little research has been conducted into the ways in which specific uses of ICT may impact upon equity (World Bank, 2008). In fact, much of this research has focused on the impact of ICT on learning, while social and cultural issues that affect students and teachers have been glossed over. Similarly, adopting a sociocultural approach allows analysis of the social impact from two important perspectives.

On one hand there is an emerging perspective (Katzman, 2010), attuned to Latin American reality, which considers differences in social capital and their effect on seizing the opportunities that new technologies offer students. The segmentation of schools in the region, often reflected in the division between public and private schools, illustrates this point. Students from higher-income families are usually overrepresented in the social composition of private schools, but underrepresented in public schools. As those students are more likely to have digital equipment at home, teaching practices in private schools will generally benefit from a greater density of students socialized in digitalized family environments.

The higher the proportion of children in a school who have been socialized in digitalized family environments, the greater the likelihood that the peer groups that form there will share digital codes and languages, establish fertile networks for exchanging information and experience in the virtual world, and in this way be able to progressively enrich their individual digital skills. This brings with it the risk of an exponentially widening gap vis-à-vis students in schools where this kind of supportive environment does not exist.

[14] "Language is an exceptionally important marginalizing factor in the digital age. One reason for this is that the Internet itself is not language-neutral. Research shows that English is more present on the World Wide Web (approximately 32% in October 2005) than any other language, and is about at parity with the next nine most prominent languages combined. Interestingly, the dominance of English has dropped somewhat from an even greater dominance only a couple of years ago (65% in mid-2001)" (Wagner, 2005, p. 59).

[15] There has been very little research on this issue in Latin America and the Caribbean.

Lastly, another useful approach stresses the changes in social relations that emerge as a consequence of these programmes.[16] The focus here is on the changes that occur in intergenerational relations, both in the teacher-pupil relationship and in the relationship between pupil and parents —in particular, when the student's mastery of digital techniques affects the self-esteem and security of the adult who accompanies the student in the education process.

Within the school, the integration of digital media can generate significant tension for the teacher and for the traditional organization of classroom work, especially because of the dynamics of independent and individualized learning that these technologies incorporate. In addition, family dynamics can be transformed when students are faster to develop digital skills and acquire a role as transmitters of certain types of knowledge. This implies reversing the traditional role of parents as vertical transmitters of knowledge and reinforcing the school education process, which may produce tensions especially in socially disadvantaged households.

In summary, research on the social impact of ICT is a strategic field for activating virtuous synergies for social integration through public policies. The pro-equity approach is key to understanding the contribution of ICT in education to reducing the digital divide among disadvantaged social groups. Also key is the sociocultural focus which examines changes in social relations as well as how social capital affects the ability to seize the opportunities offered by new technologies. However, both perspectives are important in developing more effective responses to the need for public policy guidance.

[16] See Martínez (2010).

III. The situation in the region

The previous section presented the principal findings from research —and the points that are currently being debated internationally— with respect to the contribution that ICT has made in addressing the main educational challenges. However, if the "educational promise of ICT" is to be fulfilled, some minimum conditions must be met.[17] The existence of a policy for ICT in education is a fundamental condition if ICT are to contribute to meeting the great educational challenges, and it is such a policy that will make it possible to develop those conditions.

A. Policies for ICT in education[18]

Many countries in the region have made significant progress in recent years in integrating ICT into the education sector. As part of that process, many of them have implemented policies for ICT in education, involving the creation of institutions and the allocation of significant resources. Moreover, there is now a vision of education as a strategic field in the process of transition to the information society.

Much international attention is now focused on the need for a formal ICT policy, and international agencies such as the World Bank and UNESCO are calling for the formalization of such policies (see, for example, the ICT policy formulation tool promoted by UNESCO at www.ictinedtoolkit.org).

[17] The education goals contained in eLAC2010 may be viewed precisely as necessary conditions for integrating ICT into education.

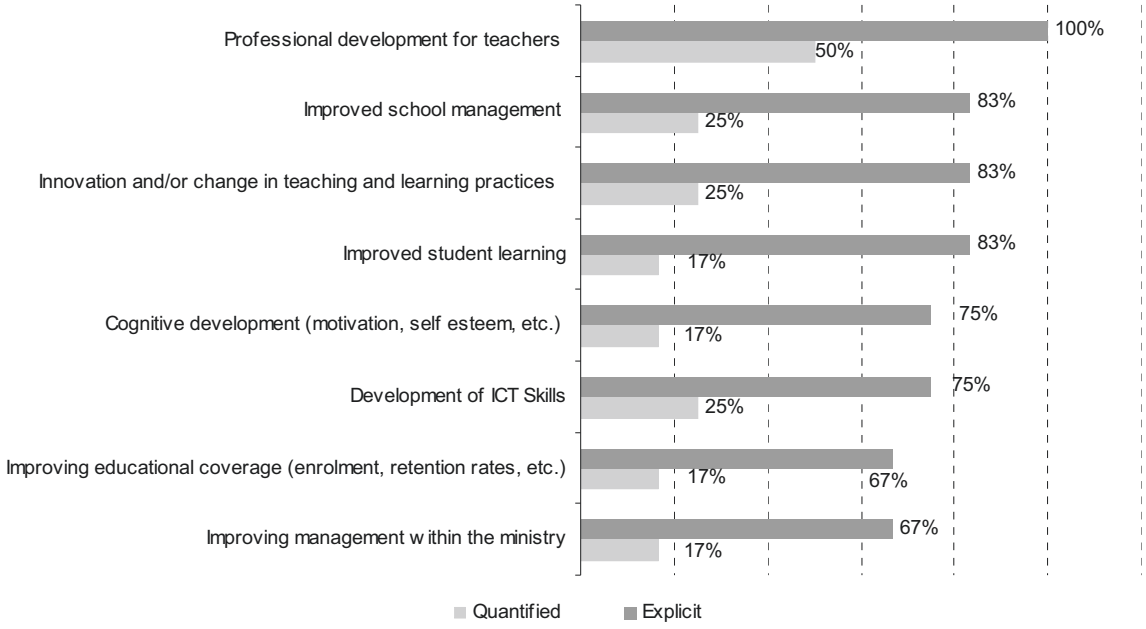
[18] This section is based on the study entitled "*Políticas de Tecnologías de Información y Comunicación en Educación en Latinoamérica: Perspectivas internacionales, realidad y proyección*", now being prepared by Enrique Hinostroza for the education component of the @LIS2 project.

A study commissioned by the Ministry of Education of Chile on the development of education technology policies in the region suggests that progress in this area has been limited (Hinostroza, 2009). Only one third of the 18 countries covered by the study have published an official policy for ICT in education. However, that information contrasts with the fact that the great majority of countries (92%) have a specialized unit dealing with education technologies within their ministries of education.

In relating the development of policies for ICT in education (their degree of formalization) to that of ICT policies in general, we see that while several countries are pursuing coordinated development in both dimensions, in most countries these policies are being pursued independently (Hinostroza, 2009).

With respect to targets on policies for ICT in education, figure 3 shows that many countries have focused their initiatives on professional development for teachers (primarily in ICT competencies), improving school management, improving student learning, and achieving innovation and/or change in teaching and learning practices (Hinostroza, 2009).[19]

FIGURE 3
POLICY GOALS



Source: Hinostroza (2009).

These goals are in keeping with international trends, indicating aspects that have been recognized as crucial for achieving effective ICT use in education, such as professional development for teachers (Barber and Mourshed, 2007). Less frequent goals are to improve management within the ministry of education and to expand educational coverage (enrolment, retention rates, and so forth). As noted earlier, however, over-age enrolment and retention are the main problems that the region's education systems face, particularly in secondary education. This suggests that policy goals for ICT in education are not fully attuned to the main challenges of educational development.

[19] The Hinostroza (2009) study includes information for 18 countries in the region: Argentina, Bolivarian Republic of Venezuela, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Plurinational State of Bolivia and Uruguay.

Regardless of the degree of policy formalization, country initiatives can be classified into four areas: infrastructure, training, digital education resources, curriculum and evaluation. Using this classification, with data from Hinostroza (2009), figure 4 shows the percentage of countries engaged in different kinds of action in each area.

When it comes to infrastructure, most countries are installing computers in classrooms and providing technical support and Internet access. Slightly under one half are delivering computers to teachers, and only a third are concerned with providing infrastructure. Contrasting these actions with the most frequent goals (professional development for teachers), it emerges that only half of the countries are delivering computers to teachers.

With respect to training, most countries are pursuing efforts to train teachers in ICT use, both generally and pedagogically, and somewhat more than half are taking initiatives to form virtual communities of teachers. Half the countries are taking steps to integrate ICT use in initial teacher training or to train teachers in using ICT in support of school management. Finally, only a third of countries include initiatives for training pupils in the use of ICT.

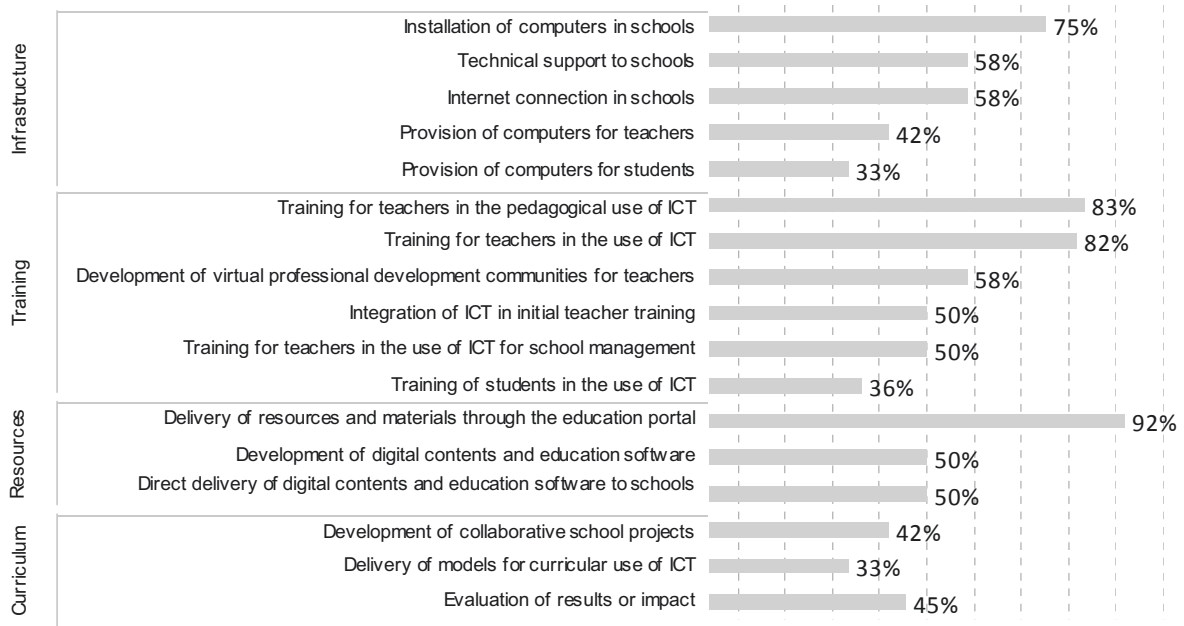
As to digital education resources, most countries are delivering resources through an education portal, and only half are developing or delivering digital education resources to schools.

In the area of curriculum, under half the countries are pursuing initiatives to develop models for the curricular use of ICT.

Lastly, with respect to evaluation, fewer than half the countries are taking steps to assess impact.

Generally speaking, from a comparison of these actions with international tendencies, policies in the region may be said to be still in an initial phase, involving the provision of infrastructure in schools and the training of teachers in the use of ICT.

FIGURE 4
PERCENTAGE OF COUNTRIES TAKING EACH ACTION



Source: Hinostroza (2009).

B. Models for incorporating ICT in schools

The basic route for integrating ICT in education in Latin America has been via public policy, primarily through programmes and projects. As seen, however, currently only a third of the region's countries have designed a formal policy for ICT in education, while the majority have developed initiatives along the lines of projects or programmes implemented by a specialized unit within the ministry of education.

A study by Alvariño and Severin (2009) provides information on the type of strategies pursued for integrating ICT into the schools. Although it does not indicate the scale of the initiatives (some of them are pilot schemes, whereas others are government projects of national scope), table 1 shows an overview of the kinds of solutions attempted and their deployment over time. The authors suggest that, on the basis of this background, a similar route may be identified for the various countries (although with different starting points) and that three critical points can be highlighted in the development of these initiatives.[20]

Programmes for ICT in education were initially strongly infrastructure-based, primarily involving the installation of a computer laboratory (rooms specifically devoted to the use of computers). Generally speaking, this first phase was accompanied by basic training for teachers (most of whom had no previous access to computers), instructing them in rudimentary uses: word processing, spreadsheets, software for multimedia presentations, and operating systems.

Subsequently, as Internet penetration expanded after the early 1990s, this model was extended to other areas such as the provision of connectivity, thereby increasing the need for web-based contents in support of school work. Ministries established institutional web pages, and the first websites with educational contents appeared. This paved the way for the first education portals, designed to showcase available contents and to promote the creation of contents relevant to national curricula.

The basic training that teachers had received was now complemented by training in Web navigation, the use of e-mail, and the creation of educational contents on the web. Efforts were made to train teachers specifically in making educational use of the new technologies, and the first initiatives were taken to provide access for teachers: classroom computers, subsidies for the purchase of personal computers, multimedia projectors, and interactive blackboards.

[20] The following discussion is based on the findings of Alvariño and Severin (2009).

TABLE 1
TYPES OF ICT PROJECTS IN SCHOOLS AND YEAR OF IMPLEMENTATION (SELECTED COUNTRIES)

Type of project [Countries]	Argentina	Brazil	Chile	Colombia	Costa Rica	Guatemala	Honduras	Nicaragua	Paraguay	Peru
Computer laboratories		1997	1992	2001	1988	1999	1999	2004	1998	1996
Classroom computers		2007	2007	2008	1992	1999		2004		1997
Computers for teachers		2008	2003	2008	1992	2007	2008		1998	2008
Computers for school management		2009	2007		1992		2007		1998	2000
Portable computers available for student use	2006		2006		1992	2007		2008		2007
One computer per pupil (project 1-1)	2006	2006	2006	2008	2007	2007		2008	2007	2007
Internet in schools		2003	1998	2002	1998	1999	2005	2005	1998	1996
Broadband in schools		2008	2003	2004		2007	2009	2006	2000	2002
Basic ICT training for teachers	2004	1998	1992	2004	2001	2000	2007	2004	2000	1996
Training in education uses of ICT for teachers	2004	1998	1992	2004	2001	2004	2007	2004	2000	1997
Certification of teachers' ICT skills					2001	2004	2007		2004	1997
Digital resources for teachers and students	2004		1992	2004	2008	2006	2008	2006	2005	2003
Education portal	2000	2004	2001	2004	2006	2006	2008	2005	2005	2003
Computerized school management systems	2000	2009	2002	2003	2003		2009			2003
Virtual networks of schools	2000		1992		2008		2009		2007	2007

Source: Alvariño and Severin (2009).

The most recent initiatives start from the growing complexity and wealth of contents available via the web. Increasing attention is being paid to certifying teachers' skills, as basic training has been found inadequate for effective incorporation into teaching practices. Teachers are able to work with ICT, but they lack strategies for translating that basic knowledge into innovative classroom methodologies.

But the current focus is on expanding options for "one computer per pupil", focused on giving students direct access to the technology. Basically, the model involves giving students low-cost portable computers (of the netbook family), which the students will either own or borrow permanently for the school year, and which they may use at school and at home. These devices have wireless access to the Internet at school, and potentially at home or in other public places (libraries, public facilities, primary health-care centres and public spaces) as well. The current option of delivering computers to pupils is likely to do a good deal for equity, and it has an important sociocultural component.

C. Progress

To examine progress and achievements in using ICT for education, ECLAC has in previous studies (Peres and Hilbert, 2009) adopted the model proposed by Selwyn (2004) for integrating ICT. This model refers to the different "stages" into which the technology incorporation process can be divided. It assumes that there is technological capital associated with ICT which is required and valued by society, that there is some agreement that this capital has an impact on people's capacities and opportunities to develop in today's world and that this, consequently, is a factor of differentiation associated with the "digital divide".

Essentially, the model identifies four stages in the digital divide: access (the availability of ICT), uses (any type of contact with ICT), appropriation (significant use of ICT, where a person exercises control and choice over technology and contents) and outcomes (immediate or short-term consequences). It is important to bear in mind that the Selwyn model assumes that integration is progressive, and thus takes a linear or "evolving" conception of the process.

The conception presented here represents a scale of progressive accumulation, where access is a necessary condition for "use", and access and use are necessary conditions for appropriation. Outcomes —such as scientific learning or performance— must be understood as phenomena reflecting the usefulness of types of access, use and appropriation. Outcomes occupy a different field from ICT and serve to validate the proposed scale of access, use and appropriation.

On the other hand, we will argue that in Latin America the process of integrating ICT must not be viewed in evolving terms —in the sense of consecutive stages that must be overcome— but rather in terms of simultaneous and overlapping divides.

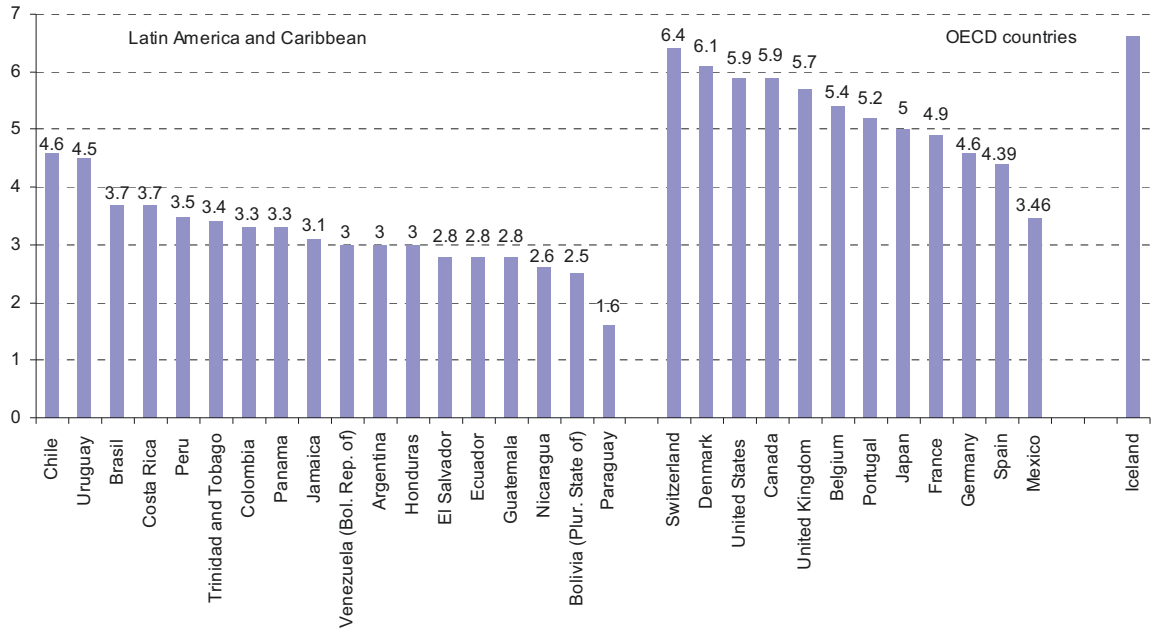
1. Access

Many of the region's countries have made significant progress in incorporating digital technology into their education systems in recent years, particularly as regards access and infrastructure. One indicator of changes in access is the number of pupils per computer, a measure of computer density. The Latin American countries participating in the 2000 and 2006 PISA test rounds showed a healthy evolution in this indicator at the secondary school level (15-year-old students): the ratio declined in Argentina from 23 to 18, in Uruguay from 30 to 13, in Chile from 31 to 18, in Mexico from 22 to 9, and in Brazil from 74 to 37. These indicators obviously reflect real progress (Sunkel and Trucco, 2009).

Yet Latin America continues to lag behind OECD countries and other regions of the world in terms of computer density. According to UNESCO data for 2008-2009, while the best performing countries of the region —Argentina and Costa Rica— had an average ratio of 34 and 25 pupils per computer, respectively, in primary and secondary schools, Finland and the Republic of Korea had ratios of four and five pupils per computer, respectively. Countries such as Guatemala and the Dominican Republic had made much less progress in this aspect, with ratios of 95 and 179 pupils per computer, respectively (Souter, 2010).

Another important indicator of computer density in schools is the degree of Internet connectivity, which reveals great differences among countries (see figure 5). Even the most advanced countries of the region, such as Chile and Uruguay, fall far short of offering frequent Internet access through the education system. These data also show that progress in connectivity varies greatly across the region.

FIGURE 5
INTERNET ACCESS IN SCHOOLS, 2008-2009
(1 = very limited, 7 = most students have frequent Internet access)



Source: World Economic Forum, Executive Opinion Survey 2007, 2008.

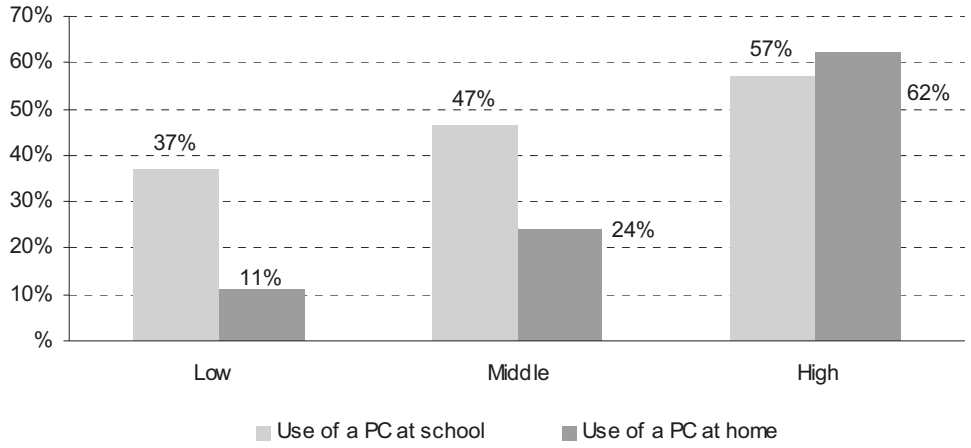
Beyond these differences between countries, there are gaps in ICT access and use within each country. There is a geographical gap, inasmuch as schools in urban areas have greater access to technology than those in rural areas, where even such basic services as electric power may be lacking. There are also gaps within urban areas.

The fact that private schools generally offer greater access than public schools constitutes yet another gap.

There are marked differences between socioeconomic groups. Computer access in the home varies greatly between socioeconomic and cultural strata. The Second Regional Comparative and Explanatory Study (SERCE) into the quality of education conducted by UNESCO found that in 2006, on average, only 11% of Latin American sixth-graders in the low socioeconomic and cultural stratum had access to a computer at home, compared with 62% of their peers from wealthier

families (see figure 6). In other words, the socioeconomic access gap is wide and students from the lowest stratum are at a sharp disadvantage.

FIGURE 6
LATIN AMERICA AND THE CARIBBEAN (16 COUNTRIES[A]): PERCENTAGE OF SIXTH-GRADERS USING A PERSONAL COMPUTER AT SCHOOL AND AT HOME, BY SOCIOECONOMIC AND CULTURAL STRATUM, 2006



Source: Economic Commission for Latin America and the Caribbean (ECLAC), based on data from the Second Regional Comparative and Explanatory Study (SERCE).
[a] Unweighted average.

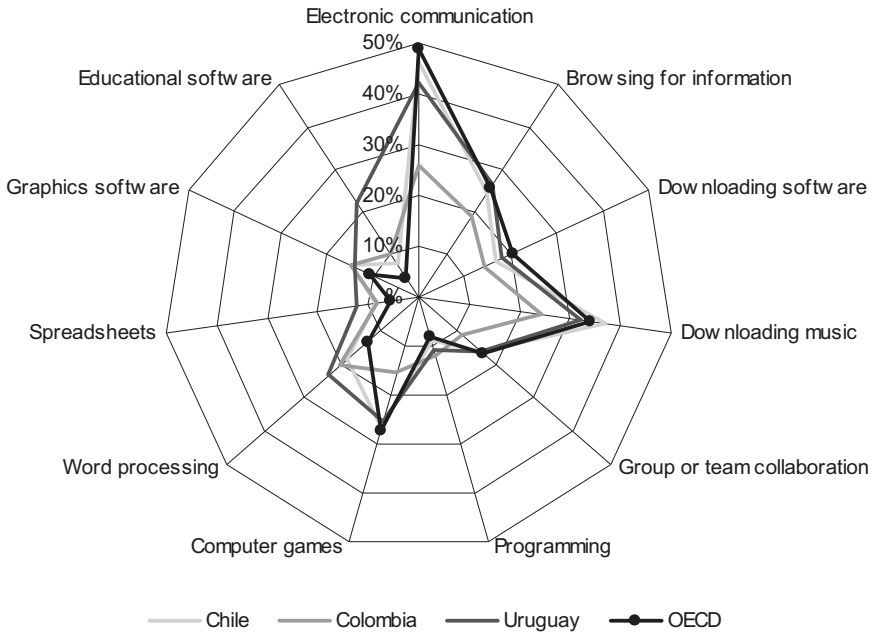
On the other hand, differences between socioeconomic groups narrow when we look at the use that students make of ICT at school. In most countries, youngsters in the poorest income quintile access ICT primarily from school.

None of these statistics, however, can reveal the degree of real access to these technologies in terms of the time that students actually spend "exercising" access to ICT. In fact, while several Latin American countries have a relatively low ratio of pupils to personal computers, the equipment goes unused for much of the day, since schools close and, generally because of administrative problems, the computer laboratories are not open after school hours.

2. Uses

The main uses that young persons make of computers involve the Internet, primarily as a means of communication and, to a lesser degree, to download music and games (see figure 7). In other words, the main uses are recreational. As schools close and, young persons take naturally to this type of recreational use, it may be expected that, as ICT facilities become more common in homes, this will become the dominant mode of appropriation of these technologies among children and adolescents. By contrast, more specialized learning with ICT —such as the use of spreadsheets, word processing, graphics software or educational software— generally requires the presence of an adult to instruct and motivate the young persons.

FIGURE 7
PERCENTAGE OF 15-YEAR-OLDS USING A PERSONAL COMPUTER ALMOST EVERY DAY, BY TYPE OF USE, 2006



Source: Economic Commission for Latin America and the Caribbean (ECLAC), prepared on the basis of PISA 2006 data.

An analysis of ICT use by secondary school students points to another set of important gaps. For one thing, and in contrast to patterns in access to digital infrastructure, there are gender differences in the uses made of ICT. In particular, males tend to use the computer more frequently for recreational purposes (for example, downloading software, music and computer games).

There are also marked differences in the types of tasks performed among the various socioeconomic strata. In particular, the proportion of high-income young persons performing recreational activities with computers is much greater than for the low-income strata (Sunkel, Trucco and Möller, 2010). As recreational use of computers tends to take place at home —where the computer can be used more freely— the significant gaps in home access are reproduced and reflected in the intensity with which young persons use the technology.

The more technical uses of the computer are performed with less intensity than those associated with the Internet. Yet this type of use is spread more evenly among the different social groups (Sunkel, Trucco and Möller, 2010). This is associated with the fact that specialized software is learned primarily in school, and as noted above this tends to compensate for access gaps.

There are two preconditions for using technology for education purposes. The first is that the teacher must be able to use ICT for teaching purposes so as to guide the student's learning. This is why strategies for incorporating ICT into schools are often accompanied by digital literacy and training programmes for teachers. Yet there is little systematized and homogeneous information on the scope and impact of these programmes in countries of the region (Bastos, 2010).

Despite the progress described above in terms of infrastructure, the proportion of teachers using computers in schools is still relatively low.[21] Most teachers who make regular use of the computer in

[21] Based on SERCE data. For a more thorough discussion, see Sunkel, Trucco and Möller (2010).

the region do so at home. Countries that have a critical mass of teachers already using computers (even for personal use) have a head start towards incorporating ICT into the learning process. Yet in several countries of the region nearly half of teachers do not normally use a computer.

The second precondition is the availability of high-quality digital education contents that teachers and students can use during the learning process. Currently all countries of the region have national education portals that make up the Education Portals Network of Latin America (RELPE), designed to offer national digital education contents. Those portals may be designed as spaces for learning, for sharing education resources and for teacher training, or as means for disseminating policies on the educational use of technologies. Recent technological advances show that portals cannot be treated simply as libraries, i.e., depositories of contents. A challenge for education portals, then, is to move towards Web 2.0 sites, which support collaborative creation and involve users themselves in the production of contents.

3. Appropriation

In Chile, Colombia and Uruguay nearly all 15-year-olds have used a computer at least once in their lives (98% on average). The study quoted above (Sunkel, Trucco and Möller, 2010) produced a typology of young persons using ICT in these three countries, taking into account the various activities they perform with the computer and the Internet and the intensity with which they say they perform them. The typology reveals four types of users, distinguished by the intensity with which they use the technology and the degree of specialization they have acquired.

The first type are occasional users, comprising young persons who use the computer infrequently but for all types of tasks (28%). Next come the "web surfers" who use the computer primarily to navigate the Internet, to collaborate with groups via the Internet, to download software and music, and to communicate (30%). Users of this type tend to employ the technology for recreational and social purposes. The third type is the specialized user, who make more frequent use of software for writing documents, preparing spreadsheets, making graphic presentations, writing computer programmes, and downloading education software (19%). Lastly, multifunctional users perform frequent activities of both a technical and a recreational kind (23%).[22]

The study suggests that multifunctional users —or "super" users— are those making the most of the opportunities that ICT offer for building their capacities, as they use both recreational and technical applications.

4. Outcomes

In the section reviewing the state of the art with respect to the impact of ICT on student learning, we noted that evidence tends to show a positive association between certain types of ICT use and academic performance. This means that not all kinds of ICT use will help students to build capabilities.

The study cited (Sunkel, Trucco and Möller, 2010) attempted to determine, using a multivariate statistical model, whether the positive correlation between certain types of ICT use and student achievements in Chile, Colombia and Uruguay on the PISA science test (2006) still holds if the research controls for other factors recognized as important for educational performance.

In fact, the study points to a degree of positive association between the type of ICT use and the performance of secondary school students in science subjects in the three countries studied. That association is especially relevant for those students who have acquired the ability to make

[22] This typology was prepared on the basis of a factor analysis that included all young persons in Chile, Colombia and Uruguay who have used a personal computer at least once, and the frequency of personal computer use for all tasks included in the PISA 2006 ICT questionnaire. For further details, see Sunkel, Trucco and Möller, 2010.

comprehensive use of the technology, and who are identified in the analysis as multifunctional (recreational and technical) users. As indicated, this group represents around 20% of young persons in those countries, mainly from more privileged socioeconomic backgrounds and mostly males. At the same time, these young persons are concentrated in private schools and urban areas. It is noteworthy that this association does not exist for other types of users (occasional users, web surfer and specialized users) (Sunkel, Trucco and Möller, 2010).

Another relevant finding is that, independently, the confidence that students have gained in using the internet has proven to be a relevant factor in their performance in the sciences. In other words, the best academic results in the sciences are associated with young persons who are more confident users of the Internet (Sunkel, Trucco and Möller, 2010).

These findings underline the importance of schools for taking advantage of ICT as a learning medium. The school is the institution best placed to compensate for inequalities of access, and it can also promote broader digital skills among students in order to take better advantage of the potential that ICT offer.

IV. Policy considerations

A. The need for a comprehensive policy

The Plan of Action of the World Summit on the Information Society (WSIS) declares that "infrastructure is central in achieving the goal of digital inclusion". It is now clear, however, that access to infrastructure is not enough: infrastructure and access have to be intimately intertwined with technical understanding and knowledge, with capacity-building and with the identification of the needs and applications required by citizens and institutions (Fonseca, 2009).

Accordingly, ECLAC has recommended that, as in those industrialized countries that have opted for a more advanced digital concept, plans in the region should focus more closely on the needs of beneficiaries and stakeholders in the development process, taking more holistic or comprehensive approaches that can embrace issues relating to access, capacity development, applications and policies. This holistic approach has a vertical axis, for plotting all the necessary dimensions of ICT policy (access, capacity-building, applications and policies) as well as a horizontal axis, for integrating other education policy aspects into ICT policy.

This approach also assumes that ICT are not an end in themselves, but instruments for meeting the needs of education systems: they are "ICT for education" and a means to achieve development goals that are clearly people-centred.

B. Aligning ICT policies with the needs of education systems

1. Equity

A central thrust of efforts in the region to deploy ICT for education has been to contribute to social integration and to avoid the social polarization that would result if broad segments of the population were denied access to the new opportunities that ICT offer. Thus, from the outset policies and programmes sought to ensure that the incorporation of ICT in schools would have a "social impact", in the sense of helping to reduce the digital divide. It is clear that ICT have been used to achieve equity, and that ICT policies have accordingly been aligned with this development objective. More recent policies for delivering computers to students (the 1 to 1 model) are to a large extent equity-oriented.

Until now the digital divide in Latin America has been understood in terms of access to technology and, from that viewpoint, schools have been seen as strategic playing fields for reducing inequalities of access. Yet, as discussed, a second digital divide is beginning to emerge between those who have the skills needed to take advantage of computers and those who lack such skills, which are recognized to be closely bound up with students' social, economic and cultural capital.

If ICT programmes in the schools are to contribute to equity, then, merely reducing inequalities of access is not enough. What is needed is to ensure that ICT for education can prevent the second digital divide from exacerbating existing differences. This means finding ways for schools to make better use of ICT for skills development, especially among low-income groups. In other words, while the region has made progress in transforming the education system into a gateway towards more equitable access to technology for different social groups, from now on it must ensure that this access translates into significant uses for beneficiaries.

Policies for ICT in education must help address the risk inherent in the second digital divide. But in addition, from a pro-equity perspective, they must help reduce both the first and the second digital divides among disadvantaged social groups. To do so will require seizing the potential of ICT to promote equity for indigenous and ethnolinguistic groups —which are in the majority in several countries of the region— in order to promote gender equity and to support people with "special education needs". In other words, policies for ICT in education must be aligned with a pro-equity agenda, which means that the issue of inequality must take central stage in policy formulation.

2. Educational efficiency

In terms of the contribution that ICT can make to greater efficiency in the education system, it is essential to bear in mind that mounting projects in the school context is in itself a challenge. The matter of intra-school relations (leadership, openness to change and innovation) is essential to the success of such projects. Schools are complex organizations that respond in diverse and unpredictable ways to policy incentives and decisions. This factor must be taken into account, for the impact of ICT on school organization is profound. It takes visionary leadership to make the dramatic changes that ICT enable, and this means that digital training programmes must include the management team if the potential of ICT is to be fully realized. At the same time, schools need to be reorganized to make working with ICT an integral part of daily school life, in contrast to the traditional individualistic and isolated approach to teaching.

Education systems have not fully appreciated the advantages and opportunities offered by ICT. As we have seen, in policies for ICT in education the least frequent goals are those of improving management in the ministry and expanding educational coverage (enrolment, retention rates, etc.). Yet late enrolment and high dropout rates are central problems of the region's

education systems, particularly in secondary school. From this viewpoint, it is important to appreciate and take advantage of the potential of ICT to help underprivileged groups complete secondary school, as the minimum educational threshold that people need to escape from poverty.

3. Quality of education

When it comes to improving the quality of education, it is essential to have a teaching staff that is not only digitally literate but is able to use the technology in innovative ways in the teaching process. As ECLAC (Peres and Hilbert, 2009) has suggested, curricular requirements must be adapted to the introduction of ICT in instruction. The evidence shows that little is known about how to integrate ICT into pedagogical work and how to teach with ICT.

Countries of the region that have provided teachers with the necessary coaching have tended to do so primarily through in-service training programmes. Some experts maintain, however, that this strategy is not sufficient, because in-service training is not remedial and necessarily relies on a certain "installed capacity" that many teachers simply do not have. Consequently, it is important to address these skills during initial teacher training. Yet little attention has been paid in the region to developing ICT skills in initial teacher training, and what is offered tends to be quite rudimentary, leaving teachers unprepared to teach with ICT (Bastos, 2010).

This paper has stressed the importance of encouraging young persons and students to take comprehensive advantage of the skills development potential of ICT. Students will tend to use the technology to suit their interests and they will explore it boldly and effectively, but mainly for recreational purposes (communication with peers, music, and so forth). If students are to develop skills in working with computers for more specialized and functional tasks, and if they are to adopt selection criteria for screening the vast quantity of information available over the web, they will need guidance and motivation from adults. This is the role that the school system must play.

C. Long-term policies

The record of ICT programmes for education in the region shows that there is no call for haste in obtaining results. The technology cannot by itself change the social and economic structures and dynamics that have held the region's development back for decades. In terms of access, for example, it is important that policies should continue efforts to incorporate technological equipment into the schools, since this remains a very significant aspect for many countries in the region. But such initiatives must recognize that the strategy does not end with the delivery of equipment to schools: it has to be adapted for use in response to demand in every classroom, and outside school hours.

Once the initial investment in equipment has been made, schools must have a regular budget for maintenance, technical support and broadband connectivity costs. In other words, equipment issues go well beyond simply supplying computers to schools or students. The cost of such policies is still an outstanding issue for research, and yet it is key to evaluating the sustainability of projects.

D. Indicators and measurement systems

In support of efforts to deploy ICT for education there is an urgent need for a system of indicators on key aspects of access, use and appropriation. The region has made little progress in developing harmonized indicators (such as would allow for comparison between countries) and those that exist focus primarily on access and infrastructure questions, which are certainly not the only concerns from an educational viewpoint.

Policymakers need better indicators as well as standards for evaluating programmes. Special efforts must also be made to the use of indicators of dissemination and impact. Some of these indicators suffer from a lack of precision. For example, the number of students per computer, commonly accepted as an access indicator, tells us nothing about the number of students who really have access, or the time that they actually devote to working with the computer, or the kind of learning it provides. Yet it is often used to demonstrate progress in all these aspects. Similar ambiguities are inherent in other frequently used indicators such as the number of schools connected to the Internet.

Bibliography

Alvariño, Celia and Severín, Eugenio (2009), "Aprendizajes en la sociedad del conocimiento. Punto de quiebre para la introducción de las TICs en la educación de América Latina", Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), unpublished.

Balanskat, A., R. Blamire and S. Kefala (2006), "The ICT impact report: A review of studies of ICT impact on schools in Europe" [online] http://ec.europa.eu/education/doc/reports/doc/ictimpact.pdf.

Barber, M. and M. Mourshed (2007), "How the world's best-performing school systems come out on top", McKinsey & Company.

Barrera-Osorio, F. and L.L. Linden (2009), "The use and misuse of computers in education: Evidence from a randomized experiment in Colombia", Washington, D.C, World Bank.

Bastos, María Inés (2010), "El desarrollo de competencias en TIC para la educación en la formación de docentes en América Latina", document prepared for the conference "El impacto de las TICs en la educación", UNESCO, Brasilia, April.

BECTA (2003), *A Review of the Research Literature on the Use of Managed Learning Environments and Virtual Learning Environments in Education, and a Consideration of the Implications for Schools in The United Kingdom,* Coventry, BECTA.

Carnoy, M (2002), "The effectiveness of ICT in cchools: current trends and future prospects", Discussion paper prepared for OECD/Japan Seminar, Tokyo, 5-6 December.

Claro, Magdalena (2010a), "Impacto de las tecnologías digitales en el aprendizaje de estudiantes. Estado del arte", *Project Documents*, Santiago, Chile, Economic Commission for Latin America and the Caribbean, forthcoming.

___(2010b), "La incorporación de tecnologías digitales en educación. Modelos de identificación de buenas prácticas", Project *Documents,* No. 328 (LC/W.328), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), July.

___(2009), "Impacto de las TIC en la gestión escolar", Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), unpublished.

Claro, Magdalena and others (2010), ¿Están los jóvenes aprendiendo lo esperado en relación a las TIC? Competencias TIC Siglo XXI en estudiantes chilenos de 15 años.

Condie, F. and B. Munro (2007), *The Impact of ICT in Schools: a landscape review*, Coventry, BECTA.

Cox, M. and G. Marshall (2007), "Effects of ICT: Do we know what we should know?", *Education and Information Technologies*, No. 12.

Dussel, I. and L. Quevedo (2010), *VI Foro Latinoamericano de Educación. Educación y nuevas tecnologías: los desafíos pedagógicos ante el mundo digital,* Buenos Aires, Fundación Santillana.

ECLAC (Economic Commission for Latin America and the Caribbean) (2010a), *Time for equality: closing gaps, opening trails* (LC/G.2432(SES.33/3)), Santiago, Chile, May.

___(2010b), *What kind of State? What kind of equality?* (LC/G.2450/Rev.1), Santiago, Chile.

___(2010c), "Banda ancha: una urgencia para América Latina y el Caribe. V Foro Ministerial Unión Europea – América Latina y el Caribe sobre la Sociedad de la Información" (LC/R.2158), La Granja de San Ildefonso, Spain, March.

___(2010d), *Achieving the Millennium Development Goals with Equality in Latin America and the Caribbean: Progress and challenges* (LC/G.2460), Santiago , Chile.

___(2009), *Social Panorama of Latin America 2009* (LC/G.2423-P), Santiago, Chile. United Nations publication, Sales No.E.09.II.G.135.

___(2007), *Social Panorama of Latin America 2007* (LC/G.2351-P), Santiago, Chile. United Nations publication, Sales No.E.07.II.G.124.

ECLAC/OEI (Economic Commission for Latin America and the Caribbean/Organization of Ibero-American States for Education, Science and Culture) (2010), "Metas Educativas 2021: Estudio de costos", *Project Documents*, No. 327 (LC/W.327), Santiago, Chile, July.

ECLAC/OIJ/SEGIB (Economic Commission for Latin America and the Caribbean/Ibero-American Youth Organization/Ibero-American Secretariat) (2008), *Juventud y cohesión social en Iberoamérica. Un modelo para armar* (LC/G.2391), Santiago, Chile.

ECLAC/UNESCO (Economic Commission for Latin America and the Caribbean/United Nations Educational, Scientific and Cultural Organization) (2004), *Financing and management of education in Latin America and the Caribbean: preliminary version* (LC/G.2249(SES.30/14)), Santiago, Chile.

Empírica (2006), "Benchmarking Access and Use of ICT in European Schools. Empirica, 2006" [online] http://ec.europa.eu/information_society/eeurope/i2010/docs/studies/final_report_3.pdf.

Fonseca, Clotilde (2009), "Deepening Understanding and Addressing Key Challenges" [online] http://publius.cc/dialogue_icts_human_development_growth_and_poverty_reduction_deepening_unde.

Fundación Omar Dengo (2006), *Educación y tecnologías digitales. Cómo valorar su impacto social y sus contribuciones a la equidad,* San José.

Hilbert, M., S. Bustos. and J. Ferraz (2005), "Estrategias nacionales para la sociedad de la información en América Latina y el Caribe", Project Documents, No. 17 (LC/W.17), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), March.

Hinostroza, J. E. (2010), "Políticas de tecnologías de información y comunicación en educación en Latinoamérica: perspectivas internacionales, realidad y proyección", Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), unpublished.

___(2009), "Integración de TIC al currículum: propuestas y realidades en Latinoamérica", *Políticas educativas y TIC en Latinoamérica series*, No.2, Santiago, Chile, Ministry of Education.

Hopenhayn, M. and E. Ottone (1999), *El gran eslabón,* Buenos Aires, Fondo de Cultura Económica.

Huyer, Sophia (2003), "Gender, ICT and Education".

Kaztman, R. (2010), "Impacto social de la incorporación de las TIC en el sistema educativo", Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), unpublished.

Martínez, A. L. (2010), "Evaluación y lecciones aprendidas en la primera experiencia 1 a 1 a nivel nacional", document presented at the seminar "El impacto de las TIC en la educación", Brasilia, UNESCO.

Martínez, A., D. Díaz and A. Serrana (2009), "Primer Informe Nacional de Monitoreo y Evaluación de Impacto Social del Plan Ceibal. Área de Evaluación de Impacto Social del Plan CEIBAL", Montevideo, December.

McFarlane, A. and J. Kirriemuir (2006), "Literature Review in Games and Learning", FutureLab Series, No. 8 [online] www.futurelab.org.uk/research/lit_reviews.htm.

McFarlane, A. and others (2000), *Establishing the Relationship between Networked Technology and Attainment: Preliminary Study 1*, Coventry, BECTA.

OEI (Organization of Ibero-American States for Education, Science and Culture) (2008), *Metas Educativas 2021. La educación que queremos para la generación de los bicentenarios*, Madrid, September.

Pedró, F. (2009), *Are the New Millennium Learners Making their Grades? Technology use and educational performance in PISA,* Paris, OECD Centre for Educational Research and Innovation (CERI).

___(2008), "New Millennium Learners: A project in progress", paper prepared for the Centre for Educational Research and Innovation (CERI), OECD Governing Board.

Peres, W. and M. Hilbert (2009), *Information Society in Latin America and the Caribbean. Development of technologies and technologies for development*, Libros de la CEPAL, No. 98 (LC/G.2363-P), Santiago, Chile. United Nations publication, Sales No.E.08.II.G.72.

Powell, M. (2006), "Rethinking education management information systems: Lessons from and options for less developed countries", Washington, D.C. World Bank - InfoDev.

Rosas, R. and others (2002), "Beyond Nintendo: design and assessment of educational video games for first and second grade students", *Computers & Education*, No. 40 (2003).

Selwyn, Neil (2004), "Reconsidering political and popular understandings of the digital divide", New Media and Society, vol.6, No.3.

Souter, David (2010), *Towards Inclusive Knowledge Societies. A Review of UNESCO's action in implementing the WSIS outcome,* Paris, UNESCO.

Sunkel, G., D. Trucco and S. Möller (2010), "Aprender y enseñar con TIC en América Latina. Potenciales beneficios", Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC).

Sunkel, G. and D. Trucco (2009), "Las nuevas tecnologías de la información y la comunicación (TIC) en educación. Avances y desafíos en América Latina y el Caribe", document prepared for the meeting "Avances eLAC2010: fijando prioridades para la sociedad de la información del futuro", Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), December.

Tomte, Catherine (2008), "Return to gender: Gender, ICT and education", background paper, OECD Expert meeting hosted by the Norwegian Ministry of Education and Research, Oslo.

Wagner, Daniel (2005), "Pro-equity approaches to monitoring an evaluation: gender, marginalized groups and special needs populations", *Monitoring and Evaluation of ICT in Education Projects. A Handbook for Developing Countries*, D. Wagner and others [online] http://www.infodev.org/en/Publication.9.html.

Winocur, R. (2006), "Internet en la vida cotidiana de los jóvenes", *Revista Mexicana de Sociología,* vol. 68, No. 3, Mexico City, July-September.

World Bank (2008), *Knowledge Maps. ICTs in Education: What do We Know about the Effective Uses of Information and Communication Technologies in Education in Developing Countries?*, Washington, D.C.

NACIONES UNIDAS

Serie CEPAL políticas sociales

Issues published

A complete list as well as pdf files are available at

www.eclac.org/publicaciones

167. Guillermo Sunkel y Daniela Trucco, "New information and communication technologies for education in Latin America: risks and opportunities", (LC/L.3266-P), Número de venta: S.10.II.G.72, (US$10.00), 2010.
166. Rubén Kaztman, "Impacto Social de la incorporación de las TIC en el sistema educativo", (LC/L.3254-P), Número de venta: S.10.II.G.59, (US$10.00), 2010.
165. Andrés Fernández, Enrique Oviedo, "Tecnologías de la información y la comunicación en el sector salud: oportunidades y desafíos para reducir inequidades en América Latina y el Caribe", (LC/L.3244-P), Número de venta: S.10.II.G.49, (US$10.00), 2010.
164. Alejandro Morlachetti, "Legislaciones nacionales y derechos sociales en América Latina. Análisis comparado hacia la superación de la pobreza infantil", (LC/L.3243-P), Número de venta: S.10.II.G.48, (US$10.00), 2010.
163. Marcela Cerrutti y Alicia Maguid, "Familias divididas y cadenas globales de cuidado: la migración de sudamericanos a España", (LC/L.3239-P), Número de venta: S.10.II.G.43, (US$10.00), 2010.
162. Alexis Rodríguez Mojica, "Programa de transferencias condicionadas, políticas sociales y combate a la pobreza en Panamá", (LC/L.3222-P), Número de venta: S.10.II.G.31, (US$10.00), 2010.
161. Gloria M. Rubio y Francisco Garfias, "Análisis comparativo sobre los programas para adultos mayores en México", (LC/L.3221-P), Número de venta: S.10.II.G.30, (US$10.00), 2010.
160. Isabel Román, "Sustentabilidad de los programas de transferencias condicionadas: la experiencia del Instituto Mixto de Ayuda Social y "Avancemos" en Costa Rica", (LC/L.3209-P), Número de venta: S.10.II.G.23, (US$10.00), 2010.
159. Laura Pautassi, Carla Zibecchi, "La provisión de cuidado y la superación de la pobreza infantil. Programas de transferencias condicionadas en Argentina y el papel de las organizaciones sociales y comunitarias", (LC/L.3198-P), Número de venta: S.10.II.G.10, (US$10.00), 2010.
158. Rodrigo Martínez y María Paz Collinao (Editores), "El Gasto Social en El Salvador, Paraguay y Perú", (LC/L.3196-P), Número de venta: S.10.II.G.12, (US$10.00), 2010.
157. Rosalía Cortés, Caudia Giacometti, "Políticas de educación su impacto sobre la superación e la pobreza infantil", (LC/L.3194-P), Número de venta: S.10.II.G.07, (US$10.00), 2010.
156. Claudia Robles, "Pueblos indígenas y programas de transferencias con corresponsabilidad. Avances y desafíos desde un enfoque étnico", (LC/L. 3170 -P), Número de venta: S.09.II.G.144, (US$10.00), 2009.
155. Ana Sojo, "Identidades y sentido de pertenencia y sus tensiones contemporáneas para la cohesión social ¿del derrotero a las raíces, y/o de las raíces al derrotero?", (LC/L. 3161 -P), Número de venta: S.09.II.G.134, (US$10.00), 2009.
154. Giacomo Marramao, "Tras Babel: identidad, pertenencia y cosmopolitismo de la diferencia", (LC/L. 3160-P), Número de venta: S.09.II.G.133, (US$10.00), 2009.
153. Roberto Gargarella y Christian Courtis, "El nuevo constitucionalismo latinoamericano: promesas e interrogantes", (LC/L.3142 -P), Número de venta: S.09.II.G.115, (US$10.00), 2009.

- Readers wishing to obtain the listed issues can do so by writing to: Distribution Unit, ECLAC, Casilla 179-D, Santiago, Chile, Fax (562) 210 2069, E-mail: publications@cepal.org.

Name:.....

Activity: .....

Address: .....

Postal Code, City, Country: .....

Phone: .....Fax:..... E-mail:.....