Chapter 9

Skills and jobs in the digital economy

This chapter examines the increasing role of information and communication technologies (ICTs) in the workplace, and policies that can support the development of the skills necessary for workers and firms to thrive in the digital economies emerging in the Latin America and Caribbean (LAC) region. It highlights the need for policy makers to develop a comprehensive and coherent approach to expanding connectivity, encouraging learning, activating digital skills and promoting their use, while measuring progress and managing the effects of the digital economy on the reorganisation of businesses, skills and jobs around the world.

Broadband connectivity brings with it many opportunities, but also new challenges. Policy makers need to understand how the Internet and investment in broadband networks can help boost productivity and create new jobs for the Latin America and Caribbean (LAC) area. At the same time, it is important to acknowledge and address the impact on employment and skills, as well as the social disruptions caused by technological advances. This chapter examines the increasing role of information and communication technologies (ICTs) in the workplace, and policies that can support the development of the skills necessary for workers and firms to thrive in the new digital economies emerging in the LAC region.

A significant body of literature links ICT, broadband and Internet adoption to increased productivity (OECD, 2012a). Many policy makers see the Internet as a tool that can support businesses to grow and hire employees. Chapter 10 addresses some of the policy issues related to broadband uptake and entrepreneurship. This chapter focuses on the implications of broadband networks and the policy responses necessary for creating jobs and skills in the digital economy.

Broadband networks are often viewed as a source of new job growth, both in the ICT sector and as a catalyst for new business innovation across all other sectors of the economy. At the same time, it is clear that the Internet is driving a significant reorganisation of businesses around the world, and this affects labour demand and ultimately, employment. The net effects of the Internet – and ICTs more generally – on jobs are complex and still poorly understood.

When any significant new technology emerges, workers and users need new skills to capture the potential productivity gains. This phenomenon has been seen in the past, and is apparent with the expansion of high-speed Internet connectivity. The Internet's effect on jobs can be classified into four broad categories:

- **New jobs**. A broadband-enabled Internet leads to the creation of new jobs. Some of these are directly tied to the technology (e.g. engineers, networking specialists, hardware), while others extend to the related ecosystem (e.g. mobile app developers, data scientists, community specialists in social networks). Most importantly, however, the Internet can lead to job growth in traditional occupations by supporting the creation of new businesses (e.g. entrepreneurship) or the expansion of existing firms (e.g. growth from tapping into foreign/new markets or more effective marketing).

- **Transformed jobs**. Technology transforms the work practices in existing jobs. The introduction of new communication technologies means that work processes can be adjusted but that workers must learn new skills to take advantage of the new technological advances. This transformation is also partially driven by the way the Internet makes it possible to outsource different parts of the production process. Transformed jobs can also outsource jobs to other domestic firms.

- **Outsourcing of jobs**. The Internet also permits global outsourcing of tasks to more-specialised locations or workers (e.g. offshoring), allowing firms with access to broadband networks to

benefit from different cost and productivity conditions, or from the availability of specific skills or firms. This implies some direct job losses in one country but job gains in another.

● **Lost jobs**. Greater use of the Internet can also lead to the loss of certain jobs, as technology replaces tasks formerly carried out by individuals (e.g. as online travel booking has replaced travel agents).

Job creation from ICTs occurs as resources – financial capital, knowledge assets and labour – move across firms and sectors. By its very nature, this process of structural change takes time and may be hampered by institutional barriers and market impediments. More fundamentally, entrepreneurial skills, intangible assets and workers' skills tend to be industry-specific and may not be appropriate for the business environment, work organisation and tasks required where they have to move. This is likely to be the case in new markets that did not previously exist, like those created by new ICT goods and Internet-based services (OECD, forthcoming a). This implies that there can be a difference between the short run, when ICTs may reduce employment, and the long run, when labour markets have had time to adjust.

The **structure of labour markets** also changes with new technologies. Lower-skilled occupations are particularly affected by labour market changes. Existing studies find that new technologies such as the Internet are leading to job growth in the low-skilled service sector but job declines in occupations that require routine tasks that can increasingly be mechanised (Marcolin, Miroudot and Squicciarini, 2016).[1] Workers with advanced technology skills (new jobs and transformed jobs) tend to fare well in the new and transformed jobs resulting from technological change. While technical skills need to be refreshed regularly, those with the necessary skills typically have many options for employment. This is a key consideration for the education and training of young people in LAC countries.[2]

Workers increasingly need both **generic and specialised ICT skills** to accomplish their tasks at work, as the Internet becomes more ingrained in work processes. Existing data show the growing demand for skills related to ICTs and the Internet. This includes employment directly in the ICT sector, ICT specialists in other sectors (e.g. health care), and also ICT-intensive users in all sectors who rely on ICT skills to perform their work (OECD, 2012b).
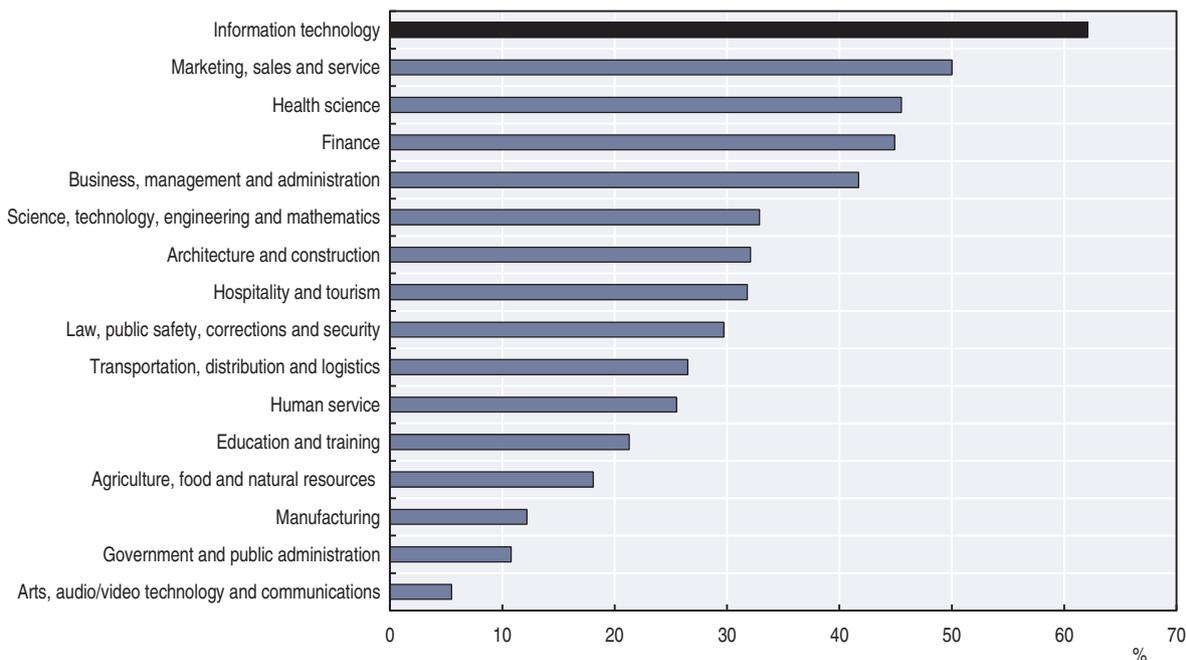
Relatively little data exists to measure the extent of ICT skills needed across occupations, but an analysis of the United States' Occupational Information Network (O*NET) database shows that information technology occupations category has the highest percentage of occupations categorised as having a "bright outlook" through 2013 (OECD, 2014a). While this data focuses only on the US situation, the overall trend of growing demand for ICT occupations globally suggests that demand for ICT skills and the need to promote these skills will continue (Figure 9.1).

These new jobs account for an increasing percentage of overall employment, even though they represent only a small portion of the people who need general ICT skills at work. Data from OECD countries highlights the growth of ICT specialist jobs between 2011 and 2014. ICT specialists now account for between 1% and 6% of total employment.

Data from the OECD's Programme for the International Assessment of Adult Competencies (PIAAC) provides a view of how ICT skills are increasingly important in different sectors of the economy. Managers, professionals, technicians and clerical support workers use more ICT skills at work than other occupational clusters. Workers in smaller firms are less likely to use ICTs than workers in much larger firms. Smaller firms typically lag behind larger firms in adopting ICTs, but such firms are likely to need to leverage ICTs more effectively to stay competitive.

Figure 9.1. **"Bright outlook" occupations across occupation clusters (2013)**

Percentage of occupations in the category that are considered to have a bright outlook

Source: OECD (2014a), *Skills and Jobs in the Internet Economy, http://dx.doi.org/10.1787/5jxvbrjm9bns-en.*

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Additionally, the diffusion of ICTs is also changing the way work is carried out, raising the demand for **ICT-complementary skills**. These are skills that are not related to the capability to use the technology effectively but to work in the "technology-rich environment" shaped by ICTs (e.g. the capability to communicate on social networks, to brand products on e-commerce platforms, etc.). OECD analysis based on PIAAC and O*NET shows that intensive use of ICT at work is associated with tasks that require higher use of influence, problem solving and interactions with co-workers and clients, as well as less physical work. Furthermore, changes in ICT-complementary skills will be more radical for workers with low education levels, presenting a challenge for the national educational and training systems that are less capable of reaching these workers (OECD, forthcoming b).

ICT skills are becoming an important requirement for employment across the economy, but a significant portion of the population still lacks the basic skills necessary to function in this new environment.[3] PIAAC data shows that the demographic factors most commonly associated with a lack of core skills and no computer experience are people aged 55-65, people with less than an upper secondary level of education, and people in semi-skilled occupations.[4] This lack of ICT skills in the adult population is of particular concern for policy makers, because the groups with the least ICT skills tend to be among the demographic groups at the most risk of losing jobs in the current technological transformation of the workforce. Labour market disruptions will affect some workers more than others, and often these people will be precisely those with the lowest levels of ICT skills and those who are the least prepared to update their skills.

Key policy objectives for the LAC region

The evolving landscape for skills and jobs highlights the need for policy makers to develop a comprehensive and coherent approach to expand connectivity, encourage learning, activate digital skills and promote their use throughout their populations, while measuring progress. This is an ongoing process (Figure 9.2). Each of its elements is explained briefly here, with more detailed analysis using country examples from the region presented later in the chapter.

Figure 9.2. **Innovation in the digital economy for new and better jobs**

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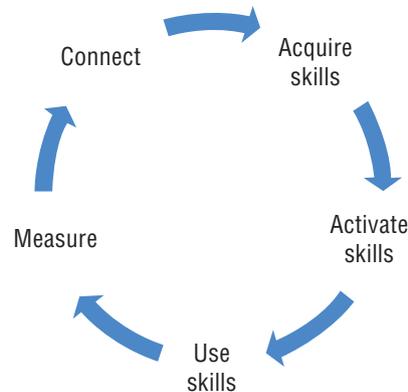
- **Connecting individuals and communities.** Without fast and affordable connectivity, the economic benefits of the Internet will be beyond any community and, if the lack of access is widespread, challenge a country's economic competitiveness. Chapter 1 provides an overview of the state of connectivity in the LAC region and Chapter 5 highlights the importance of extending broadband access by connecting schools, community access centres and other places of public access that can provide a platform for teaching digital skills.

- **Developing skills.** Once networks and hardware are in place, they can be used as tools for learning and skills development. At the most basic level, people at work need to be comfortable using a computer, tablet or mobile phone and to understand how to perform basic tasks, such as watching a video or searching for information (e.g. being digitally literate). At the other end of the spectrum, ICT specialists often need specialised skills that closely follow technology developments.

- **Activating and using skills.** Once broadband access networks are in place and people have the necessary skills, the next step is ensuring that ICTs are used to the greatest extent possible throughout the economy. Policy makers can focus on how to activate existing and new skills throughout the economy and put them to effective use. Benefits of activating and using skills effectively include higher levels of labour productivity, improving the competitiveness of domestic firms, and opening doors for innovative services that benefit users and the economy as a whole.

- **Measuring policy initiatives.** The measurement component is important because it illuminates areas of strength and weakness that can be targeted by policy. More importantly, measurement is important for evaluating whether policy actions have been successful, and areas that need more attention in the next cycle.

Tools for measurement and analysis in the LAC region

Surveys and statistical studies outside the region can be good models for policy makers building initial data collections.

- **Connectivity data.** Governments need information on connectivity across schools, public access centres, and throughout the population in general. Policy makers have an incentive to promote digital skills, but efforts will be less effective if proper infrastructure is not in place. Understanding where the gaps are can help policy makers target specific priority areas for support.

- **Other infrastructure data.** Data from the International Energy Agency (IEA) on electricity penetration and data on school electrification from UNESCO are important inputs in policy making. Countries that do not already collect and submit such information could look for ways to move in this direction.

- **Computer access.** A key input in policy making is information on access to computing resources. Mobile phones have become important access terminals, but computer skills will remain important tools for workers throughout the economy for the foreseeable future. Data on access to computers often comes from population or business surveys (see Chapter 10).

- **Job and skills surveys.** The OECD's Programme for International Student Assessment (PISA) and PIAAC studies are important tools for measuring skills, and digital skills in particular. Involving more LAC countries in both studies would be a good way to assess recent developments, both domestically and internationally. The US O*NET is one of the best sources for data on skills required for different occupations. They provide useful information for policy makers who would like to highlight growth trends over the next five to ten years, share the information with students and teachers, and adjust academic strategies accordingly (O*NET, 2010).

- **Research on ICT usage and educational outcomes.** One important area of academic and policy research, including the OECD's PISA study, has attempted to assess the complex relationship between ICT usage and educational outcomes. International research offers some insights, yet country-specific factors may play an important role. Domestic studies can help policy makers find the best ways to integrate ICTs into education.

A key challenge facing policy makers is that these functions are often handled by different segments of the government. Communications ministries and regulators focus on expanding connectivity, while the education and labour ministries may take the lead on curriculum in schools and retraining workers. Economic ministries are often the core group tasked with promoting business creation and growth. Finally, the national statistical agency is likely to be responsible for collecting the statistics that follow progress in each of these areas. While the responsibilities fall on different areas of the government, any successful transition to a digital economy will require strategic planning and co-ordination across the different governmental agencies. As a result, it becomes necessary to adopt whole-of-government approaches, such as those of the OECD's *Better Skills, Better Jobs, Better Lives* publication (hereafter "OECD Skills Strategy") (OECD, 2012c), whereby different ministries can align their respective policies and identify more clearly potential or existing policy trade-offs. These approaches may help avoid duplication of efforts and ensure policy efficiency.

## Overview of the situation in the LAC region

This section offers examples of the data available for policy makers on the digital economy and on assessing the situation in the LAC region. It is followed by a section examining specific policies and best practices around the region.

State of connectivity

Connecting schools has been a key policy goal for many governments, yet there is relatively little comparable information about the number of schools connected to high-speed broadband in the LAC region. However, the level of connectivity in schools varies considerably between primary, secondary and tertiary institutions. Among countries responding to the OECD/Inter-American Development Bank (IDB) survey, primary schools were the least likely to have an Internet connection, while levels of connectivity increased through secondary, tertiary and university levels (Figure 9.3). The low level of connectivity among reporting primary schools indicates that many children may be subject to digital divides in access, potentially putting them at a disadvantage in developing digital skills.

Figure 9.3. **LAC schools with an Internet connection**

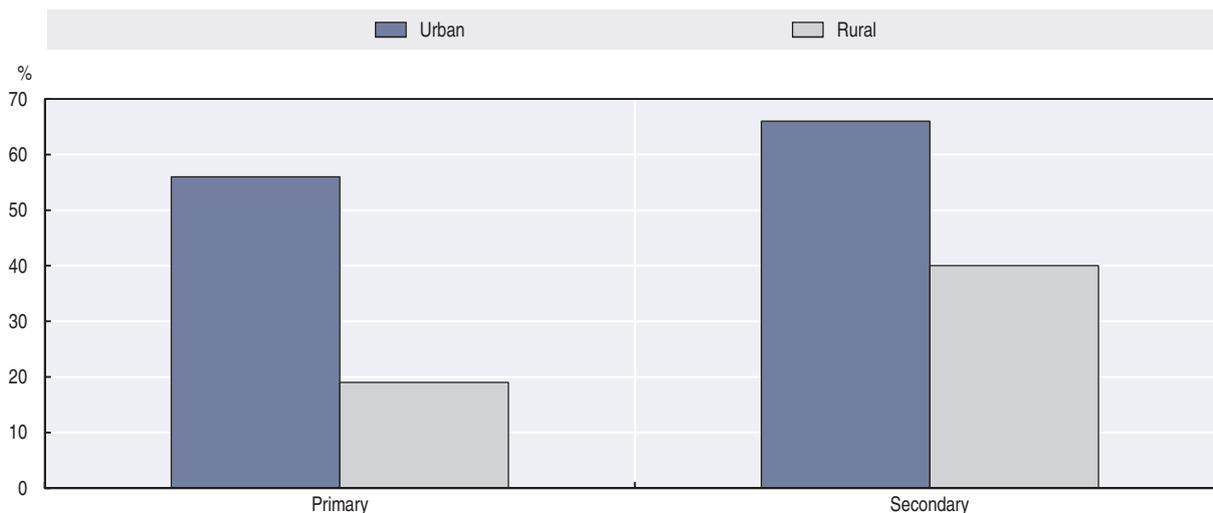Percentage of schools, by grade, 2015
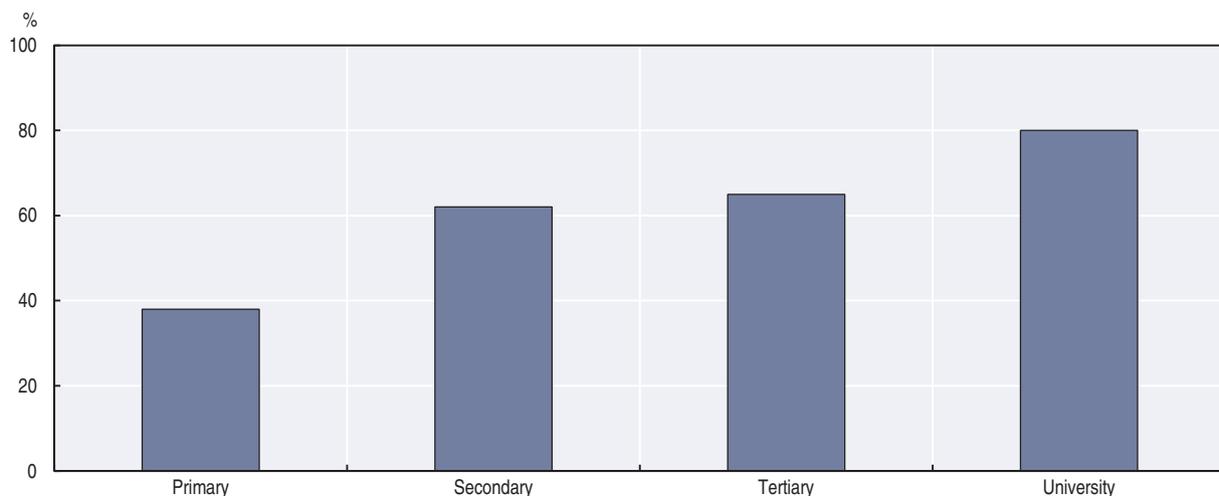
Note: Includes a relatively small sample of countries that reported data throughout the region. The results should therefore be considered only as broad trends.

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There is also a significant connectivity gap between schools in rural and in urban areas. Urban primary schools are more than twice as likely to have an Internet connection than rural schools (Figure 9.4). The gap narrows slightly for secondary schools, but is still pronounced. In some cases, these gaps are linked to a lack of electricity, but they represent an important hurdle for policy makers working to advance a digital economy agenda.

A power source is needed to provide electricity to desktops, run equipment and charge portable devices. Schools without a stable electricity supply face additional challenges in adopting technology during classroom instruction. The United Nations Educational, Scientific and Cultural Organization (UNESCO) produces data on the number of educational institutions with electricity. Over half the countries in the region are fully powered, while others struggle to provide electricity to primary and secondary schools (Figure 9.5).

Figure 9.4. **LAC schools with an Internet connection**

Percentage of schools, by urbanisation, 2015

Note: Includes a relatively small sample of countries that reported data throughout the region. The results should therefore be considered only as broad trends.

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Figure 9.5. **Proportion of educational institutions with electricity (2010)**
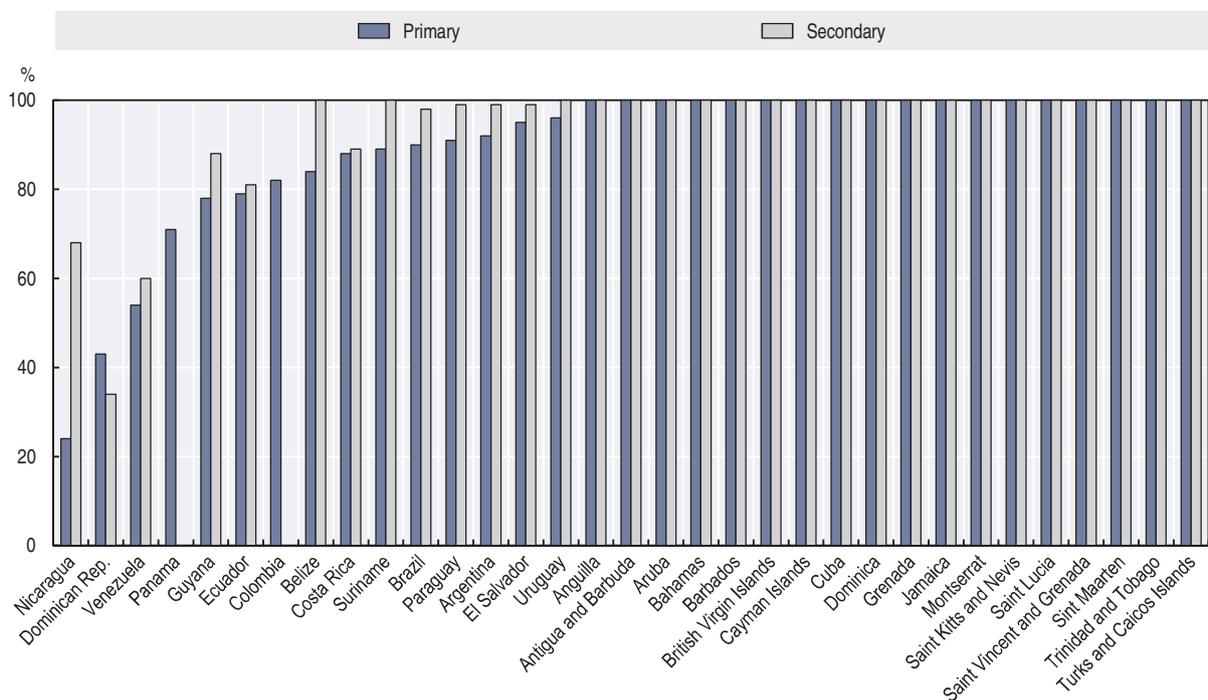
Source: UNESCO (2012), *ICT in Education in Latin America and the Caribbean – A Regional Analysis of ICT integration and e-readiness, www.uis. unesco.org/Communication/Documents/ict-regional-survey-lac-2012-en.pdf.*

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Policy makers are keenly aware of the need to connect schools in rural areas. Nearly 87% of countries in the region have a plan or initiative to connect schools in those countries. The data on connected schools shows that the process is still under way and that more needs to be done. The targets of these plans range from connecting primary schools up through universities, but secondary and tertiary institutions are receiving slightly more attention from policy makers in the region (Figure 9.6).

On the whole, primary schools are the least likely to be connected, and yet still receive less attention than secondary and tertiary institutions in policy initiatives to introduce Internet access.

Figure 9.6. **LAC governments with a plan/initiative to connect schools**
Percentage, by type of school, 2015
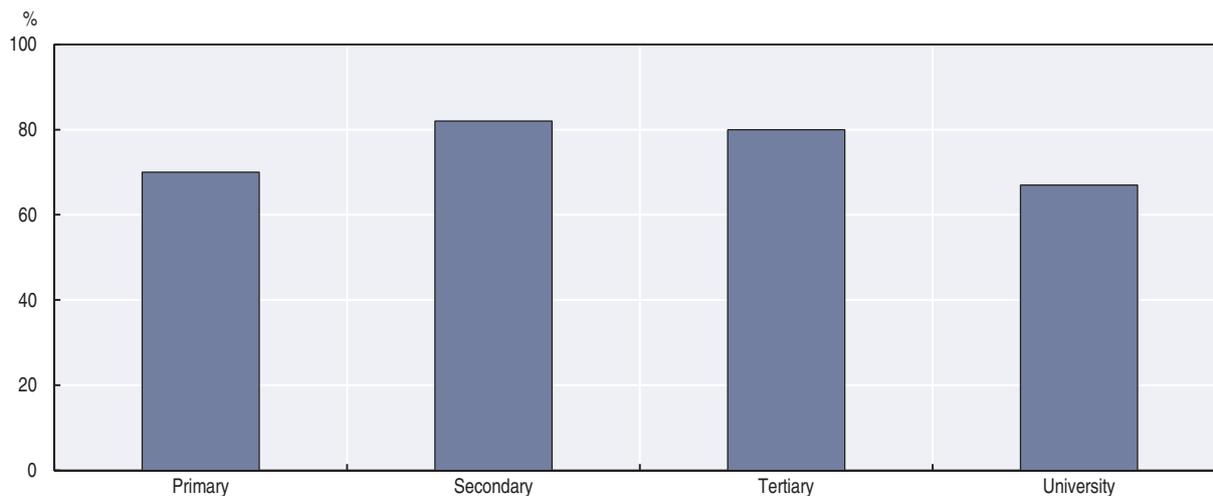
Note: Includes a relatively small sample of countries that reported data throughout the region. The results should therefore be considered only as broad trends.

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In terms of hardware, UNESCO data shows that the learners-to-computer ratio varies significantly across the region, from Uruguay with a 1-to-1 ratio, rising to more than 100 students per computer in several countries (Figure 9.7).

State of developing skills

While some countries, such as the Dominican Republic and Costa Rica, have promoted ICT skills, the majority of countries in the LAC region appear to be active proponents of e-learning. A high percentage of countries (92%) reports having an initiative to promote e-learning or tele-learning in the country (Figure 9.8). One key element of these policies is to make classroom content available online for wider dissemination. Roughly 86% of countries report policies to create and disseminate content to the general public.

A lower proportion of countries have implemented e-learning projects to train teachers how to integrate digital learning in the curriculum. These include Brazil, Colombia and Costa Rica. By contrast, roughly 20% of countries report that they have no plans in place to provide teachers with digital skills.

Figure 9.7. **Learners-to-computer ratio in primary and secondary education (2010)**
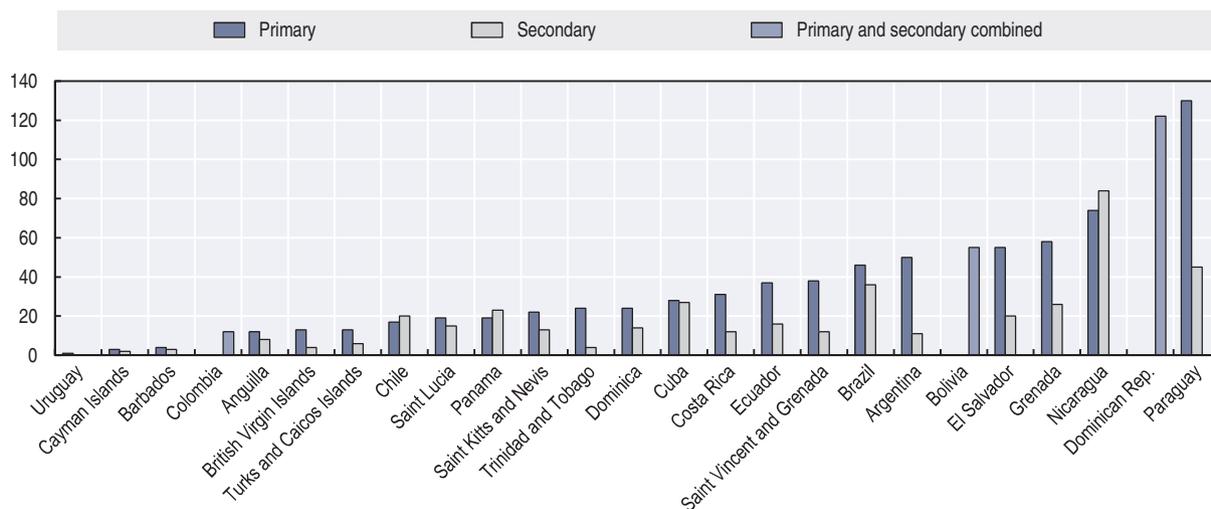
Notes: In Argentina, Barbados, the Plurinational State of Bolivia (herafter "Bolivia"), Chile, El Salvador, Trinidad and Tobago, and Uruguay, data are for 2009. In Anguilla, secondary education data reflect the public sector only. In the Dominican Republic, Nicaragua, St. Lucia, and Trinidad and Tobago, primary- and secondary-level data reflect the public sector only. In Uruguay, secondary-level data are missing. In Turks and Caicos, primary-level data include the lower secondary level.

Source: UNESCO (2012), *ICT in Education in Latin America and the Caribbean – A Regional Analysis of ICT integration and e-readiness, www.uis. unesco.org/Communication/Documents/ict-regional-survey-lac-2012-en.pdf.*

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Figure 9.8. **LAC government projects to promote e-learning**
Percentage, 2015
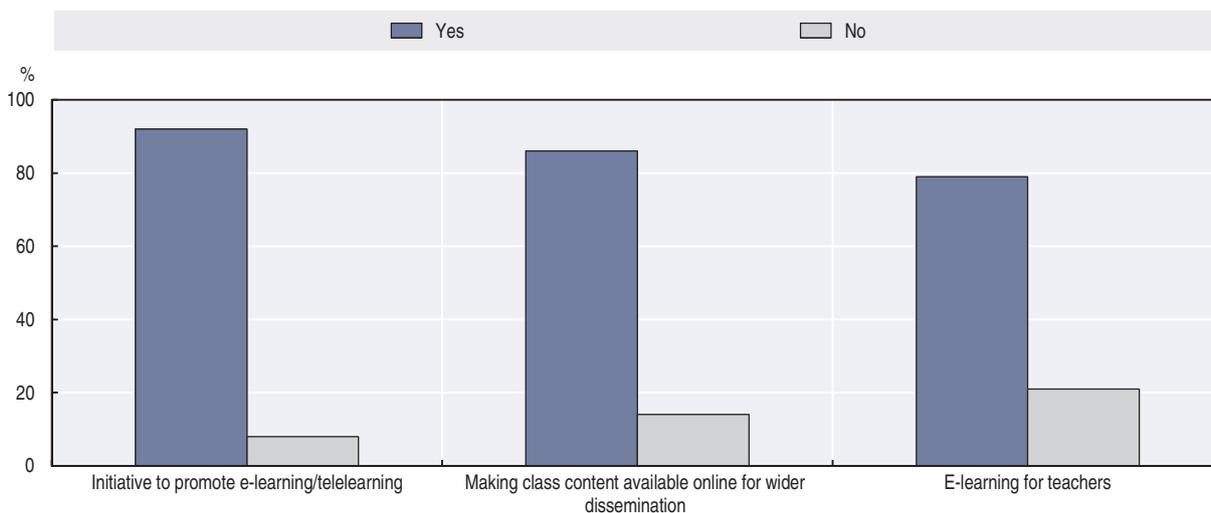
Note: Includes a relatively small sample of countries that reported data throughout the region. The results should therefore be considered only as broad trends.

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Online learning uses the Internet to deliver educational materials to students. These can be in the form of text-based or multimedia resources delivered over an Internet connection. UNESCO data show a significant variation among countries in terms of educational institutions with Internet-assisted instruction (Figure 9.9).

Figure 9.9. **Proportion of educational institutions with Internet-assisted instruction in LAC (2010)**
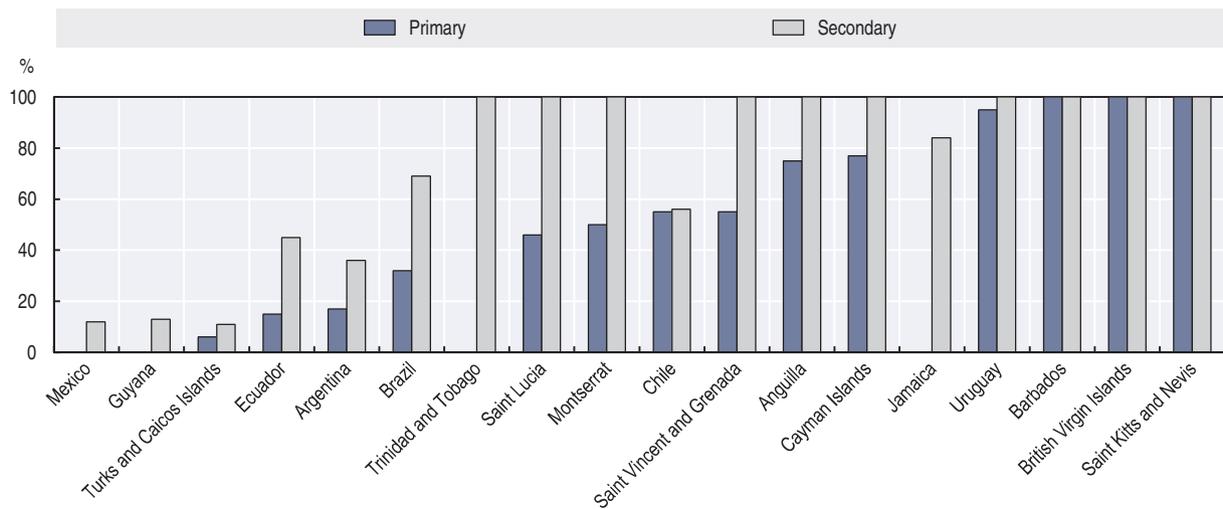
Notes: Data for Barbados and Trinidad and Tobago reflect public educational institutions only. For Jamaica, data reflect ISCED 3 level in public institutions only. For Guyana, data reflect ISCED 2 level in public institutions only. For Argentina, Chile, Montserrat, Suriname, Trinidad and Tobago, and Uruguay, data are for 2009.

Source: UNESCO (2012), *ICT in Education in Latin America and the Caribbean – A Regional Analysis of ICT integration and e-readiness, www.uis. unesco.org/Communication/Documents/ict-regional-survey-lac-2012-en.pdf.*

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State of measurement

ICT jobs account for up to 6% of total employment in OECD countries, and the percentage is growing. Accurate data on demand for ICT workers helps policy makers target specific markets or segments of the population. In 2015, only 43% of respondents in the LAC area reported gathering information on ICT jobs in the economy. In a related area, only about half of countries gather data about job matching and job search.

Despite the high number of countries reporting initiatives to promote e-learning, less than a quarter have a survey in place to gather data on e-learning adoption and use. As a result, countries lack the means to assess the level of success of e-learning programmes. In the LAC area, the Centre for Studies on the Development of the Information Society (Cetic.br) is a reference centre for the production of indicators and statistics on the use of ICTs in Brazil. Cetic.br has been conducting national surveys on ICT use in schools since 2010 and leading ICT measurement partnerships in the whole LAC region as an official UNESCO centre since 2012 (Nic.br/Cetic.br, 2011).

Countries in the LAC region could benefit from the participation in regional and international surveys of competences measuring digital literacies and ICT skills, such as the OECD's PISA and PIAAC study. These international studies could also illuminate the discussion of the influence of ICT adoption on learning outcomes and shed light on the use of digital skills across the economy. Last but not least, important measurement efforts should be directed towards assessing the impact of the Internet on job creation/destruction in the country, with a special attention to the sharing economy.
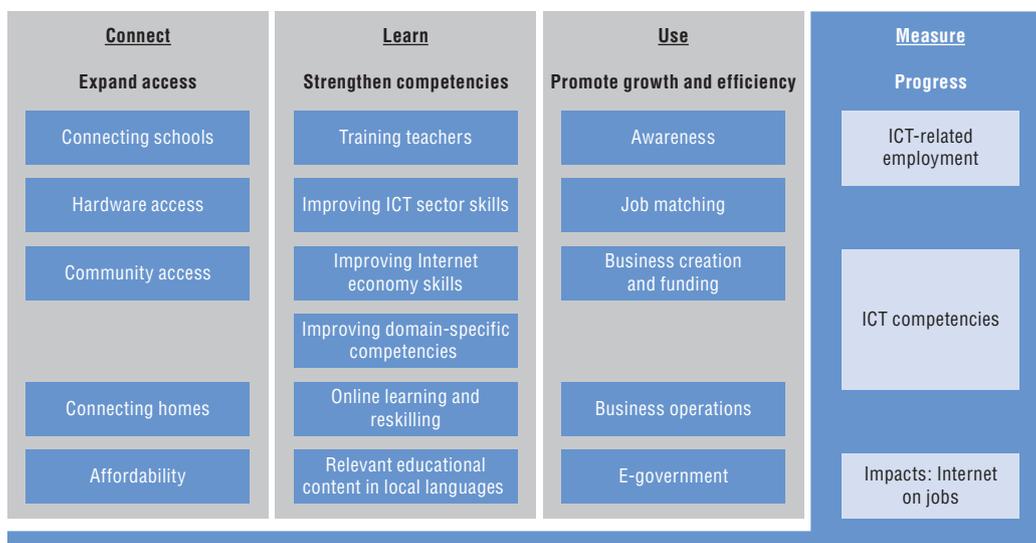
Good practices for the LAC region

As mentioned earlier, the evolving digital economy requires a comprehensive approach that focuses on expanding connectivity, encouraging learning and promoting the use of digital skills, while measuring progress. The growth of the digital economy will require updated and new skills from most workers. People, as well as governments, will have to prepare and position themselves with the appropriate skills for the opportunities being created.

First, it is important that policy makers develop a comprehensive strategy to address issues related to skills and jobs in the digital economy. The OECD Skills Strategy (OECD, 2012c) provides a systematic framework that helps countries identify the strengths and weaknesses of their national skills systems, to benchmark them internationally and to develop policies that can transform better skills into better jobs, encouraging economic growth and social inclusion.

The OECD Skills Strategy provides a framework for developing, activating and putting skills to use. This chapter adds to this framework the elements of expanding networks to institutions and measuring progress. Four categories are identified as being crucial for public policy action: connect, learn, use and measure (Figure 9.10). This section provides examples of good practices to assist LAC countries with the development of skills and jobs in the digital economy.

Figure 9.10. **Policy innovation in the digital economy for new and better jobs**

Connect	Learn	Use	Measure
Expand access	**Strengthen competencies**	**Promote growth and efficiency**	**Progress**
Connecting schools	Training teachers	Awareness	ICT-related employment
Hardware access	Improving ICT sector skills	Job matching	
Community access	Improving Internet economy skills	Business creation and funding	
	Improving domain-specific competencies		ICT competencies
Connecting homes	Online learning and reskilling	Business operations	
Affordability	Relevant educational content in local languages	E-government	Impacts: Internet on jobs

Connect

Improving connectivity is a fundamental step for making sure that the economic benefits of the Internet are within the reach of individuals, businesses and government. Key among connectivity goals are often targets to extending broadband access to tertiary, secondary and primary schools throughout the country. In some cases, these connected schools are the first to go online in the entire community and become an "anchor" tenant, supporting the expansion of future commercial products and boosting the acquisition of digital skills by the population.

Across Latin America and the Caribbean, connectivity varies considerably, both across countries in the region and between rural and urban areas. Some countries, such as

Brazil, have had significant success connecting schools across the country, with an overall penetration rate of over 95%. Other countries face a significant challenge bridging the connectivity gap between rural and urban areas. Peru, for example, has connected 56% of urban primary schools, but only 6% of rural schools. Primary schools are less likely to be connected than secondary and tertiary institutions. Bolivia, Suriname, Trinidad and Tobago, and Uruguay have reached near universal connectivity for tertiary schools. Several initiatives throughout the LAC region focus on extending broadband connectivity to schools (Box 9.1).

Box 9.1. **Initiatives in LAC for extending broadband connectivity to schools**

Costa Rica has been successful in extending Internet connectivity to over 95% of its schools, though many connections were initially slower than 2 megabits per second. Another challenge was that some connected schools only had Internet connectivity to the front office. In 2013, the Ministry of Public Education (MEP) and the Omar Dengo Foundation (FOD) launched an initiative to connect schools with a fibre-optic network and then share connections throughout the schools using wireless technology (MEP, 2013).

Peru has a national education project for 2021 that aims to equalise learning opportunities and resources for students across the entire country. Every school needs to have fundamental learning elements that include services such as water and electricity, as well as educational materials, a library and Internet connectivity (CNE, 2006). Peru is building a National Fibre-Optic Backbone, through a public-private partnership (PPP) project, which aims to expand broadband to almost all the country. Primary and secondary schools in the digital inclusion project will be the first beneficiaries.

Nicaragua has worked with partners to launch a pilot project connecting five remote schools to the Internet as a way to introduce connectivity into the community. The schools in rural areas often serve a dual purpose as a community access centre. The schools were connected by a range of wireless technologies (microwave, 3G wireless and satellite) and used donated computers and connectivity.

Brazil has a programme to reach schools by first connecting municipalities with high-speed fibre-optic networks that can extend connectivity to local schools. In 2013, the digital cities project (*Cidades Digital*) selected 262 municipalities, each with a population of up to 50 000 inhabitants, to expand connectivity (MC, 2016). In addition, Brazil included provisions in the auctions for the 450 megahertz and 2.5 gigahertz frequencies that required winners to connect any schools located within 30 kilometres of the municipality (MC, 2015).

1. *www.mc.gov.br/cidades-digitail.*

Connecting a school to the Internet requires **basic infrastructure** such as electricity that can present a challenge in rural and remote areas. Electrification projects are also an important opportunity to install wired telecommunication infrastructure, preferably fibre-optic networks.

In addition to broadband connections, communities need access to **hardware**, such as computers or tablets and routers/networking equipment that can effectively use and share a broadband connection throughout a school or access centre. The initial Internet access may have been supplied in one place within a school (often the front office), but a significant amount of networking may be necessary to reach all the classrooms in larger schools. This internal networking often requires both additional funding and expertise to install. In other cases, schools had a computer in a classroom, or a dedicated lab students could use on a rotating basis. The costs of outfitting a computer lab and keeping it updated are a significant challenge for many schools. These investments have shown some positive

payoffs in terms of digital skills. IDB research suggests that adding just one more computer per 40 students in Peru was associated with a large increase in the students' digital skills (Bet, Cristia and Ibarrarán, 2014).

One approach to the problem was making inexpensive laptops available to students. Partnerships between foundations and the One Laptop Per Child (One Laptop, 2015) initiative provided primary school children with an inexpensive but rugged laptop they could use at school and take back home in the evenings. In countries such as Nicaragua, foundations have distributed over 30 000 laptops to over 104 schools (One Laptop, 2013a, 2013b).

Evidence of the effectiveness of these programmes is mixed at best. Finding from a Randomized Controlled Trial experiment in Peru (Beuermann et al., 2015) showed that, despite an increased familiarity with the computer, the intervention had few effects in the short run. No significant differences between the treatment and control group were found in academic achievement in mathematics and science and in cognitive skills, and in some cases, teachers observed students exerting lower levels of academic effort. In another experiment, Bet, Cristia and Ibarrarán (2014) found that introducing students to computers led to improved general cognitive skills, verbal fluency and coding skills. However, the programme did not show significant effects on enrolment and test scores. Another randomised experiment in Ecuador found that providing computer-aided instruction in mathematics to students in primary school had a positive effect on mathematic test scores (Carrillo, Onofa and Ponce, 2011). Some projects across the region focus on providing computers for Internet access (Box 9.2).

Box 9.2. **Providing computers for Internet access in LAC**

Mexico has a federal programme, Mi Compu.mx, that provides computers for learning at school and at home. The programme takes a novel approach to bridging the digital divide, devoting part of the resources on computers for school-aged children, and part to adult learning by other members of the household. The content is pre-loaded on the computer, and can be used either online or without an Internet connection.

Argentina's federal programme *Conectar Igualdad* aims to provide a laptop to all students and teachers (ANSES, 2013).

Uruguay has a programme funded by the Inter-American Development Bank (IDB) to provide computer access to all students in the country. The IDB team also focused on training teachers/staff, strengthening the educational components of the plan, improving monitoring activities to better gauge outcomes, and extending the use of computers to the broader society, particularly in low-income areas (IDB, 2015).

The Bahamas has benefitted from the IDB programme for Investing in Students and Programmes for the Innovative Reform of Education (INSPIRE). In 2014, all 78 public high schools were equipped with computer labs and Promethean boards. The IDB's two-part strategy matched infrastructure investment with teacher training on using these technologies in the classroom (IDB, 2016).

1. *www.conectarigualdad.gob.ar/seccion/directivos-4.*

In some countries, the target of providing hardware to school-aged children has shifted to inexpensive mobile tablets. Colombia has been a pioneer in this area, as part of its Computers for Education programme that focuses on bringing ICTs and ICT education to schools in rural and remote areas. The programme aims to i) equip all public education institutions with terminals (PCs, laptops, tablets) to achieve a ratio of 12 students per computer; ii) train teachers how to integrate ICTs in their course work and pedagogics; iii) train parents; and iv) recycle old terminals (OECD, 2014b).

Mobile smartphones may also become an important hardware platform for education. Studies have found that mobile learning can significantly reduce barriers to education, attaining educational outcomes comparable to traditional educational methods (Valk Rashid and Elder, 2010). However, mobile phones have small screens, a lack of properly formatted content, less-than-robust software and costs comparable to other hardware platforms'.

Too often, advocates for education technology have extolled its benefits without recognising that technology alone will not transform education. Initiatives such as the One Laptop per Child clearly illustrate that technology needs to be guided by expert teachers and pedagogical leaders to be used effectively in the classroom. A failure to address teacher training in ICTs and the need for new pedagogical models need to be overcome before the benefits of technology in education can be fully realised.

In OECD countries, **schools, governments' offices and hospitals** were often the first connections installed in remote communities and served as the first community access centres. These served as anchor tenants and aggregated the initial demand for a broadband connection in that area. Once network edges reached the community, it was much easier to provide commercial and residential service.

Installing connectivity in **community centres** is one way to ensure that basic connectivity is available to as broad a segment of the population as possible. Community access centres also serve another critical role; they provide a physical space to give people their first exposure to the Internet and obtain help getting online from other people in the community. These initial experiences can prepare the way for a richer online experience once advanced services become widely available. Some of the best-connected countries in the world, such as Korea, began expanding connectivity by installing public computers with Internet access in municipal government offices. The LAC region has a number of examples of community access programmes (Box 9.3).

Box 9.3. **Community access projects in LAC**

Costa Rica's CECI project provides community access centres across the country with computers and access to the Internet. They are staffed by government workers, university students, and volunteers. The next stages of the programme will train people in SMEs on how to use online government services (Costa Rica, 2015).

The government in the **Dominican Republic** has installed community access centres in shopping areas where they will be close to students and the community. These classrooms offer free Internet access, newspapers, magazines and even books that can be checked out. It is notable that the centres also have audio books, a reading room, a playground, puzzles, chess and various other board games. The goal is to introduce digital access in centres that offer a broad range of community services (CTC, 2015).

Brazil has 7 755 telecentres throughout the country that offer free Internet access. These also act as a gathering place for culture and leisure. They were installed through a partnership between ministries, municipalities and the agencies responsible for administering them. Brazil's Assistance to Citizens Service (GESAC) also offers Internet connections free for telecentres, schools, medical facilities and indigenous communities in areas of social vulnerability. About 29 000 such centres have been set up throughout the country under the programme.

Mexico has an extensive programme, *México Conectado*, offering connectivity in community access centres. An online database maps access points by geography, or the type of type of centre offering the access (e.g. health clinics, schools, government offices, or public spaces).

The role of community access centres has evolved in the smartphone era. Expensive computers are no longer barriers to Internet access as inexpensive smartphones and affordable data plans become more available. Yet, the support community and learning potential of community access centres are still important as more of the economy moves online. As a result, community access centres can be an important component of teaching online skills and providing broadband access to a community.

The digital skills necessary for the new economy cannot be learned effectively only at schools. It is important that people have **access to the Internet** on devices in the places where they live. The PISA study finds a hill-shaped relationship between the uses of computers at home for leisure and digital reading performance. Moderate users tend to perform better than both intensive users and rare users. In contrast, computer use at school may be better than no use at all, but levels of computer use above the current OECD average are associated with significantly poorer results (OECD, 2015b).

These data on connections from home are from developed countries, but connectivity and computer access is much lower in many parts of the world. These data can still provide an important lesson for policy. Governments focusing on ICT skills may need to broaden their policies beyond simply serving community locations such as schools, and include elements that introduce connectivity at home as well.

A lack of affordable Internet access for individuals will slow the adoption of digital services and development of digital skills that could be used throughout the economy. As the PISA data show, Internet access plays an important role in developing digital skills, so efforts to make access more affordable will have an effect on the skill level of users across the economy. As shown in Chapter 6 on affordability, governments are taking steps to make access affordable through policies such as ensuring effective competition. This benefits not just the users, but the economy at large.

Skills development

Once networks and hardware are in place, they can be used as tools for learning and skills development. In the past, much of the emphasis was placed on connecting schools, and less attention devoted to building digital skills. Evidence suggests that infrastructure investments are necessary but not sufficient conditions for promoting digital skills and learning. Hardware needs to be complemented with content, teacher training and guidance on pedagogical uses (Arias Ortiz and Cristia, 2014). Recent OECD work shows that schools have yet to take advantage of the potential of technology in the classroom to tackle the digital divide and give every student the skills needed in today's connected world (OECD, 2015b).

At the most basic level, people should be comfortable using a computer, tablet or mobile phone and understand how to perform basic tasks, such as watching a video or searching for information. At the other end of the spectrum, ICT specialists often need specialised and evolving skills.

Internet economy skills are broader than ICT specialist skills and represent the **skills people need to interact in the digital economy**. In 1998, the IDB noted, "technological fluency may stand alongside reading and mathematics as one of the essential skills for a successful life" (Wolff et al., 1998). While most users need not be specialists, they must have the skills to use digitally supported services such as downloading and running apps on a smartphone and searching for information online. This also includes the ability to use e-mail, spreadsheets, word processors and conduct transactions online. The OECD finds that these skills are often linked to personal attitudes, cultural attributes and experiences that shape the level

of generic skills in the economy (OECD, 2014c). Governments in the LAC region have taken steps to help increase basic skills for interacting with the Internet throughout the economy as a way to build a baseline of skills (Box 9.4).

Box 9.4. Initiatives in the LAC region for enhancing skills

In 2012, **Peru** passed the National Digital Literacy Plan, which seeks to train every citizen in the use of computer tools and mobile devices. In addition, Peru made 107 online courses available to teachers online as part of the Educate Peru Programme. Eight of these courses focus on developing digital skills incorporating ICTs in the classroom. Over 25 000 teachers have received training online, with 2 000 taking courses on integrating ICTs in the classroom (Perueduca, n.d.).

Uruguay has a broadcast television programme, *Ceibal Channel*, that teaches a course about computers that can be applied to different schooling levels. The programmes are broadcast over local television channels and available online so students and the public have permanent access.

Costa Rica's state universities offer ICT training courses for the general population, particularly its vulnerable segments (e.g. the elderly and disabled). Examples include the National University's Informatics Assistance and Training Institute (ICAI) (ICAI, 2013), the National Technical University's Centre for Communication and Information Technologies (CETICS)[1] and Costa Rica University's Integral Programme for the Elderly (UCR, 2016).

Trinidad and Tobago has a National Training Agency that offers jobs search and career coaching services, including ICT training (NTATT, 2016).

1. *http://extension.utn.ac.cr/.*

Demand is growing for **ICT specialists** with skills in telecommunications networking, databases and app development. These specialised skills are in demand across all sectors of the economy. In developed countries, ICT specialists typically account for between 1% and 6% of total employment in OECD countries, and their percentage in total employment has grown over the past decade in most countries (Figure 9.11).

Figure 9.11. **Growth in ICT specialist jobs**
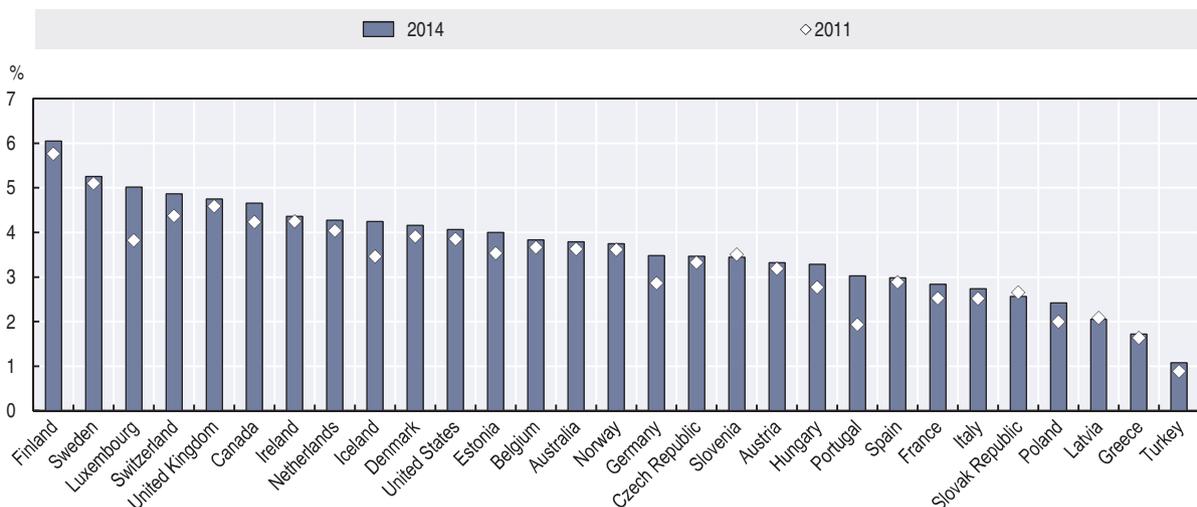
Source: OECD (2015a), *OECD Digital Economy Outlook 2015, http://dx.doi.org/10.1787/9789264232440-en.*

StatLink ⟶ *http://dx.doi.org/10.1787/888933354457*

Some countries in the LAC region have developed policy initiatives to promote ICT specialist skills (Box 9.5). These programmes tend to fall under digital agendas (as discussed in Chapter 2) or national plans for education or innovation.

Box 9.5. **Public programmes in LAC to encourage ICT specialist skills**

Uruguay is developing a programme to train specialised technicians in the ICT area and in medical informatics that will be run from the Technological University of Uruguay. The programme is part of the Digital Agenda of Uruguay 2011-2015.

Brazil's "Science without Borders" programme aims to increase Brazilian competitiveness by sponsoring graduate studies and research abroad for Brazilians and also supporting foreign researchers who come to do research in Brazil in priority subjects. The programme helps train ICT specialists and brings workers into the economy. Brazil has also developed an initiative under the "*TI Maior*" Strategic Programme for Software and IT Services, *Brasil Mais TI*, intended to develop ICT skills by providing online courses and job postings. In three years, the initiative has trained more than 208 000 young people in courses ranging from 16 to 380 hours.

In **Peru**, PRONABEC (the public agency in charge of granting scholarships) through its BECA 18 (Social Scholarship Programme) sponsors the studies of graduate and college students for ICT-related careers in national universities and abroad. The National Council for Science and Technology (CONCYTEC) finances postgraduate studies and research in ICT.

Colombia's ICT Ministry leads the "Transversal Skills Development" programme and funds training programmes to develop soft skills for professionals linked to the IT industry.

Adapting skills should also include targeted actions for **domain-specific ICT skills** linked to an industry or enterprise. This can include specific software for a sector (e.g. computer aided design, or CAD) or software specific to a role in an office environment (e.g. SAP). These skills are commonly learned on the job or via work-sponsored training. Policy makers in the LAC region have also established policies to encourage these specific ICT skills (Box 9.6).

Box 9.6. **Building domain-specific ICT skills in the LAC region**

Brazil's *Banco Nacional do Desenvolvimento* (*National Development Bank or* BNDES) programme supports training and professional qualifications for workers. The government provides tax incentives to firms that provide software training for their employees (BNDES, 2012).

Chile provides tax credits for firms that invest in on-the-job or industry training for their employees. The goal of the credit is to promote job skills and train more people in IT skills.[1] Another programme, *ChileValora*, provides certification for labour skills, regardless of the means by which an individual obtained the skill set (e.g. formal education, individual learning, online courses). The programme has 753 unique occupational profiles that apply to different industries and sectors, including IT (Chile Valora, 2014).

1. *www.sence.cl/portal/*.

Finally, developing **teachers' skills** is a crucial part of any ICT skill development strategy. Teachers can integrate technology into the subjects they teach as a way to improve the digital skills of students. If they lack ICT training and skills, an opportunity is lost to improve students' skills.

IDB research has shown that integrating ICT in instruction depends on teachers' belief in the usefulness of technology and their level of confidence using computers. This provides additional support for incorporating ICT teacher training in education policy. It also suggests that such training should address not only ICT mastery, but also teachers' readiness for the pedagogical integration of technology (Hinostroza, 2011). Successful ICT countries, such as Korea, have also made training teachers in ICT skills a top priority (Severin and Capota, 2011).

Teachers and administrators can then apply one of the recommended frameworks for integrating ICTs into the classroom. The IDB has developed a conceptual framework for ICTs in education that maps out student learning from inputs, processes and products through to their effects (Figure 9.12).

Figure 9.12. **IDB conceptual framework for using ICTs in education**
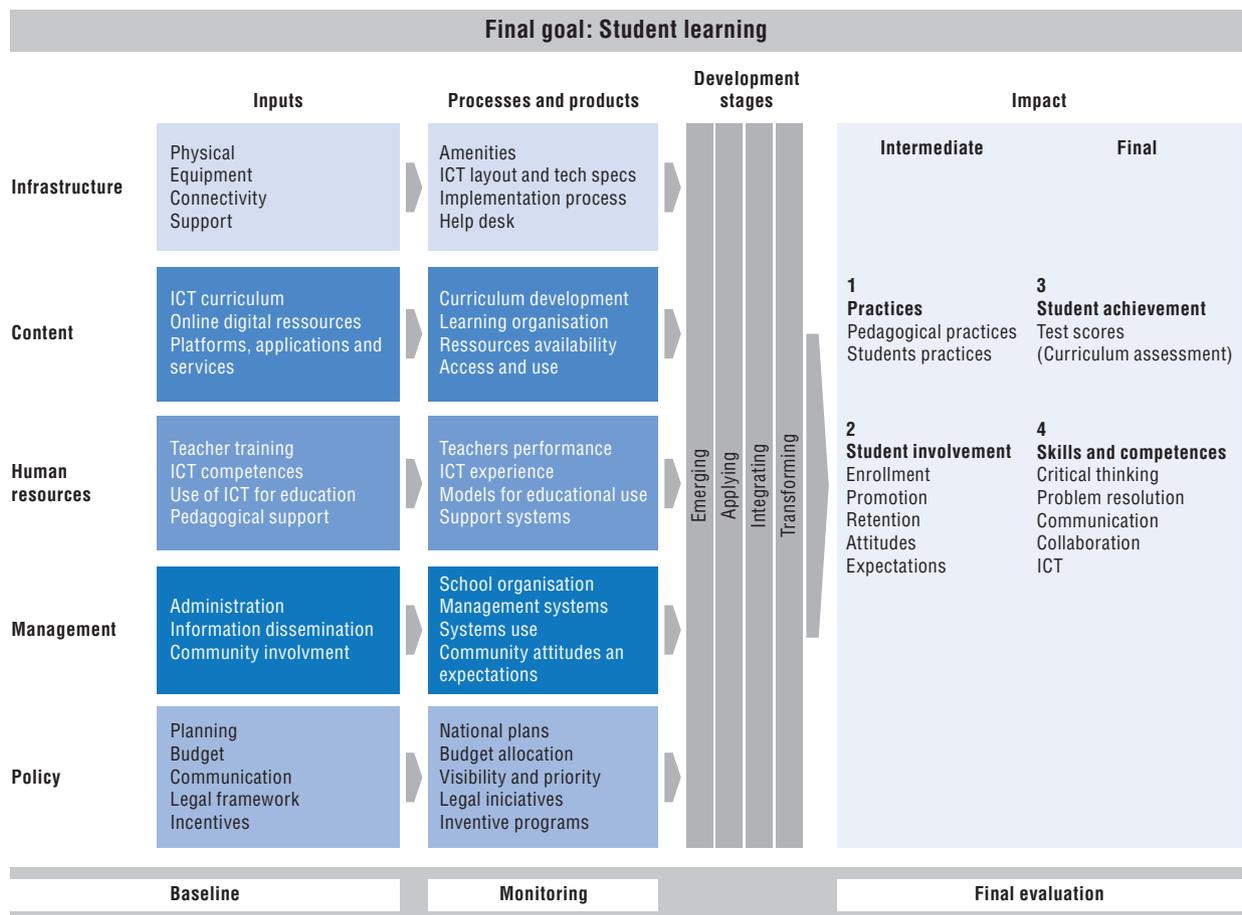
Source: Severin (2010), *Projects for the Use of Information and Communication Technologies in Education: Conceptual Framework, https://publications. iadb.org/handle/11319/3468?locale-attribute=en.*

UNESCO has also developed a framework for teachers that sets out the competencies required to teach ICTs effectively by focusing on technology literacy, knowledge deepening and knowledge creation (Table 9.1) (UNESCO, 2011). The framework starts with basic technological literacy and progresses to a state where users are actually creating content for others.

Table 9.1. **UNESCO ICT Competency Framework for Teachers**

Technology literacy	Knowledge enrichment	Knowledge creation
Increasing the extent to which new technology is used by students, citizens and the workforce, by incorporating technology skills into the school curriculum.	Increasing the ability of students, citizens and the workforce to use knowledge to add value to society and the economy, applying it to solve complex real-world problems.	Increasing the ability of students, citizens and the workforce to innovate, produce new knowledge and benefit from this new knowledge.

Source: UNESCO (2011), *ICT Competency framework for teachers, unesdoc.unesco.org/images/0021/002134/213475e.pdf.*

Initiatives to encourage ICT competences for teachers should be supported by national plans aiming to strengthen teaching skills throughout the country. Some governments in the LAC region have launched such initiatives (Box 9.7). Teachers should be involved in their design and implementation, and the targets of these initiatives should also be routinely evaluated.

Box 9.7. Training teachers with ICT skills in LAC

In **Costa Rica**, the Ministry of Public Education created a virtual training campus targeting teachers and public servants. It offers virtual and bimodal training to strengthen teaching throughout the country.[1] There is also a training platform for teachers, which helps them to integrate technology in their classrooms. The creators of the platform understood that it could be leveraged across countries in the region as well as just in the home. The result is a platform serving an educational community throughout Central America and the Dominican Republic, CEDUC@R (CEDUC@R, 2016).

In **Peru**, the Ministry of Education developed and published digital resources for teaching through the platform PerúEduca.[2]

Chile has a platform that provides digital mathematics and English resources to teachers and schools. The content includes training for teachers on how to install and use the platform in schools.[3]

Colombia is implementing a training programme for teachers and guidance counsellors of basic and secondary institutions, to disseminate information on the dynamics of the IT industry, starting with basic IT concepts. In 2014, this reached 3 526 people. The strategy will continue until 2017, and is aiming to reach 25 000 teachers and counsellors.

1. *www.capacitacion.mep.go.cr/.*
2. *www.perueduca.pe/recursos.*
3. *www.enlaces.cl/index.php?t=44&i=2&cc=2372&tm=2.*

Once users have sufficient skills to get online, they will need rich **content** that is accessible in local languages and with a local context. The content that is most important to people is typically in their own language and relevant to the communities in which they live and work. OECD research shows a strong correlation between the development of network infrastructure and the growth of local content, even after controlling for economic and demographic factors (OECD, ISOC and UNESCO, 2013).

Universities have been making more of their rich content available for free online in collaborations such as "The Open Education Consortium".[5] Online video distribution sites such as YouTube and DailyMotion have also become an important repository of nontraditional, specialised learning, but the content is often in English. Efforts are under way to translate the content (such as the Khan Academy's)[6] into languages such as Spanish, but the process takes time and funding. Even when content is in a locally spoken language, the context may be different for geographical or other reasons.

Governments have various policies to promote the development and use of online and digital content. One example is Haiti's "Library for All", a digital library platform that provides e-books to students via an app on inexpensive tablets. The programme provides over 500 books in Haitian Creole, English, French and Spanish in a format that is easily searchable, device-agnostic and works offline if necessary. During the pilot project, the books in Haitian Creole proved the most popular with readers (Library for all, 2015).

Local "master teachers" also have an important role to play in teaching concepts to the broader public. Governments can help identify educators with exceptional teaching skills and provide resources and support to make their lessons available online. Teachers can play an important role in creating local and digital content tailored to national or regional needs. Online platforms are increasingly being used for these purposes, both as resources that facilitate content and application creation, and for networking with other educators (Box 9.8). Other aspects of policies to increase local content are discussed in Chapter 10.

Box 9.8. Teaching programming online platforms

Scratch[1] is a free tool developed by MIT's Media Lab to help students aged 8-16 learn computer programming. Students can programme interactive stories, games and animations and share their creations with the online community. Scratch is used in more than 150 different countries and is available in more than 40 languages. Educators in Peru are using it to teach programming skills to primary and secondary school students.

MIT's **App Inventor**[2] is another free tool for learning programming. It is a blocks-based programming tool that enables people to learn programming and build fully functional apps for Android devices. In 2015, nearly 3 million users in 195 countries had built more than 7 million Android apps. In any given week, more than 100 000 people use the platform.

1. *http://scratch.mit.edu.*

2. *http://appinventor.mit.edu/explore/about-us.html.*

Skills activation and effective use

Once networks are in place and people have the necessary skills, these skills must be activated and used. Activation policies encourage people to supply their skills to the labour market, particularly by reintegrating newly skilled workers outside the workforce, or retaining skilled workers. Policy should also focus on transitioning to efficient use of ICTs throughout the economy, which requires both specialist and general ICT skills. This section provides examples both promote both the activating and using skills.

The Internet has significantly reduced the transaction costs of **matching employers and employees**, through powerful search capabilities, the emergence of social networks and the Internet's global reach. It is now the foundation for the largest job/skills-matching platforms in the world and benefits users who have connectivity and a baseline level of digital skills.

Sites such as Monster,[7] Indeed,[8] and CareerBuilder[9] offer global employment-matching services. Sites such as CompuTrabajo[10] provide job matching to Spanish speakers in Latin America. In September 2015, it listed 320 000 jobs in 91 countries (CompuTrabajo, 2016). In other cases, specialised sites provide employment-matching services in specific fields such as technology (Dice),[11] tourism and hospitality (Turijobs)[12] or health (eMedCareers).[13]

Social networks have recently become powerful tools, making professional networking much easier and matching workers with job openings that require specific skills. Companies such as LinkedIn,[14] Viadeo,[15] and Xing,[16] geared towards professionals, offer networking services and job boards. These companies have started leveraging their large databases to help firms find employees with particular skills.

ICTs also have the potential to make a significant contribution in **enhancing and extending guidance career services**, particularly for young people completing their education and older adults in career transitions.

Many governments are taking steps to improve the **availability of labour market information**, in most cases by providing Internet-based portals for job ads and searches. In a few cases, governments provide lists of occupations and skills, and where shortages have been observed or are most likely to occur in the near future. In Canada, for example, the Labour Market Information (LMI) portal provides "detailed labour market information at the local or community level". This includes job and skill requirements, wages and salaries, as well as employment prospects by occupations and locations, allowing workers to better plan their career path and employers their recruitment (ESDC, 2014). As part of its services, the Canadian government also has a searchable job bank.[17] Some examples of such initiatives can also be found in the LAC region (Box 9.9).

Box 9.9. **Improving labour market information in LAC**

In **Chile**, the government runs an online portal called the National Employment Exchange (BNE),[1] a free site where companies publish job offers and workers can submit CVs for consideration. In addition to offering job matching, the BNE portal also contains links to programmes, training and career guidance.

Mexico has several programmes to link students, teachers and jobs. The "*Circuito conectados contigo*" portal ("Circuit connected to you") helps match companies with both students and teachers.[2] In 2013, the "*Total Uni*" portal launched to help high school students to connect to jobs in the market (Total Uni).[3]

In the **Dominican Republic**, the Ministry of Labour has a job portal that matches employers with potential workers. Candidates can register their information and apply to jobs. In September 2015, 11 000 businesses were listed on the platform and nearly 42 000 jobs posted.[4]

Brazil has a publicly certified platform for CVs managed by the National Centre of Scientific Research, the CNPQ (Lattes platform).[5] It is often used by university graduates. In September 2015, the site hosted nearly 1.2 million CVs.

1. *www.bne.cl.*
2. *www.sems.gob.mx/en_mx/sems/programa_circuito_conectados_contigo.*
3. *www.totaluni.com.*
4. *http://ovi.mt.gob.do/empleateya/home/.*
5. *http://lattes.cnpq.br/.*


Online learning offers a significant opportunity to leverage broadband network access to spread knowledge across the economy in a cost-effective way. Online learning can take many forms. It can be delivered as traditional university-style courses online, or as informal task training related to specific work skills or lifetime learning activities. It can increase the opportunities for people in the LAC countries to access relevant material, irrespective of its location in the region or around the world.

One example of broadband networks supporting online learning is the growth of massive open online courses (MOOCs) that allow students around the world to follow courses taught by instructors at well-known universities. MOOCs are academic courses offered online, often for free, that aim at large-scale interactive participation from around the world (Figure 9.13). The number of students signing up for these services and participating in parts of the courses is significant. The online course provider Coursera (coursera.org) had 10 million registered users in 2014 and edX (edx.org) 4 million. The majority of courses on both platforms are in English, but other languages such as Spanish are coming online.

Figure 9.13. **MOOCs from edX**
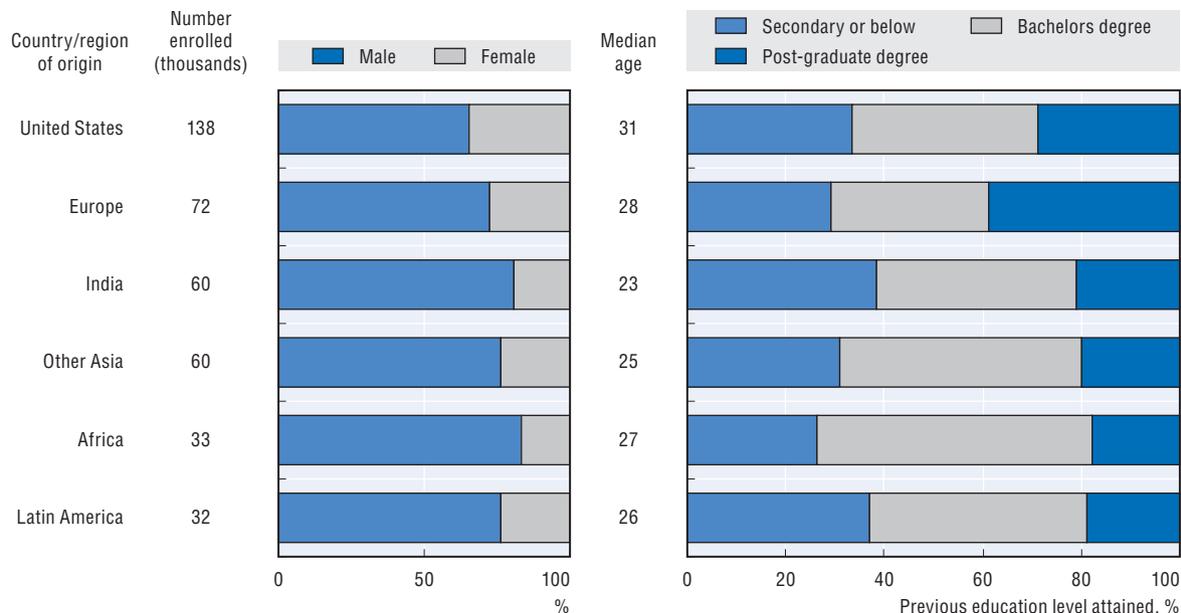
Notes: MOOCs : Massive open online course; data provided by edX : Harvard University and Massachusetts Institute of Technology. Student statistics, 2012-13 academic year.

Source: The Economist (2014), "The staid higher-education business is about to experience a welcome earthquake", *www.economist.com/ news/briefing/21605899-staid-higher-education-business-about-experience-welcome-earthquake-digital.*

MOOCs can also be used to fill workplace training needs efficiently and provide alternative routes to training for employment for the unemployed. MOOCs have the potential to address many shortcomings of workforce training. First, they avoid the cost of setting up expensive training boot camps whose effects are limited in time. Second, semi-synchronicity allows learners to go through the materials at their own pace, while motivating them to collaborate on common learning objectives. Lastly, certificates allow employees to demonstrate the acquisition of specific skills (Meister, 2013). Internationally recognised badges and certifications may also help workers show their proficiency in certain programming skills.

Other new online services take a broader focus and offer courses on a wide range of work and life subjects. One example is SkillShare[18] which caters to learners looking for specific skills, which can range from promoting a business, making meals or interior design. One of the interesting aspects of SkillShare is that it allows people to propose their own courses to teach. Teachers can charge for their courses and SkillShare keeps 12% of revenues. Students from more than 150 countries use the service with active participation from the LAC region. A class in 2015 on drawing with ink attracted students from Argentina, Chile, Columbia, Mexico and Peru (Skillshare, 2015).

Conclusion

The expansion of broadband networks in the LAC region is often viewed as a source of potential new job growth, both in the ICT sector and as a catalyst for new business innovation across all other sectors of the economy. At the same time, it is clear that the Internet is forcing a significant reorganisation of businesses around the world, and this affects skills and labour demand and ultimately, employment. This evolving landscape of skills and jobs requires policy makers to develop a comprehensive, coherent approach to expand connectivity, encourage learning, activate digital skills and promote their use throughout their populations, all while measuring progress.

It is crucial that policy makers develop a comprehensive strategy to address the evolving issues needed for skills and jobs in the digital economy. Improving connectivity to community centres and schools is a first step. Individuals need access to hardware so they can effectively use a broadband connection, and to attain sufficient levels of digital literacy and specialist ICT skills. Finally, they need to use them proficiently in workplaces. Infrastructure investments are necessary but not sufficient conditions for promoting digital skills, and learning as hardware needs to be complemented with content, teacher training and guidance on pedagogical approaches.

Policy makers are beginning to realise that expert teachers and pedagogical leaders are needed if technology is to be used effectively in classrooms. Developing teachers' skills is a crucial part of any ICT skill development strategy.

Digital skills development is needed from the most basic levels to the acquisition of specialist ICT. Digital skills are not only learned in schools, but through computer use at home, so strategies should be comprehensive. Providing universal and affordable access to broadband is fundamental, but monitoring of school performance in relation to use of computer at home should also be carried out.

Many governments in the LAC region have improved the availability of labour market information, chiefly by providing Internet-based portals for job ads and searches. Online learning also presents a cost-effective way of leveraging broadband network access to spread knowledge throughout the economy. MOOCs can be used to target workplace training needs and provide alternative training for the unemployed.

Notes

1. Autor and Dorn (2013) and Autor, Levy and Murnane (2003) called this "routinisation" and find that within industries, occupations and education groups, computerisation is associated with reduced labour input of routine manual and routine cognitive tasks and increased labour input of nonroutine cognitive tasks. Service jobs that require cognitive and interpersonal skills are believed to be growing because it is more difficult for these jobs to be automated. The wages of these service-based jobs tend to rise relative to other low-skill occupations. This phenomenon is significant because it offers insight into the polarisation of employment and earnings in the United States and, potentially, other industrialised countries (Autor, Katz and Kearney, 2006; Goos and Manning, 2007). Recent work by the OECD on routinisation shows that technological innovation matters for employment across all levels of routinisation, and that ICT capabilities are positively correlated with employment levels in all groups of work except for those with high-routine occupations (Marcolin, L., S. Miroudot and M. Squicciarini, 2016).

2. According to the United Nations, there are approximately 156 million young people between age 15 and 29 in Latin America and the Caribbean, representing over one-quarter of the region's population.

3. PIAAC data across developed economies reveal that between 7% and 27% of adults have no experience in using computers or lack the most elementary computer skills, such as the ability to use a mouse. In addition, only 33% to 40% have the skills to succeed in a technology-rich environment

(OECD, 2012b). In OECD countries, only 6% of the population is categorised with the highest level of ICT skills, meaning that they can complete tasks involving multiple applications, a large number of steps, impasses and the discovery and use of *ad hoc* commands in a novel environment.

4. Young adults, those with tertiary levels of education, and those in skilled occupations are the most likely to have the ICT core competences and experience with computers.

5. *www.oeconsortium.org/.*

6. The Khan Academy provides an extensive set of short videos to teach educational concepts in subjects such as mathematics and science.

7. *www.monster.com.*

8. *www.indeed.com.*

9. *www.careerbuilder.com.*

10. *www.computrabajo.com.*

11. *www.dice.com.*

12. *www.turijobs.com.*

13. *www.emedcareers.com.*

14. *www.linkedin.com.*

15. *http://us.viadeo.com.*

16. *www.xing.com.*

17. *www.jobbank.gc.ca.*

18. *www.skillshare.com/.*

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