2 Enhancing connectivity to develop skills in Latin America

Digitalisation brings many opportunities for learning and developing skills, in initial education and throughout life. This chapter examines the extent to which digital divides (gaps or inequalities in the access, use or benefits derived from the use of information and communication technologies) in Latin American countries are likely to hinder individuals' ability to make the most of new technologies for learning. Schools can help bridge connectivity gaps by providing access to ICT infrastructure to a large number of children, but many digital divides remain in Latin American countries.

Summary of the main insights

Latin American countries are lagging behind OECD countries with respect to the skills of their populations but digital technologies can be part of the solution. However, countries in the region lack the basic skills to engage in the rapidly changing world of work and societies.

- Only less than 10% of individuals in Chile, Ecuador, Mexico and Peru have a well-rounded level of literacy, numeracy and problem-solving skills in technology-rich environments and around 42% of Latin American 15-year-olds who participated in the Programme for International Student Assessment (PISA) in 2018 are low performers in science, reading and mathematics. In the Dominican Republic, this share goes up to 75%.

Although the lack of connectivity is an obstacle for technology-driven learning in Latin America, it is not the only factor. The lack of skills and digital competence, as well as security and affordability-related issues are Latin America's most relevant barriers for Internet adoption.

- Penetration of broadband services is low relative to levels observed in OECD countries. In 2017, penetration of mobile broadband was, on average, of 64.9% in Latin American countries in contrast to 102% for OECD countries. Penetration of fixed broadband was just above 12% in contrast to more than double (30%) in OECD countries. Some Latin American countries, together with Asia and Africa, also fare poorly in terms of average Internet connection speed relative to OECD countries. In addition, many inequalities persist across and within countries in the region in individuals' access and use of digital technologies by socio-economic status, gender, age and territory.

Public institutions and in particular schools can play a leading role in bringing individuals and young people on line.

- Connectivity remains a challenge for the overall population in Latin America, but this is less so for students as public institutions and, in particular, schools are helping to bridge this divide. Around 75% of students in the region reported having access to a computer, desktop or laptop in their school and a similar share to have an Internet connection.
- Schools in many Latin American countries play an important role in bringing connectivity to ICT to many disadvantaged students who would otherwise be left disconnected. Around 25% of socio-economically disadvantaged students in Latin American countries have access to a computer only when at school and 16% of them are able to go on line exclusively when at school, lacking the chance to connect when at home. In Peru, almost two-thirds have access to a computer solely on the school premises and more than one-third of students have Internet access only at school.
- In Colombia, Peru and Mexico, schools act as Internet providers for more than 20% of rural students who lack access at home but who can go on line at school. Schools, more generally, also play an important role in making computers, and not only connection to the Internet, available for

rural students in those same countries. For instance, more than 41% of rural students in Peru have access to a desktop/laptop/tablet only at school. In Colombia, this is the case for 20% of rural students and in Mexico for 27% of them.

Socio-economic background plays an important role in students' access to technology in Latin America, leading to divides that policy makers should address.

- Around 18% of Latin American 15-year-olds from socio-economically disadvantaged backgrounds lack an Internet connection at home and at school, in contrast to less than 2% on average in OECD countries. Some 24% of them, in addition, do not have access to a computer (desktop, laptop or tablet) neither at home, nor at school. In contrast, computer access of socio-economically advantaged students in Latin American countries is comparable to that of students in OECD countries. In Latin American and OECD countries alike, less than 1% of socio-economically advantaged students lack access to a desktop, laptop or tablet. Important divides persist between advantaged and disadvantaged students and need urgent policy intervention to make the digital revolution truly inclusive across the countries of the region.
- The extent to which disadvantaged and advantaged students are able to connect varies widely across countries in the region. Among countries with available data, the digital divide between advantaged and disadvantaged students is especially large in the Dominican Republican, Mexico and Peru. One-third of disadvantaged students in the Dominican Republic are not able to connect to the Internet and 40% of them lack access to a computer.

Relative to other potential barriers, shortage or inadequacy of digital technology for instruction (e.g. software, tablets, computers, smart boards) and insufficient Internet access are very often reported to be important challenges hindering instruction in Latin America schools.

- Much needs to be done to put teachers and schools in a position to make the most of the digital revolution for learning and teaching activities. Around 51% of principals, on average in the region, report insufficient Internet access as a barrier to the provision of quality instruction, in contrast to 17% on average in OECD countries. This share goes up to 73% in Colombia. Around 43% of principals also complain about the shortage or inadequacy of digital technology for instruction.

New technologies bring opportunities for skills development

Digitalisation profoundly transforms the world of work and societies, and individuals need a mix of skills to thrive in an increasingly digital environment (OECD, 2019[1]). Without a well-rounded level of cognitive, socio-emotional and digital skills, individuals are locked out of all the benefits new technologies can provide, whether at home, in society, or at work. At the same time, digitalisation brings many new opportunities for developing skills. People go on line to learn from tutorials; they can attend massive open online courses (MOOCs) from leading universities outside of their country, exchange in online communities with other professionals about their practice, or access a vast amount of knowledge and information through open resources. A digital device and Internet connection open the door to countless learning opportunities available at any time, from anywhere and to anyone.

Latin American countries are lagging behind OECD countries with respect to the skills of their populations but digital technologies can be part of the solution. Data from the OECD Survey of Adult Skills, a product of the Programme for the International Assessment of Adult Competencies (PIAAC) (Figure 2.1) show that in Chile, Ecuador, Mexico and Peru, a large share of individuals lack the basic skills to engage in the rapidly changing world of work and societies. This is the case for around 60% of 16-65 year-olds in Ecuador and Peru in contrast to an average of 14% in OECD countries. Less than 10% of individuals in Chile, Ecuador, Mexico and Peru have a well-rounded level of literacy, numeracy and problem-solving skills in technology-rich environments.[1]

While school enrolment has improved in the last decades in Latin American countries, the quality of education remains a major challenge in the region (OECD, 2015[2]): many young people leave school without having acquired the necessary foundation skills. Around 42% of Latin American 15-year-olds who participated in PISA in 2018 are low performers in science, reading and mathematics (Figure 2.2). In the Dominican Republic, this share goes up to 75%.

A good level of cognitive and socio-emotional skills, developed early in life, provides a strong basis for the development of further skills (Heckman, 2006[3]) and the impact of unfavourable conditions (e.g. socio-economic disadvantage) on skills development is better tackled early in life than later (Cunha, Heckman and Schennach, 2010[4]).

This is particularly important for Latin American countries as analyses based on PISA show that socio-economic status decreases the chances of disadvantaged students performing well, to a larger extent than it shields advantaged ones from being low performers (OECD, 2015[2]) (Box 2.1). Equity of outcomes is yet another challenge that many Latin American countries need to address in order to equip their populations with the necessary skills to thrive at work and in life.

Box 2.1. Equity in education in Latin American countries

OECD (2015[2]) examines the relationship between socio-economic status and student performance in PISA (2015) in Latin American countries, including Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Mexico, Peru and Uruguay.

In Brazil, the Dominican Republic and Peru, student performance is below that of students in OECD countries, irrespective of whether students come from advantaged or disadvantaged backgrounds. In contrast, in a number of Latin American countries (Chile, Colombia, Costa Rica, Mexico and Uruguay), the mean performance of socio-economically disadvantaged students is on a par with that of disadvantaged students in other OECD countries. However, advantaged students in all Latin American countries with available data perform less well than advantaged students in OECD countries.

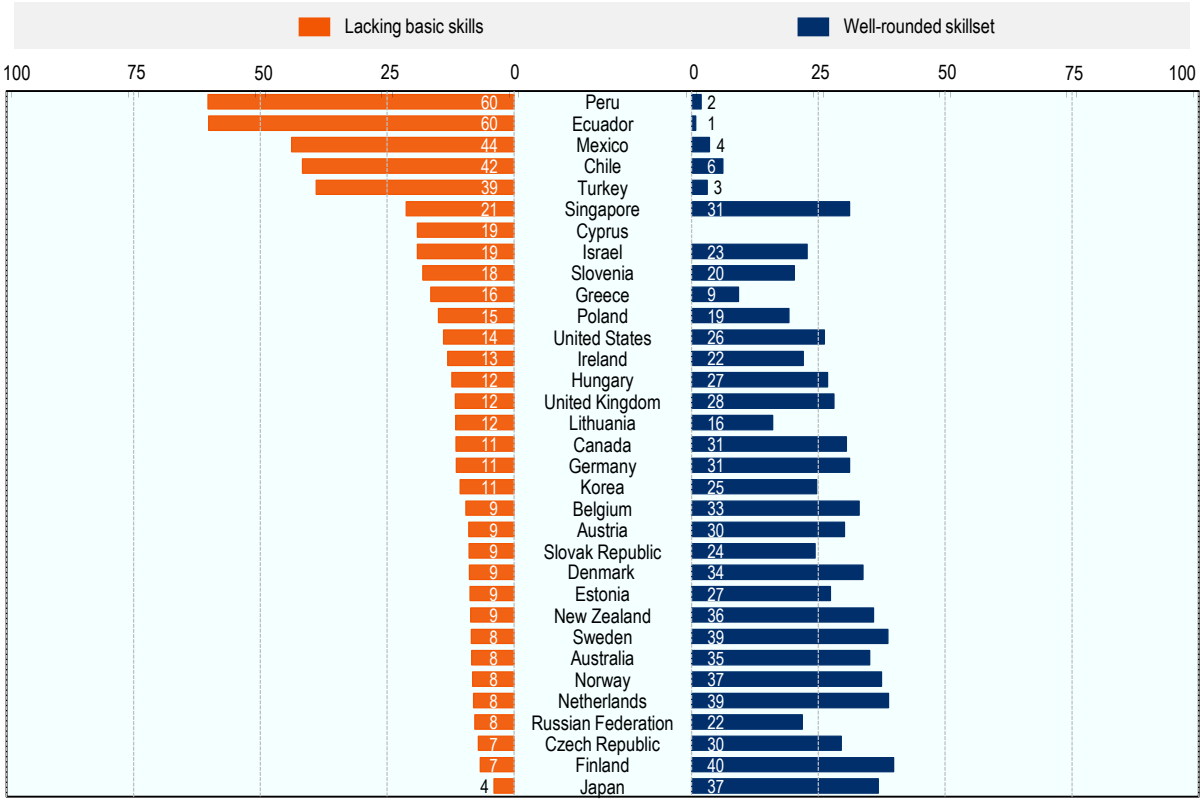
Comparing the performance of socio-economically advantaged and disadvantaged students in Latin American countries shows that the latter have lower chances to perform well in the assessment. Disadvantaged students have a higher likelihood than non-disadvantaged ones of reaching a baseline level, whether in science, reading or mathematics. In Peru, for example, disadvantaged students are almost 16 times more likely to be low performers in reading than non-disadvantaged ones. Additional analyses show that in most Latin American countries (excluding Chile), socio-economic status is more detrimental for disadvantaged students' likelihood to be top performers than it shields their more advantaged peers from poor performance (OECD, 2016[5]).

Source: OECD (2015[2]), *Skills in Ibero-America: Insights from PISA 2015*, www.oecd.org/pisa/sitedocument/Skills-in-Ibero-America-Insights-from-PISA-2015.pdf; OECD (2016[5]). *PISA 2015 Results (Volume I): Excellence and Equity in Education*, https://dx.doi.org/10.1787/9789264266490-en.

New technologies, including mobile devices, can help bridge gaps between individuals and foster the skills they need to engage in societies and in an increasingly digital-intensive future. In schools, the use of digital tools can potentially support the development of digital and cognitive skills, enhance student engagement and enable innovative teaching methods that personalise instruction and allow all students to thrive. In the case of adults, MOOCs and open education resources open the possibility of engaging in learning at all stages in life. For workers who lack time, resources, or are in informal employment with little opportunities for training, new technologies open the path for alternative ways of acquiring knowledge and developing skills.

Figure 2.1. Skills mix of countries' populations

Share of 16-65 year-olds lacking basic skills or having a well-rounded skill set, by country (%)



Note: Indicators are based on the *OECD Skills Outlook 2019* (OECD, 2019[1]). Individuals lacking basic skills score at most level 1 (inclusive) in literacy and numeracy and at most below level 1 (inclusive) in problem solving (including failing ICT core and having no computer experience). Individuals with a well-rounded skill set score at least level 3 (inclusive) in literacy and numeracy and at least level 2 (inclusive) in problem solving. Chile, Greece, Israel, Lithuania, New Zealand, Singapore, Slovenia and Turkey: Year of reference 2015. Ecuador, Hungary, Mexico, Peru and the United States: Year of reference 2017. All other countries: Year of reference 2012. Data for Belgium refer only to Flanders and data for the United Kingdom refer to England and Northern Ireland jointly.
Source: OECD calculations based on OECD (2017[6]), Survey of Adult Skills (PIAAC) (2012, 2015, 2017) (database), http://www.oecd.org/skills/piaac/.

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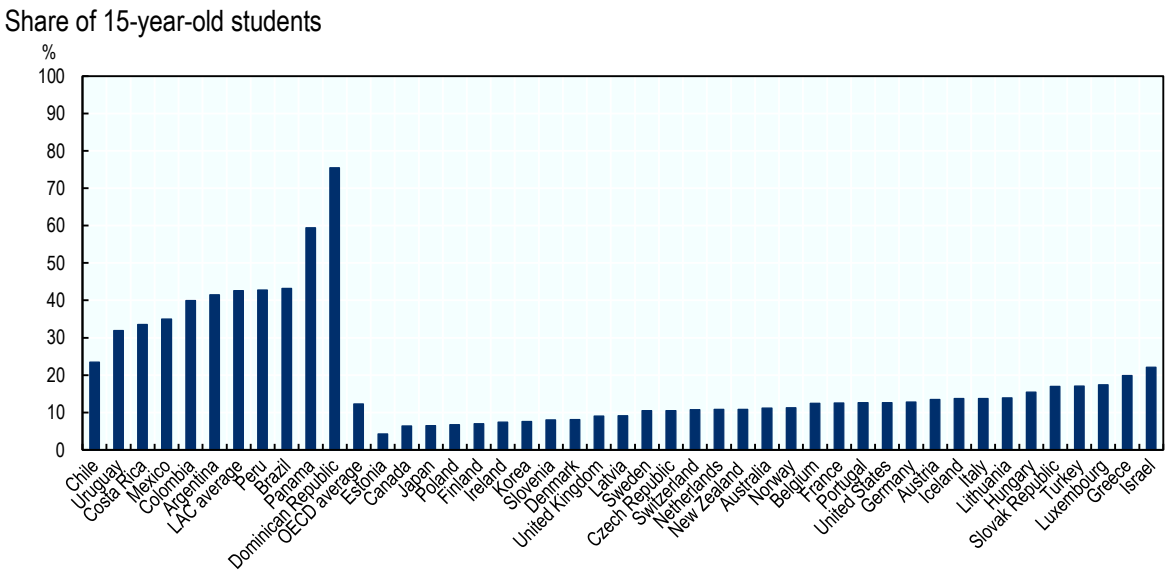
Figure 2.2. Low-performing students in science, reading and mathematics



Note: Students who are low performers are students who score at less than level 2 in the reading, mathematics and science assessments. Level 2 is considered the baseline level of proficiency in reading, mathematics and science.
Source: OECD calculations based on OECD (2018[7]), PISA 2018 Database, https://www.oecd.org/pisa/data/2018database/.

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Boosting connectivity and Internet adoption is a first step in making the most of all the new learning and training opportunities brought about by new technologies. Without accessible, good quality and affordable Internet connection, individuals are completely locked-out of the potential benefits of digital transformation. In Latin American countries, around 237 million people were still offline in 2017 and a digital divide in access persists both across countries but also within Latin American countries between individuals coming from different socio-economic backgrounds or between urban and rural areas. Against this backdrop, effective intervention should be implemented in key policy areas to address challenges of connectivity and Internet in the region (OECD, 2019[8]).

Enhancing access, connectivity and quality of ICT infrastructure is a prerequisite for learning with new technologies in Latin America

Latin American countries are lagging behind OECD countries in their citizens' exposure to digitalisation. In 2017, 38% of individuals in Latin American countries made no use of the Internet (Figure 2.3) though large variations between countries persist. While Chile is on par with the OECD average, Haiti has made almost no progress in the last two decades and in seven other Latin American and Caribbean countries[2] more than half of individuals still do not go on line.

In the last decade, however, the region has made progress and expanded connectivity: the gap between OECD and Latin American countries in terms of Internet penetration and use has progressively narrowed (Fernando Rojas and Poveda, 2018[9]). For Internet penetration at the household level (households with Internet connection) the gap decreased from 50.8 percentage points in 2010 to 40.8 percentage points in 2016, while for Internet use it decreased from 40 percentage points in 2007 to 25 percentage points in 2017. Despite these advances, at the end of 2018, still 48% of the population had not subscribed to mobile Internet networks. Nevertheless the coverage gap did not represent a barrier since 94% of the Latin American population has access to mobile Internet services (GSMA, 2019[10]).

Latin American countries still need to make substantial efforts to enhance the digital competence of their citizens, strengthen safety and security online, and reduce affordability barriers. This requires a holistic approach to the challenges stemming from the digital transformation. Policy intervention needs to foster both demand and supply simultaneously to ensure that countries in the region harness the benefits stemming from digitalisation (OECD, 2019[8]). The mix of different challenges faced by Latin American countries raises concerns about the extent to which individuals are (and will be) able to take advantage of the opportunities brought by digitalisation. Penetration of broadband services, for instance, is low relative to levels observed in OECD countries (OECD, 2019[8]): in 2017, penetration of mobile broadband[3] was on average of 64.9% in Latin American countries in contrast to 102% for OECD countries; penetration of fixed broadband was over 12% in contrast to 30% in OECD countries.

The rise in mobile-cellular telephone subscriptions opens new possibilities for higher-quality connectivity in many Latin American countries (Figure 2.4). In the last decade, mobile-cellular telephone subscriptions in Costa Rica increased by more than four times and in Nicaragua they tripled. Nevertheless, some Latin American countries, together with Asia and Africa, fare poorly in terms of average Internet connection speed relative to OECD countries (Broadband Commission for Sustainable Development, 2018[11]).

In addition, inequalities in connectivity are pervasive within Latin American countries. the divide in access to digital technologies has not been closed in many countries of the region: individuals from rural areas, disadvantaged backgrounds or with low education levels are less likely to have access and hence to use Internet (Fernando Rojas and Poveda, 2018[9]; OECD, 2019[12]; UNESCO, 2017[13]). Among the countries with available data on Internet access by income distribution, Uruguay displays the greatest degree of equality in contrast to Brazil where the distribution of Internet access has become more unequal (Fernando Rojas and Poveda, 2018[9]). Nevertheless, the rural gap in mobile Internet use in low- and middle-income countries for the Latin American and Caribbean region, at 29% in 2018, is smaller than the global average of 40%, and similar to Europe and Central Asia region, at 26% in 2018 (ITU/UNESCO Broadband Commission for Sustainable Development, 2019[14]). Closing the gap in rural areas remains an open challenge. More efforts should be put in spurring public-private co-operation as the private sector intervention alone may be insufficient and firms may lack incentives to develop businesses there. A successful example of such public-private initiatives is "*Internet para Todos in Perú*" which provides digital access in remote areas (IDB, n.d.[15]).

A gender-based digital divide is also still present in the region. Girls in Latin American countries are exposed to new technologies later in life relative to boys (OECD, 2015[16]), display lower levels of self-perceived autonomy related to ICT use and self-perceived ICT competence (OECD et al., forthcoming[17]). Girls also exhibit less interest in ICT-related and science careers except for health sciences (OECD, 2019[18]).

Public institutions and in particular schools, can play a leading role in bringing individuals and young people on line. Data from several Latin American countries (Brazil, Colombia, Ecuador, Honduras, Paraguay and Peru) show that Internet access is not limited to home access and individuals use other locations to go on line (UNESCO, 2017[13]). In Honduras for instance, access to the Internet from public centres is more widespread than access from home.

Investments in ICT infrastructure for schools have been extensive, across many OECD and Latin American countries (Box 2.2). In Latin American countries with available data from PISA (2015), around 75% of students reported having access to a computer, desktop or laptop in their school and a similar share have Internet connection (Figure 2.5). A relatively high share of Latin American students thus has access to ICT infrastructure in schools, although rates remain below the OECD average and hide both between and within-country inequalities. Students in Chile, Colombia and Uruguay, for instance, have levels of access that are very similar to those of OECD countries, but connectivity in schools remains an issue in other countries such in the Dominican Republic where more than one-third of students are unable to access the Internet or computers. Internet connection refers both to connection through school computers and to

connection through wireless. In some countries (e.g. Colombia), the proportion of school computers connected to the Internet is in fact much lower than the OECD average.

Box 2.2. Programmes to expand connectivity for Latin American schoolchildren

Launched in 1997 and reformulated in 2007, ProInfo is the main national policy in Brazil promoting the use of ICT technologies in primary and secondary public schools. The programme provides equipment, digital content and media, and training of professors and students. In 2017, the Ministry of Education also launched the Connected Education Innovation Programme (Programa de Inovação Educação Conectada) which aims to ensure universal access to high-speed Internet and the use of technology in all Brazilian (primary and secondary) public schools by 2024, in line with the National Plan for Education. The programme is designed around four complementary dimensions: vision, competencies, digital educational resources and infrastructure, all considered crucial to ensure ICTs are effective in improving education. The programme promotes actions such as helping schools to be prepared to receive Internet connection, as well as teacher training through a virtual learning environment (OECD, forthcoming[19]).

In Chile, the programmes "Yo elijo mi PC" and "Me conecto para aprender" seek to reduce divides in access to new technologies and support student learning by providing a laptop computer to students in seventh grade (Ministerio de Educacion, 2019[20]). The laptops also provide access to digital resources and portals for learning activities. In 2019, around 130 000 laptops were provided to students. "Me conecto par aprender" targets students enrolled in the 7th grade in public schools (ChileAtiende, n.d.[21]). "Yo elijo mi PC" targets socio-economically disadvantaged students, with an average grade greater than or equal to 5.8 and enrolled in a subsidised private school.

Since 2000, Colombia has unfolded the programme "Computadores para Educar". The programme has focused on the provision of schools with computers and of training for teachers in order to support them in integrating ICT in their pedagogies (Radinger et al., 2018[22]). Data from PISA 2015 showed that Colombia displayed one of the highest computer-student ratios in schools among countries with available data (Radinger et al., 2018[22]).

Peru introduced the programme "Un Laptop por Niño" in 2007, targeting students from public primary schools in poor rural areas (OECD, 2015[2]). The programme also included a training component for teachers, supporting them in the use of the type of laptops (XO portable computers) distributed in schools.

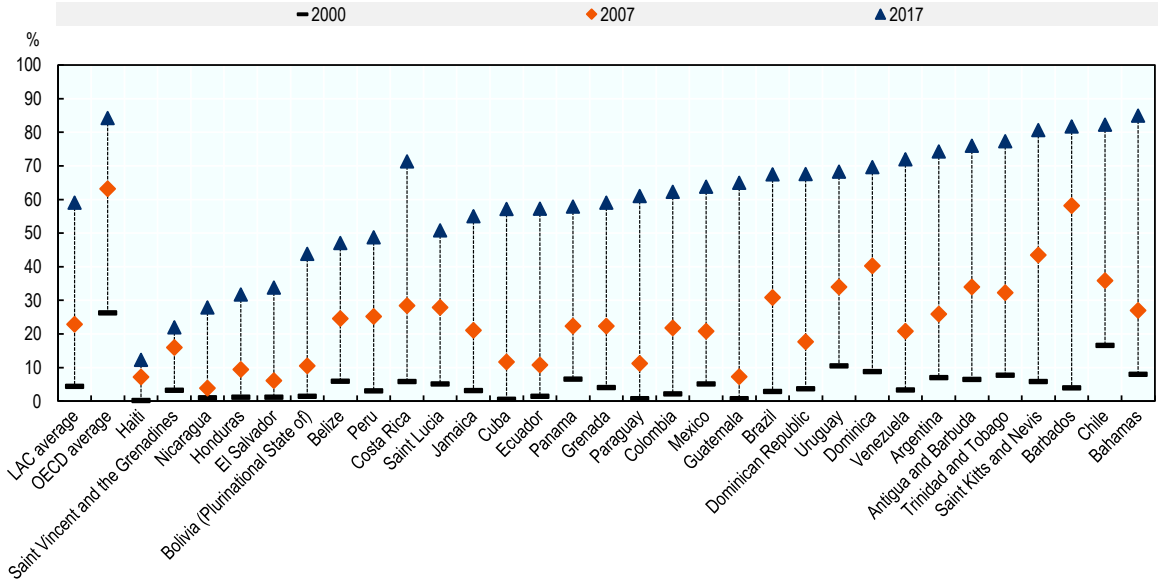
Created in 2007, the Plan Ceibal in Uruguay relied on the distribution of laptops to students and teachers in public schools (primary and lower secondary), together with the provision of free Internet connection (Santiago et al., 2016[23]). The plan also covers students and teachers from private schools in low-income areas (Plan Ceibal, 2017[24]). After the first step of the programme that revolved around expanding connectivity, the focus was put on professional development for teachers, introduction of educational software and digitalisation of textbooks (Plan Ceibal, 2017[24]). Since 2013, the plan has shifted towards the development of an approach related to "New Pedagogies for Deep Learning" by "implementing student-cantered methodologies, extending teaching beyond the classroom, and using technology to achieve specific goals" (Plan Ceibal, 2017[24]).

Source: ChileAtiende (n.d.[21]), *ChileAtiende - Me conecto para aprender,* www.chileatiende.gob.cl/fichas/41874-me-conecto-para-aprender; Ministerio de Educacion (2019[20]), *Me Conecto para Aprender*, http://meconecto.mineduc.cl/; OECD (2015[2]), *Skills in Ibero-America: Insights from PISA 2015*, www.oecd.org/pisa/sitedocument/Skills-in-Ibero-America-Insights-from-PISA-2015.pdf; Plan Ceibal (2017[24]), *Hicimos historia haciendo future,* www.ceibal.edu.uy; Radinger et al (2018[22]), *OECD Reviews of School Resources: Colombia 2018*, https://dx.doi.org/10.1787/9789264303751-en; Santiago et al. (2016[23]), *OECD Reviews of School Resources: Uruguay 2016,* https://dx.doi.org/10.1787/9789264265530-en.

As in OECD countries, all students in Latin America countries (for which information is available) who have access to computers in schools do not necessarily use them. With the exception of Colombia, where most students who have access to computers, laptops or tablets in schools also report using them, around 25% of students in the other Latin American countries have access to ICT infrastructure but do not use it.

Figure 2.3. Internet use in Latin America and Caribbean countries

Share of individuals



Source: Based on data from ITU (2019[25]), ITU World Telecommunication/ICT Indicators database, https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

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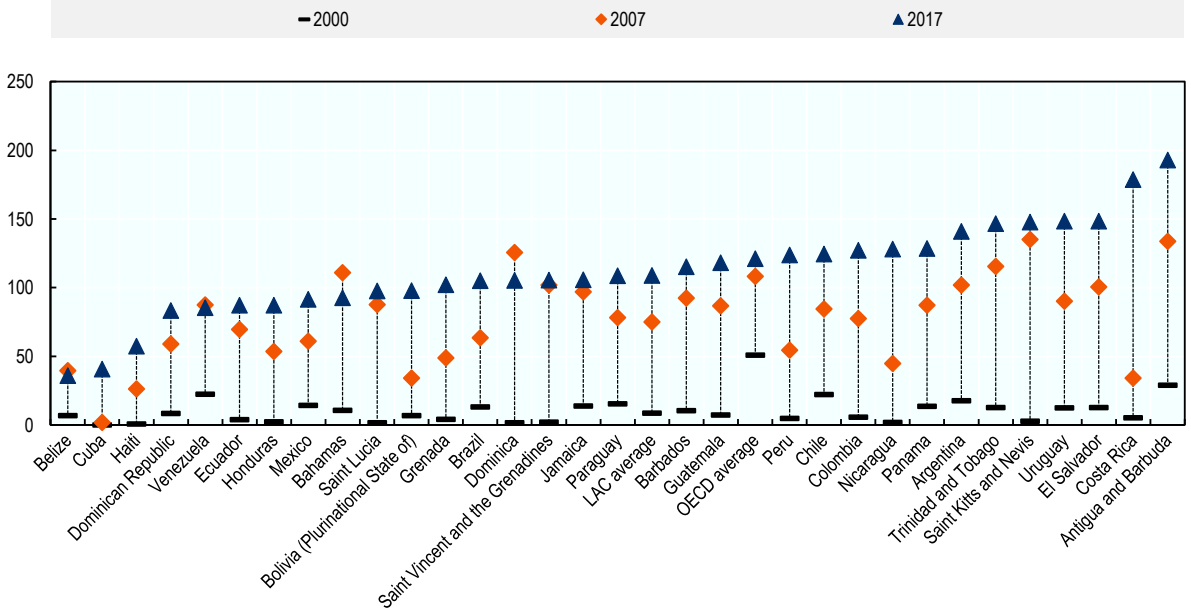
Figure 2.4. Mobile-cellular telephone subscriptions, per 100 inhabitants



Source: Based on data from ITU (2019[25]), ITU World Telecommunication/ICT Indicators database, https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

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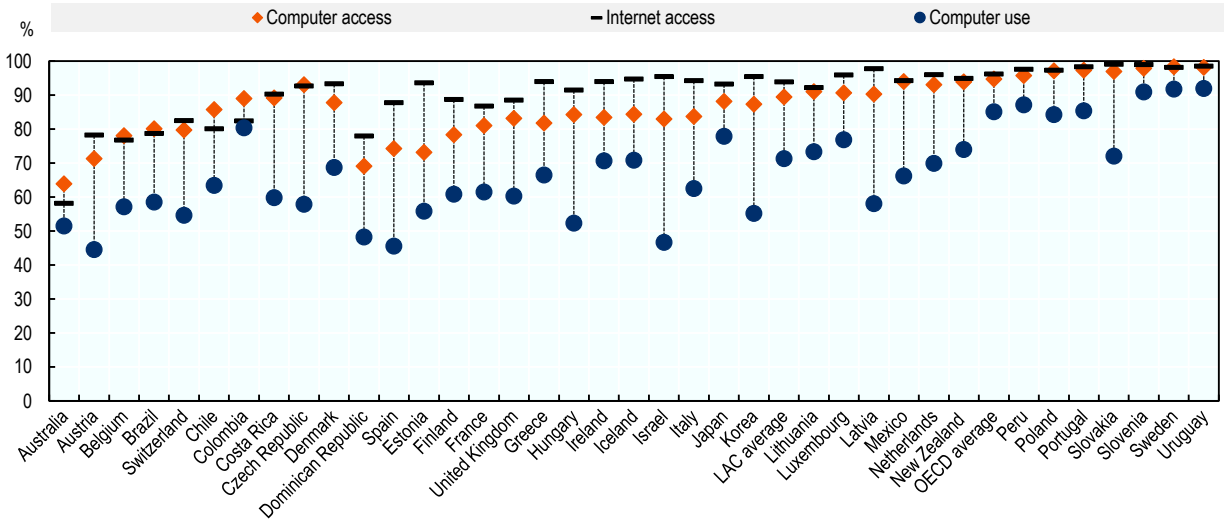
Many reasons may lie behind the limited use of school computers and ICT infrastructure in schools. On the one hand, students may be using their own digital devices within schools, bringing either mobile phones or laptops, especially as schoolchildren in several Latin American countries have benefited from one laptop per child type of programmes (One Laptop per Child, n.d.[26]; Bulman and Fairlie, 2016[27]). On the other hand, the quality of the ICT infrastructure available in schools may be poor or teachers may find the devices not useful or appropriate for their teaching practices or activities. In a similar vein, while Latin American students may have access to computers in schools, they may have to share them if there are not enough computers for all students. For instance, in Brazil more than five students share each Internet connected computer (OECD et al., forthcoming[17]).

Figure 2.5. Access and use of computers available in schools

Share of 15-year-old students



Note: Students with computer access at school are students for whom a desktop computer, a portable laptop/notebook or a tablet computer is available to use at school, whether they use it or not. Students with Internet access at school are students who have access to Internet connected school computers or to Internet connection via wireless network. Students who use computers at school are students for whom a desktop computer, a portable laptop/notebook or a tablet computer is available to use at school and who use it.
Source: Calculations based on OECD (2015[28]), PISA 2015 Database, http://www.oecd.org/pisa/data/2015database/.

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While data from PISA (Figure 2.5) quantify the availability of ICT infrastructure in schools, principals' perception on shortages of resources hindering instruction can shed light on an equally important issue: the quality of ICT resources. Data from the Teaching and Learning International Survey (TALIS) show that in Latin American countries, around half of principals report that shortages or inadequacy of ICT hinder the school's capacity to provide quality instruction (Figure 2.6).[4]

Relative to other potential barriers, shortages of digital technology for instruction (software, tablets, computers and smart boards) and the insufficiency of Internet connection are very often reported to be important challenges hindering instruction in Latin America schools, being those factors mentioned by the highest share of principals in most Latin American countries.

On the contrary, principals in OECD countries report more frequently other types of barriers to instruction, unrelated to digital technologies, such as shortages of teachers with competence in teaching students with special needs, shortages of support personnel and shortages or inadequacy of time for instructional leadership (OECD, 2018[29]).

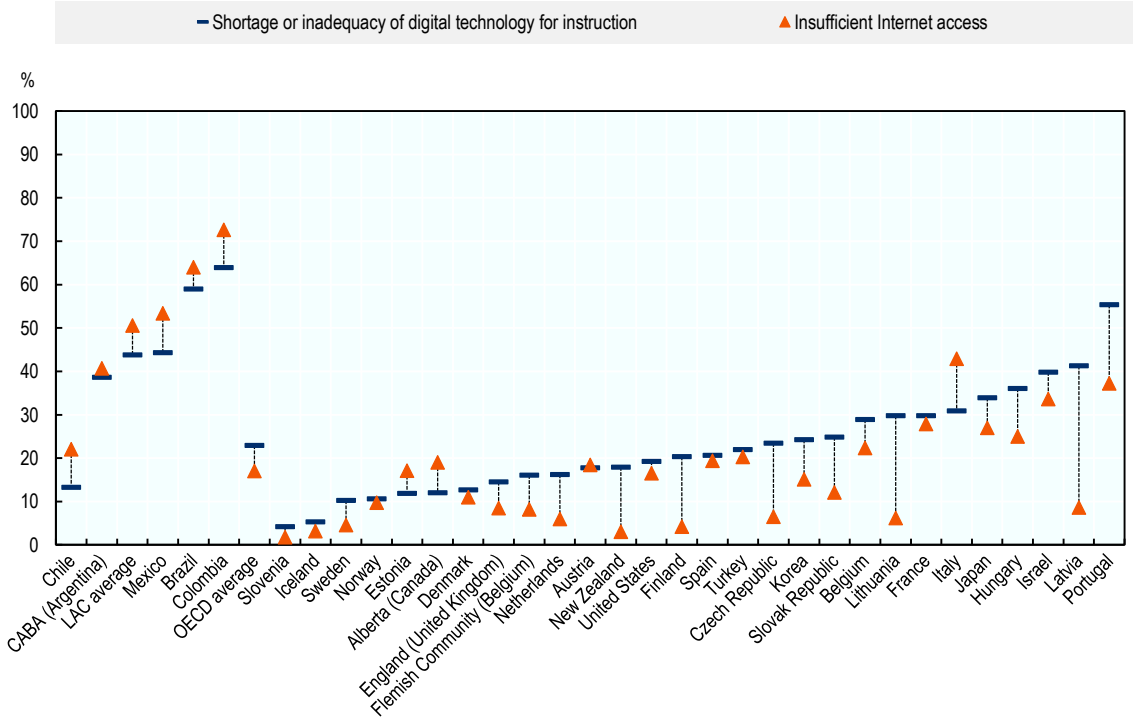
Investment in ICT infrastructure is often associated with an increase in the time students actually spend using ICT and government programmes in the LAC region have tried to encourage the use of ICT in schools and classrooms (Bulman and Fairlie, 2016[27]; Escueta et al., 2017[30]) hoping that this would boost learning and skill development. While providing an adequate number of digital devices is fundamental to expand access, the quality and relevance of available digital technologies is key in ensuring that technologies can be used effectively, paving the way towards enhanced teaching and learning activities.

However, if digital devices are of low quality or the educational software available is inadequate for instruction, then mere use of ICT for simple tasks may substitute for more efficient instructional activities (see Chapter 3) and eventually worsen student outcomes instead of providing true learning opportunities.

All in all, results seems to suggest that digital technologies in Latin American schools may be insufficient (e.g. Internet connection) or inadequate (e.g. educational software) for instruction. Perceived shortages and inadequacies in terms of digital technology in schools are large in Latin American countries. These perceptions may reflect that computers may be malfunctioning, not adequate for pedagogical needs; software may be of little use for teaching or Internet connection too slow. In order to the make the most out of digital opportunities, governments should strike the right balance between expanding access to digital devices and enhancing the quality and relevance of ICT investments made in Latin American schools, making them more aligned to teaching and learning needs.

Figure 2.6. Perceived shortages or inadequacy of digital technology and Internet for instruction

Percentage of principals reporting that the following shortages of resources hinder the school's capacity to provide quality instruction "quite a bit" or "a lot"



Note: Digital technology refers to software, computers, tablets, smart boards, etc. CABA (Argentina) refers to the Ciudad Autónoma de Buenos Aires, Argentina.
Source: Adapted from Table I.3.63, OECD (2018[29]), *TALIS 2018 Database*, http://www.oecd.org/education/talis/.

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Schools help narrow connectivity and access-related gaps, but many digital divides remain

In OECD countries, the divide in access to digital technologies has been shrinking, although urban-rural disparities in broadband penetration remain somewhat a challenge (OECD, 2019[12]). Similarly, the digital divide in terms of access to ICT infrastructure in schools has generally been bridged (OECD, 2019[1]).

In most Latin American countries, instead, connectivity gaps are still pervasive at many levels. Around 18% of Latin American 15-year-olds from socio-economically disadvantaged backgrounds lack Internet connection at home and at school. Moreover, 24% of them do not have access to a computer (desktop, laptop or tablet) (Figure 2.7) neither at home, nor at school. Strikingly, instead, computer access of socio-economically advantaged students in Latin American countries is comparable to that of students in OECD countries. The same holds for access to an Internet connection: almost all Latin American students from high socio-economic background report having Internet access either at home and at school, or at home only.

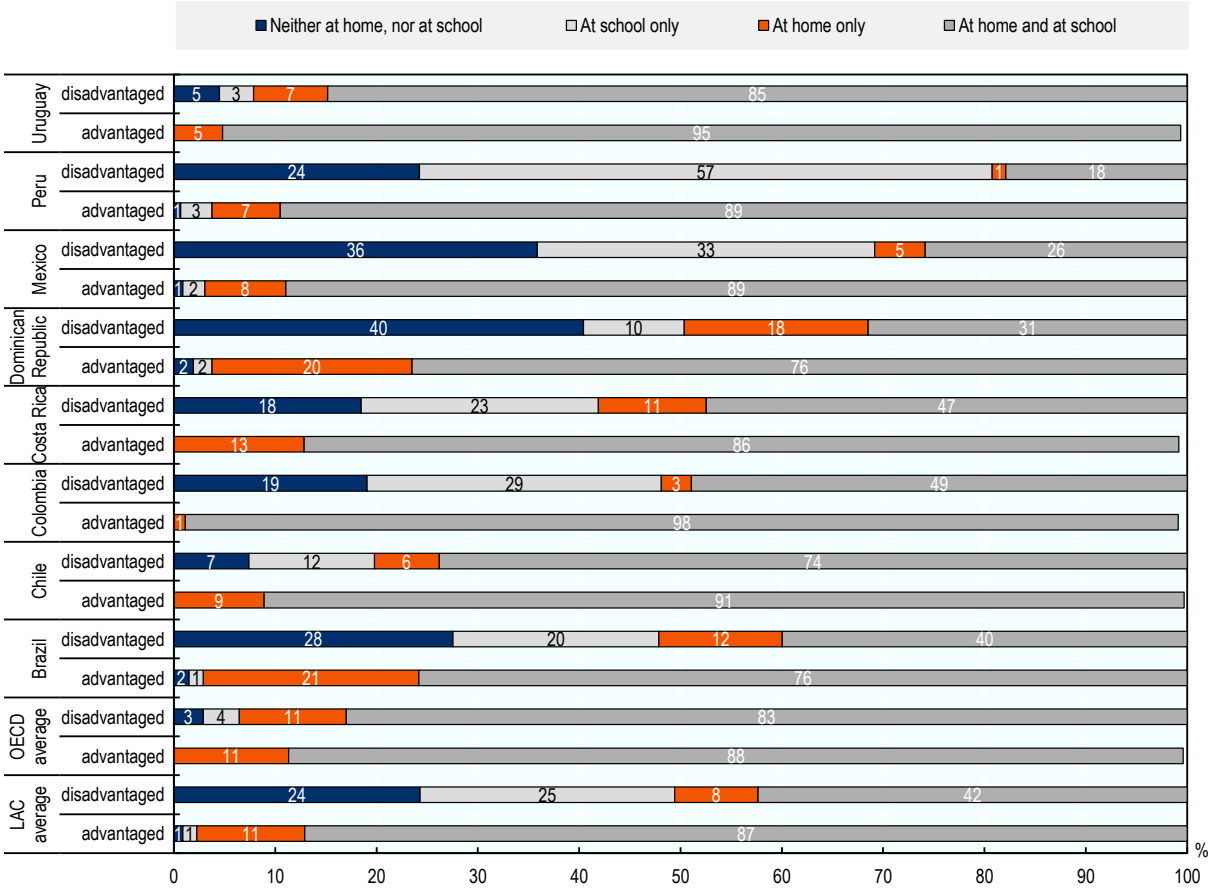
If many disadvantaged students lack ICT access at home, schools and/or local community centres as well as government offices (OECD/IDB, 2016[31]) can act as ICT providers and bridge the gap between students who do not have ICT at home and those who do, thus increasing connectivity for young disadvantaged people.

De facto, schools in many Latin American countries play an important role in bringing connectivity to ICT to a large share of students who would otherwise be left unconnected. Around 25% of socio-economically disadvantaged students in Latin American countries have access to a computer only when at school and 16% of them are able to go on line exclusively when at school, lacking the chance to connect when at home (Figure 2.7). In Peru, almost two-thirds have access to a computer in the school premises and more than one-third of students have Internet access only at school.

With the spread of mobile phones, students may more easily connect to Internet at home as well through personal or family phones. Owning a mobile phone, however, does not seem to be sufficient to ensure connectivity to all students at home as Internet connection may be too expensive or, in remote rural areas, not even available.

Figure 2.7. Access to computers (desktop/laptop/tablet), by socio-economic background

Share of 15-year-old students

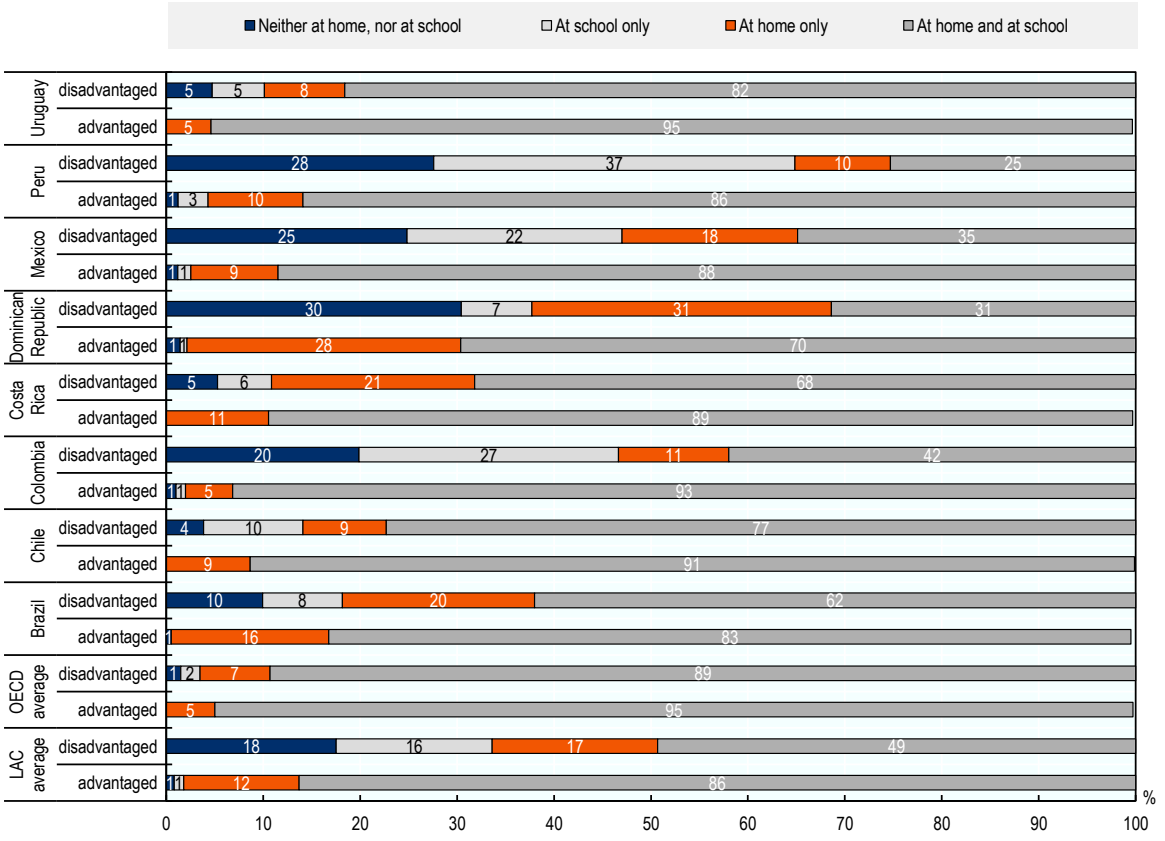


Note: Students are considered to be socio-economically advantaged if they are among the 25% of students with the highest values on the PISA ESCS index in their country or economy. Students are considered to be socio-economically disadvantaged if their values on the PISA ESCS index are among the bottom 25% within their country or economy.
Source: OECD calculations based on OECD. (2015[28]), *PISA 2015 Database*, http://www.oecd.org/pisa/data/2015database/.

StatLink https://doi.org/10.1787/888934135357

Figure 2.8 Access to Internet, by socio-economic background

Share of 15-year-old students



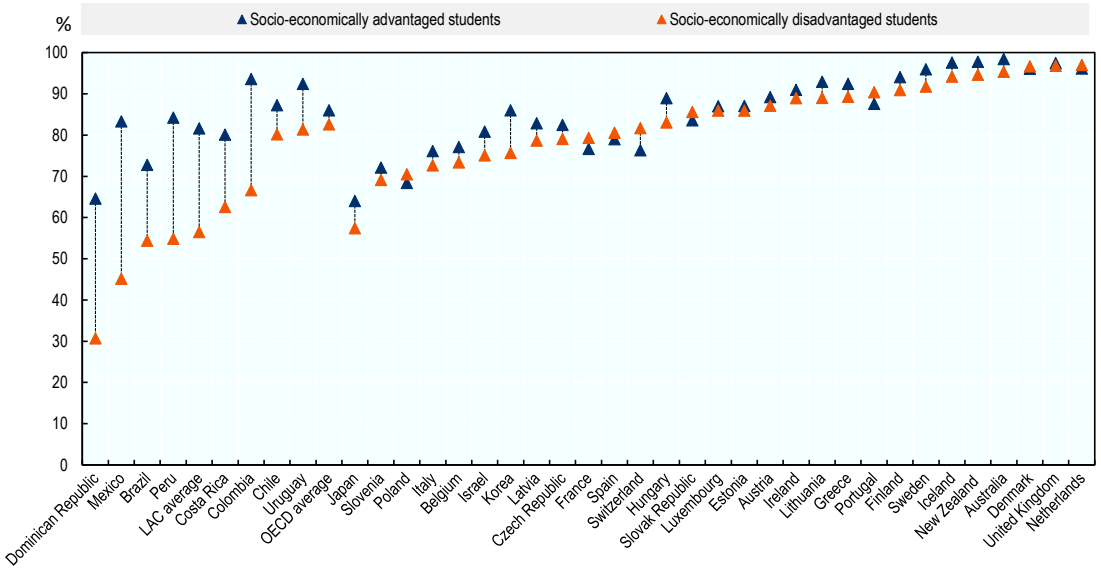
Note: Students are considered to be socio-economically advantaged if they are among the 25% of students with the highest values on the PISA ESCS index in their country or economy. Students are considered to be socio-economically disadvantaged if their values on the PISA ESCS index are among the bottom 25% within their country or economy.
Source: OECD calculations based on OECD. (2015[28]), *PISA 2015 Database*, http://www.oecd.org/pisa/data/2015database/.

StatLink https://doi.org/10.1787/888934135376

The extent to which disadvantaged and advantaged students are able to connect varies widely across countries in the region. Among countries with available data, the digital divide in access to Internet between advantaged and disadvantaged students is especially large in the Dominican Republican, Mexico and Peru. One-third of disadvantaged students in the Dominican Republic are not able to connect to the Internet and 40% of them lack access to a computer. They also benefit less from connectivity at school than 15-year-olds in other countries and are thus at high risk of being unprepared for an increasingly digitalised society and work environment. While Mexico or Peru equally display a large share of disadvantaged students deprived of access to the Internet or computers at home, they also provide access to ICT through schools to a larger extent.

Figure 2.9. Divide in access to ICT at school, by students' socio-economic status

Share of 15-year-old students who have access to a desktop computer/laptop/tablet and Internet at school



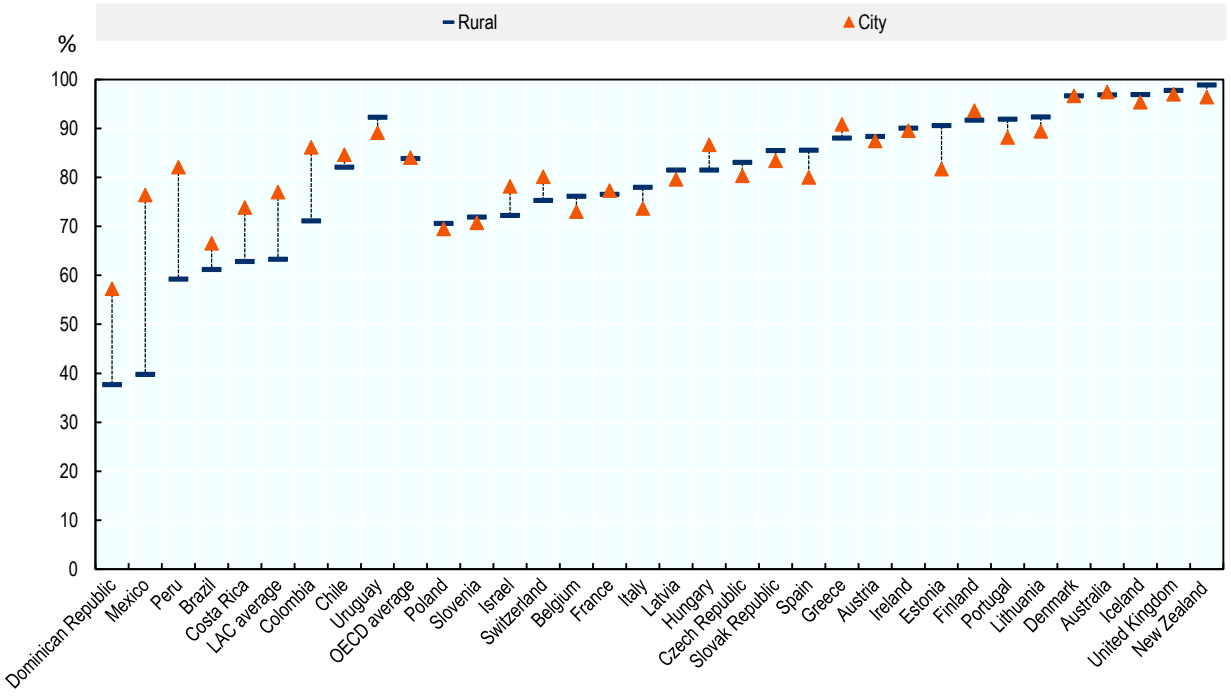
Note: Students are considered to be socio-economically advantaged if they are among the 25% of students with the highest values on the PISA ESCS index in their country or economy. Students are considered to be socioeconomically disadvantaged if their values on the PISA ESCS index are among the bottom 25% within their country or economy.
Source: OECD calculations based on OECD (2015[28]), *PISA 2015 Database*, http://www.oecd.org/pisa/data/2015database/.

StatLink https://doi.org/10.1787/888934135395

While Latin American schools do provide some ICT access to disadvantaged students, they have not managed to close the digital divide in access related to students' socio-economic status (Figure 2.9). The average divide in access between disadvantaged and advantaged students is more than 30 percentage points larger in Latin American countries with available data than in the OECD average. In a similar vein, the urban-rural digital divide is still largely present in Latin American countries (Figure 2.10). In Mexico, the connectivity gap at school between rural and urban students goes up to 35 percentage points. In the Dominican Republic, Mexico and Peru, one in four students in rural areas has no Internet access, while on average, less than 8% of advantaged students in the three countries cannot connect to the Internet (Figure 2.11). In Brazil, national statistics show a higher rural-urban divide: only 43% of schools in rural areas have desktop computers, compared to 96% in urban areas (CGI, 2019[32]). The gap is larger when considering connectivity: on average only 36% of schools in rural areas are on line, as compared to nearly all schools in urban areas. In addition, connection speeds also differ widely between rural and urban schools (CGI, 2019[32]).

Figure 2.10. Rural-urban divide in access to ICT at school

Share of 15-year-old students who have access to a desktop computer/laptop/tablet and Internet at school



Note: Students in rural schools are students whose school is located in "a village, hamlet or rural area with fewer than 3 000 people" while students in urban schools are students whose school is located in a city of over 100 000 people.
Source: OECD calculations based on OECD (2015[28]), *PISA 2015 Database*, http://www.oecd.org/pisa/data/2015database/.

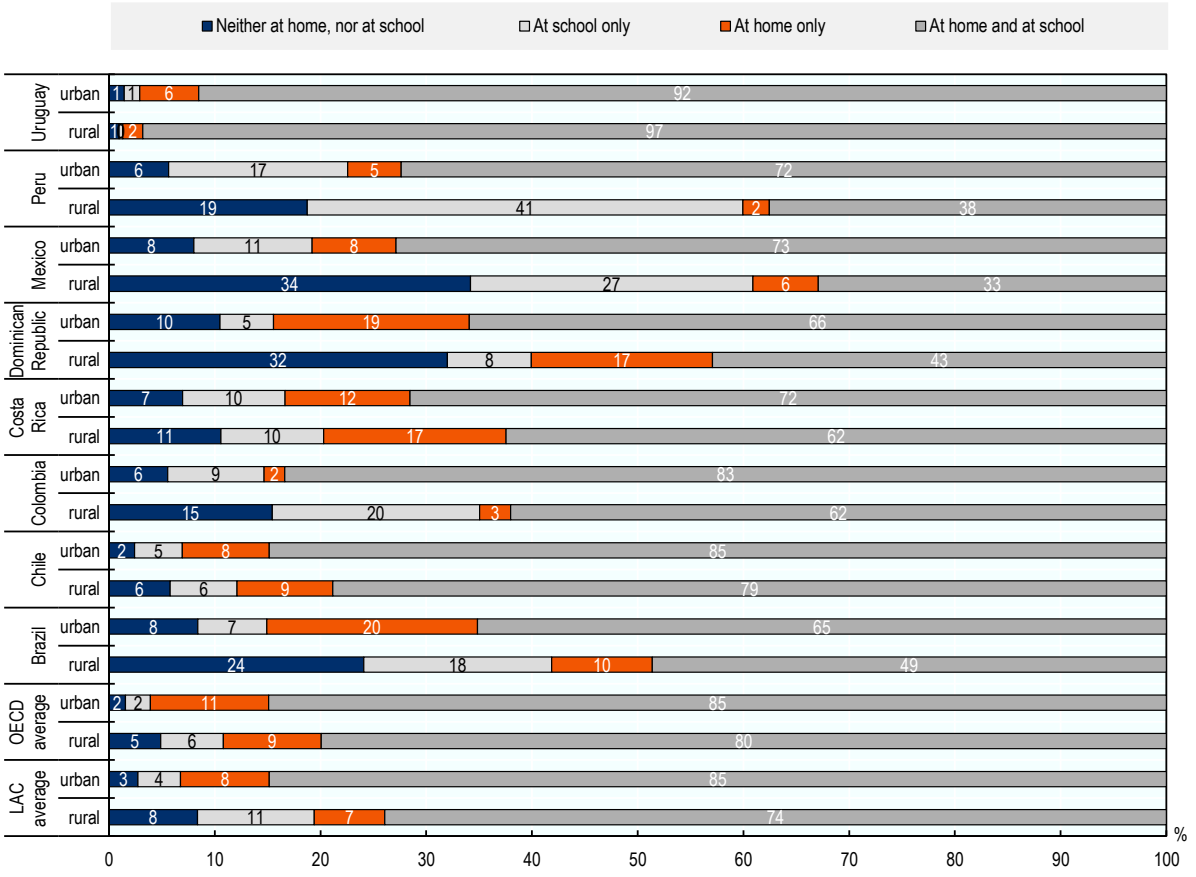
StatLink https://doi.org/10.1787/888934135414

In Colombia, Peru and Mexico, schools act as Internet providers for more than 20% of rural students who lack access at home but who can go on line at school. Schools, more generally, also play an important role in making computers available for rural students in those same countries. For instance, more than 41% of rural students in Peru have access to a desktop/laptop/tablet only at school. In Colombia, this is the case for 20% of rural students and in Mexico for 27% of them.

Other LAC countries such as Uruguay, and to a lesser extent Chile, seem to have bridged the urban-rural divide with students from rural contexts being able to access the Internet and computers widely, both at home and at school.

Figure 2.11. Access to computers (desktop/laptop/tablet), by school location

Share of 15-year-old students



Note: Students in rural schools are students whose school is located in "a village, hamlet or rural area with fewer than 3 000 people" while students in urban schools are students whose school located in a city of over 100 000 people.
Source: OECD calculations based on OECD (2015[28]), *PISA 2015 Database*, http://www.oecd.org/pisa/data/2015database/.

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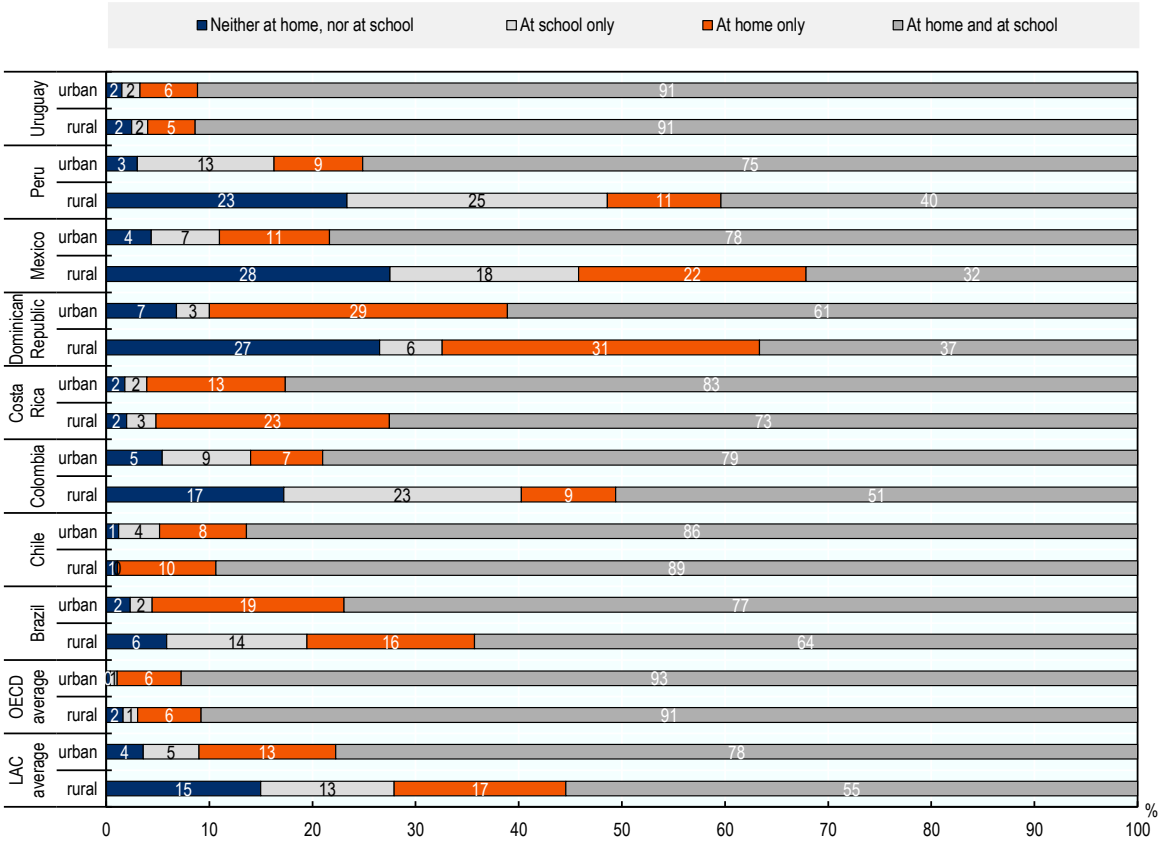
Figure 2.12. Access to Internet, by school location

Share of 15-year-old students

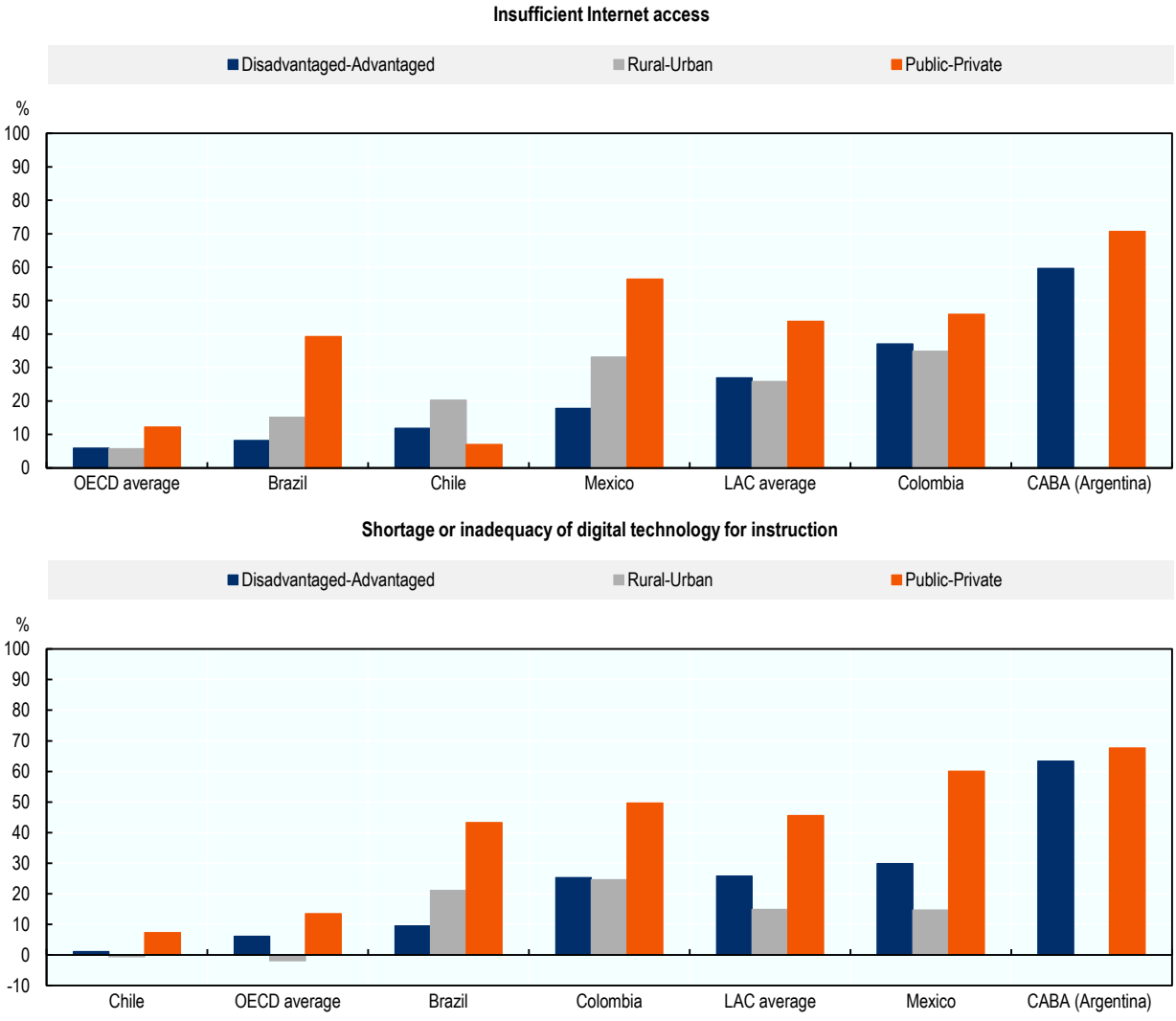


Note: Students in rural schools are students whose school is located in "a village, hamlet or rural area with fewer than 3 000 people" while students in urban schools are students whose school located in a city of over 100 000 people.
Source: OECD calculations based on OECD (2015[28]), *PISA 2015 Database,* http://www.oecd.org/pisa/data/2015database/.

StatLink https://doi.org/10.1787/888934135452

Figure 2.13. Gaps in perceived shortages or inadequacy of digital technology and Internet for instruction, by school profile

Difference in the percentage of principals reporting that the following shortages of resources hinder the school's capacity to provide quality instruction "quite a bit" or "a lot"



Note: "Disadvantaged" refers to a school with more than 30% of students from socio-economically disadvantaged homes. "Advantaged" refers to a school with fewer than 30% of students from socio-economically advantaged homes. Digital technology refers to software, computers, tablets, smart boards, etc. CABA (Argentina) refers to the Ciudad Autónoma de Buenos Aires, Argentina.
Source: OECD calculations based on OECD. (2018[29]), *TALIS 2018 Database*, http://www.oecd.org/education/talis/.

StatLink https://doi.org/10.1787/888934135471

In many Latin American countries, students from socio-economically disadvantaged backgrounds and students who live in rural areas and students who attend public schools are penalised twice. They are less likely to have Internet and computer access at home but also at school. Moreover, the quality of ICT infrastructure available in their schools is also poorer than the average of their country: principals in schools with more disadvantaged students, from rural areas and that are publicly managed are more numerous to report that shortages or inadequacy of new technologies are major obstacles to the provision of quality instruction (Figure 2.13).

Providing high-quality Internet connection and access to digital tools is not enough though to help develop skills. What individuals do when they go on line is equally crucial. The digital divide increasingly relates to how individuals use the Internet and the extent to which they are able to seize the opportunities and benefits of their engagement in online activities (OECD, 2019[1]). For young people in Latin America, connectivity in schools is a way to narrow gaps in connectivity at home. Nevertheless, access to and use of technology do not automatically translate into better learning outcomes. Integrating technology in innovative teaching and learning practices is crucial and Latin American teachers play a pivotal role in realising the untapped potential of new technologies in initial education.

References

Broadband Commission for Sustainable Development (2018), *The State of Broadband 2018: Broadband Catalyzing Sustainable Development*. [11]

Bulman, G. and R. Fairlie (2016), "Technology and Education: Computers, Software, and the Internet", in *Handbook of the Economics of Education*, http://dx.doi.org/10.1016/B978-0-444-63459-7.00005-1. [27]

CGI (2019), *Survey on the Use of Information and Communication Technologies in Brazilian Schools: ICT Education 2018*. [32]

ChileAtiende (n.d.), *ChileAtiende - Me conecto para aprender*, 2019, https://www.chileatiende.gob.cl/fichas/41874-me-conecto-para-aprender (accessed on 24 November 2019). [21]

Cunha, F., J. Heckman and S. Schennach (2010), "Estimating the technology of cognitive and noncognitive skill formation", *Econometrica*, Vol. 78/3, pp. 883-931, http://dx.doi.org/10.3982/ECTA6551. [4]

Escueta, M. et al. (2017), "Education technology: An evidence-based review", *NBER Working Paper*, No. 23744, http://www.nber.org/papers/w23744. [30]

Fernando Rojas, E. and L. Poveda (2018), *State of Broadband in Latin America and the Caribbean 2017*, United Nations, ECLAC, https://repositorio.cepal.org/bitstream/handle/11362/43670/1/S1800532_en.pdf. [9]

GSMA (2019), *The Mobile Economy: Latin America*, http://www.gsmaintelligence.com (accessed on 19 March 2020). [10]

Heckman, J. (2006), "Skill formation and the economics of investing in disadvantaged children", *Science*, Vol. 312, pp. 1900-1902, http://dx.doi.org/10.1126/science.1130121. [3]

IDB (n.d.), *Internet Para Todos: Disminuyendo La Brecha Digital en América Latina*, https://www.iadb.org/es/mejorandovidas/internet-para-todos-disminuyendo-la-brecha-digital-en-america-latina (accessed on 19 March 2020). [15]

ITU (2019), *ITU World Telecommunication/ICT Indicators database*, https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx. [25]

ITU/UNESCO Broadband Commission for Sustainable Development (2019), *The State of Broadband 2019 Broadband as a Foundation for Sustainable Development*. [14]

Ministerio de Educacion (2019), *Me Conecto para Aprender*, http://meconecto.mineduc.cl/ (accessed on 24 November 2019). [20]

OECD (2019), *Measuring the Digital Transformation: A Roadmap for the Future*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264311992-en. [12]

OECD (2019), *OECD Skills Outlook 2019 : Thriving in a Digital World*, OECD Publishing, Paris, https://dx.doi.org/10.1787/df80bc12-en. [1]

OECD (2019), *PISA 2018 Results (Volume II): Where All Students Can Succeed*, PISA, OECD Publishing, Paris, https://dx.doi.org/10.1787/b5fd1b8f-en. [18]

OECD (2019), *Shaping the Digital Transformation in Latin America: Strengthening Productivity, Improving Lives*, OECD Publishing, Paris, https://dx.doi.org/10.1787/8bb3c9f1-en. [8]

OECD (2019), *TALIS 2018 Results (Volume I): Teachers and School Leaders as Lifelong Learners*, TALIS, OECD Publishing, Paris, https://dx.doi.org/10.1787/1d0bc92a-en. [33]

OECD (2018), *PISA 2018 Database*, https://www.oecd.org/pisa/data/2018database/. [7]

OECD (2018), *TALIS 2018 Database*, http://www.oecd.org/education/talis/. [29]

OECD (2017), *Survey of Adults Skills (PIAAC) (2012, 2015, 2017)*, (database), http://www.oecd.org/skills/piaac/. [6]

OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, PISA, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264266490-en. [5]

OECD (2015), *PISA 2015 Database*, http://www.oecd.org/pisa/data/2015database/. [28]

OECD (2015), *Skills in Ibero-America: Insights from PISA 2015*, OECD, Paris, http://www.oecd.org/pisa/sitedocument/Skills-in-Ibero-America-Insights-from-PISA-2015.pdf. [2]

OECD (2015), *Students, Computers and Learning: Making the Connection*, PISA, OECD Publishing, http://dx.doi.org/10.1787/9789264239555-en. [16]

OECD (forthcoming), *OECD Reviews of Digital Transformation: Going Digital in Brazil*, OECD Publishing, Paris. [19]

OECD et al. (forthcoming), *Latin American Economic Outlook: Fostering Development in the Digital Age*. [17]

OECD/IDB (2016), *Broadband Policies for Latin America and the Caribbean: A Digital Economy Toolkit*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264251823-en. [31]

One Laptop per Child (n.d.), *Worldwide | One Laptop per Child*, http://laptop.org/map (accessed on 9 October 2019). [26]

Plan Ceibal (2017), *Hicimos historia haciendo futuro*, http://www.ceibal.edu.uy (accessed on 28 November 2019). [24]

Radinger, T. et al. (2018), *OECD Reviews of School Resources: Colombia 2018*, OECD Reviews of School Resources, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264303751-en. [22]

Santiago, P. et al. (2016), *OECD Reviews of School Resources: Uruguay 2016*, OECD Reviews of School Resources, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264265530-en. [23]

UNESCO (2017), *Digital society: Gaps and Challenges for Digital Inclusion in Latin America and the Caribbean*, UNESCO Office Montevideo and Regional Bureau for Science in Latin America and the Caribbean, https://unesdoc.unesco.org/ark:/48223/pf0000262860_eng?posInSet=1&queryId=12146cc0-ecca-4b00-bf19-2d26b45d9af0. [13]

Notes

[1] Individuals with a well-rounded skill set score at least level 3 (inclusive) in literacy and numeracy and at least level 2 (inclusive) in problem solving in technology-rich environments in the OECD Survey of Adults Skills (PIAAC).

[2] Saint Vincent and the Grenadines, Nicaragua, Honduras, El Salvador, Bolivia, Peru, Belize.

[3] Penetration of mobile broadband is computed as subscriptions per 100 inhabitants. This statistics can therefore exceed 100%, as it is the case for the OECD average.

[4] Principals are asked to indicate the extent to which shortages of various resources hinder the school's capacity to provide quality instruction. TALIS data used for this analysis are based on self-reported information provided by principals and teachers and, therefore, subjective in nature. Data from TALIS provide insights into how teachers and school principals "perceive the learning environments in which they work" (OECD, 2019[33]). There is no imputation of data from administrative sources.