4 Teachers' use of new technologies in Latin America

This chapter investigates Latin American teachers' use of new technologies in the classroom. It identifies the main enabling factors for teachers' frequency of ICT use and self-efficacy in supporting student learning using digital technologies. Many Latin American teachers rely on ICTs in the classroom, and many train in and with technology. However, teachers' self-reported training needs in ICT skills for teaching remain high in Latin America.

Summary of the main insights

Training in information and communications technology (ICT) skills for teaching, teacher self-efficacy and collaboration with other teachers matter for teachers' use of ICT in class and their self-efficacy in supporting student learning using digital technologies.

- Whether in Latin American or OECD countries, teachers' use of ICT in class and self-efficacy in supporting student learning using ICT relate strongly to their training in ICT skills for teaching. Merely receiving training in the use ICT for teaching in their initial education is not sufficient to enable teachers' use of ICT in their classroom and their self-confidence in supporting student learning through digital technologies. What drives Latin American teachers' use of ICT is how well-prepared they actually felt after receiving training. Participation in professional development in ICT skills for teaching seems, also, to be very important.
- Teachers who feel more efficient about their instruction are more likely to let their students use ICT frequently for learning activities and feel more confident about their capacity to support learning using new technologies. In addition, the likelihood that teachers let their students use ICT frequently also increases with teachers' degree of collaboration with other teachers.

Many Latin American teachers use technologies in the classroom and receive training in ICT skills for teaching.

- In Latin American countries with available data in the OECD Teaching and Learning International Survey (TALIS) (2018), many teachers frequently use technology in the classroom and feel quite confident about their capacity to support student learning through ICT use. Latin American teachers seem to use ICT in class with relatively higher frequency than their OECD counterparts. However, these data do not allow knowing how technology is integrated in teaching practices. In addition, teachers' self-efficacy in ICT use for student learning is based on self-evaluative questions and replies may reflect the opinion of teachers about what they think is expected from them rather than an objective assessment of their capacity to effectively integrate digital technologies in the classroom.
- More than 70% of teachers in Latin America let their students use ICT frequently or always for projects or class work. Aggregate results hide, however, large disparities within the region. In Brazil, only 41% of lower secondary teachers display a high frequency use of ICT in class and one in five teachers never relies on ICT for class work.
- Many Latin American teachers report having received training in the use of ICT for teaching as part of their initial teacher education or training. In Chile, Colombia and Mexico, more than 70% of lower-secondary teachers report having trained in the use of ICT for teaching during their initial teacher education. Similarly, many report having engaged in professional development activities to develop their ICT skills for teaching. Colombia displays one of the largest shares of teachers who have engaged in professional development in ICT skills for teaching in the year prior to the survey (78%).
- In addition, a relatively high share of teachers in Latin American countries train through technology. On average, around 40% of Latin American lower-secondary teachers have participated in online courses or seminars as part of their professional development activities.

Teachers' training needs in ICT skills for teaching remain high, raising the need to revisit how teachers are trained for teaching with new technologies.

- As many as 60% of Latin American teachers report the need for further professional development in ICT skills for teaching and for 22% the need is substantial. Even when they already received training in ICT skills for teaching in the year prior to the survey, a relatively large share of Latin American teachers still report high levels of need in professional development.
- In Colombia, the level of self-reported need for further training in ICT is much larger than in the majority of OECD countries, irrespective of whether teachers have already participated or not in professional development activities in ICT skills for teaching. In Brazil and Buenos Aires (Argentina), more than 30% of lower-secondary teachers did not participate in ICT-related professional development activities and report a high level of need in this area.
- Spending on high-quality professional development for teachers is considered a highly important spending priority for many more Latin American teachers than for teachers across OECD countries, pointing to the need to reinforce quality, more than quantity of teachers' training. In particular, in a scenario where the education budget were to increase, 86% of Latin American teachers consider that spending on the provision of high-quality professional development would be of high importance. Evidence suggests that in many Latin American countries, the accessibility and quality of professional development programmes should be a major focus for policy intervention.
- Teachers in Latin American countries with available data in the OECD Survey of Adult Skills, a product of the Programme for the International Assessment of Adult Competencies (PIAAC), perform poorly in problem solving in technology-rich environments. Across the countries participating in the Survey of Adult Skills (PIAAC), the share of teachers with low problem solving skills in technology-rich environments varies from less than 5% in Australia to around 54% in Ecuador. Teachers' skills relate to student performance. Substantial gains in students' performance could be obtained by strengthening teachers' skills and this should become a priority for Latin American governments.

What factors enable teachers' use of new technologies and their self-confidence in supporting student learning using ICT?

The teaching profession is pivotal for making the most of new technologies in the classroom. Students' performance relates closely to the quality of their teachers (Chetty, Friedman and Rockoff, 2014[1]; Hanushek, Piopiunik and Wiederhold, 2014[2]) and technology use has the potential to translate into better student outcomes when technology is blended into innovative teaching and learning practices (Chapter 3). This puts teachers, their skills, attitudes and pedagogies at the core of an effective integration of ICT in teaching in initial education.

Teachers' reliance on ICT for student learning activities and their self-confidence regarding the use of new technologies for supporting student learning can be enabled by a variety of factors. The availability and quality of ICT infrastructure in schools, school policies, teachers' commitment, skills and attitudes towards ICT are likely to shape whether and how new technologies enter the classroom. Data from TALIS (2018) allow investigating (Box 4.1) the factors that enable teachers to let their students use ICT frequently for their projects and make teachers feel self-confident about their capacity to support student learning through the use of new technologies.

Training in ICT skills for teaching makes a difference for teachers' ICT use and self-efficacy

Whether in Latin American or OECD countries, teachers' use of ICT in class (Figure 4.1) and self-efficacy (Figure 4.2) in supporting student learning using ICT relate strongly to their training in ICT skills for teaching.

Teachers may feel overwhelmed by the different technological options that are arrive in their classrooms or are available to them for teaching, and feel that they are not sufficiently skilled or supported in order to make the most of the new technologies. The quality of teachers' training in ICT skills becomes, then, a key factor behind the extent to which teachers finally rely on ICT and feel confident about supporting learning through technology use.

What drives Latin American teachers' use of ICT is how well prepared they actually felt after receiving training in the use of ICT for teaching as part of their initial teacher education. Results in Panel B of Figure 4.1 suggest, for instance, that teachers who received training in the use of ICT for teaching in their initial teacher education but felt unprepared display a similar frequency of technology use as teachers who did not receive such training and felt unprepared.

Box 4.1. Enabling factors for teachers' ICT use and self-efficacy in ICT use – empirical analysis

The econometric analysis in this chapter examines the factors that enable teachers' frequency of ICT use in class and their self-efficacy in ICT use. The main results of the analysis are presented in Figure 4.1 and Figure 4.2. Estimation tables with all coefficients are reported in Annex Table 4.A.1 and Annex Table 4.A.4.

Potentially enabling factors

The analysis relies on two research papers aiming to identify a series of factors potentially associated with the use of ICT in the classroom for students' projects and teachers' self-confidence in ICT use for learning.

The first, (Gil-Flores, Rodríguez-Santero and Torres-Gordillo, 2017[3]) investigates the role of ICT infrastructure and teacher characteristics in explaining ICT use by Spanish lower-secondary teachers. It relies on data from the Spanish sample of TALIS (2013).

The second, (Le Donné, Fraser and Bousquet, 2016[4]) identifies a series of factors that are most important in explaining differences in teachers' cognitive activation and active learning teaching practices. The analysis relies on the TALIS (2013)–PISA (2012) link database and explores the relationship between teachers' teaching strategies and student performance.

The following variables are therefore included in the analysis of the main enabling factors associated with teachers' ICT use and self-confidence:

School attributes

- Private or public school; school in rural or urban area; whether teacher determines course content, including curricula; whether teacher chooses learning material; organisational and team's innovativeness (OECD, 2019[5]); professional collaboration in lessons among teachers; shortage or inadequacy of digital technology for instruction; insufficiency of Internet access.

The index of professional collaboration among teachers is based on four items related to how often teachers do the following in school: teach jointly as a team in the same class, provide feedback to other teachers about their practice, engage in joint activities across different classes and age groups (e.g. projects) and participate in collaborative professional learning (OECD, 2019[5]).

School composition

- Share of students from disadvantaged homes; percentage of immigrant students.

Classroom composition

- Disciplinary climate; percentage of low academic achievers; percentage of students with special needs; percentage of students from disadvantaged homes; percentage of gifted students.

Teacher characteristics

- Years of teaching experience; age; gender; permanent contract; relationship with students and other teachers; effective professional development; index of job satisfaction; use of ICT for teaching included in teacher's initial education or training; preparedness to use ICT for teaching after initial teacher education or training; ICT skills for teaching part of professional development in the 12 months prior to the survey; need for professional development in ICT; self-efficacy in instruction, classroom management and student engagement.

Self-efficacy indices are based on a series of items derived from teachers' answers to the question "In your teaching, to what extent can you do the following?" (OECD, 2019[6]):

- Self-efficacy in instruction is a composite indicator based on the extent to which teachers can: craft good questions for students, use a variety of assessment strategies, provide an alternative explanation, for example when students are confused, vary instructional strategies in my classroom.
- Self-efficacy in classroom management is a composite indicator based on the extent to which teachers can: control disruptive behaviour in the classroom, make their expectations about student behaviour clear, get students to follow classroom rules, calm students who are disruptive or noisy.
- Self-efficacy in student engagement is a composite indicator based on the extent to which teachers can: get students to believe they can do well in schoolwork, help students value learning, motivate students who show low interest in schoolwork and help students think critically.

Econometric analysis

The analysis is based on a multilevel (teacher and school levels) mixed-effects regression model. Two different estimations are performed, examining:

- Enabling factors for the use of ICT: the dependent variable for this estimation is a dummy for whether the teacher lets students use ICT for projects or class work frequently or in all or nearly all lessons (vs. never/almost never or occasionally).
- Enabling factors for teachers' self-efficacy in ICT use to support student learning: the dependent variable for this estimation is a dummy for whether the teacher perceives he or she can support quite a bit or a lot student learning through the use of new technologies.

Source: Gil-Flores, J., J. Rodríguez-Santero and J. Torres-Gordillo (2017[3]), "Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastructure", *Computers in Human Behavior*, http://dx.doi.org/10.1016/j.chb.2016.11.057; Le Donné, N., P. Fraser and G. Bousquet (2016[4]),, "Teaching strategies for instructional quality: insights from the TALIS-PISA link data", *OECD Education Working Papers*, No. 148, https://dx.doi.org/10.1787/5jln1hlsr0lr-en; OECD, (2019[6]), *TALIS 2018 Results (Volume I): Teachers and School Leaders as Lifelong Learners*, https://dx.doi.org/10.1787/1d0bc92a-en.

Simply having had the use of ICT for teaching included in their initial teacher education does not appear to boost teachers' ICT use in classroom and self-confidence if the quality of that training is low and teachers end up feeling unprepared. Participation in professional development in ICT skills for teaching, instead, seem to matter quite a lot. Evidence shows, in fact, that teachers who participated in professional development in this area in the year prior to the survey are significantly more likely to use ICT with high frequency in class.[1] They are also significantly more likely to report they can support student learning quite a bit or a lot using digital technologies. This association is observed in all Latin American countries with available data in TALIS 2018 (Annex Table 4.A.3).

While perceived shortages related to ICT infrastructure are associated with less frequent uses of digital technologies in the classroom and lower teacher self-efficacy in ICT, programmes that focus only on the provision of ICT infrastructure will not be sufficient. To support the integration of ICT in classrooms and teachers' confidence in their capacity to make effective uses of these tools for student learning, investments in ICT infrastructure should come jointly with high-quality training in ICT skills for teaching during teachers' initial teacher education and professional development (Gil-Flores, Rodríguez-Santero and Torres-Gordillo, 2017[3]).

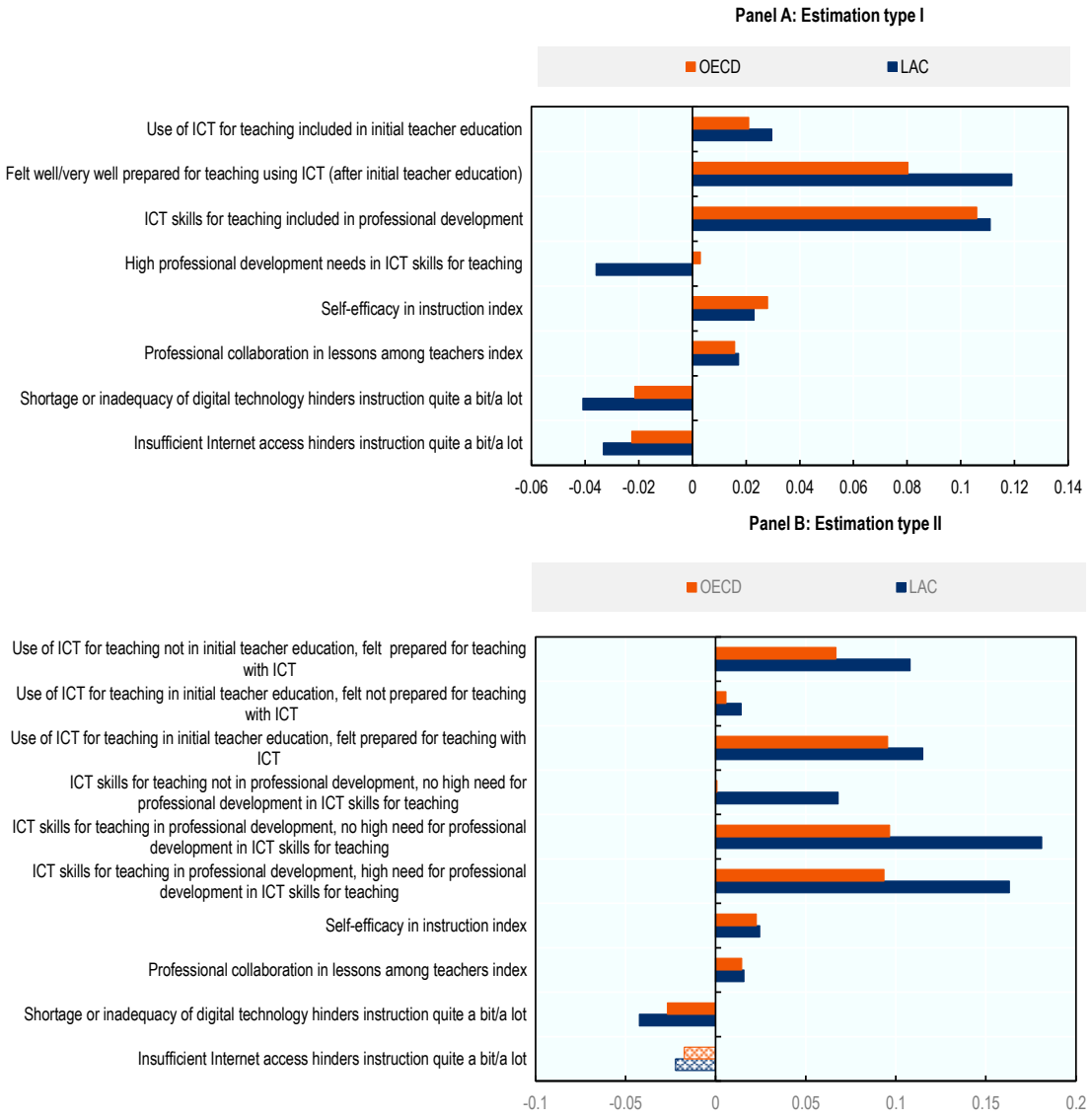
Teacher self-efficacy in instruction and collaboration with other teachers also matter

Teachers who feel more efficient about their instruction are more likely to let their students use ICT frequently for learning activities and feel more confident about their capacity to support learning using new technologies. TALIS examines teachers' perception on their self-efficacy, meaning the extent to which teachers report they can do a series of activities in three dimensions: instruction, classroom management and student engagement (Box 4.1). Teacher self-efficacy is closely related to instructional quality (Holzberger, Philipp and Kunter, 2013[7]). Self-efficacy in instruction reflects teachers' confidence in using diverse instructional and assessment strategies, as well as providing alternative explanations, for instance, when students are confused.

In addition, the likelihood that teachers frequently use ICT also increases with teachers' degree of collaboration with other teachers. Higher levels of collaboration among teachers in a school tend also to be related to higher teacher job satisfaction and teacher self-efficacy (OECD, 2014[8]).[2]

Figure 4.1. Factors related to teachers' frequent use of ICT for students' projects/class work

Effects of each variable on teachers' frequent use of ICT for students' projects/class work



Note: "Frequent ICT use" is a dummy for letting students us ICT for projects or class work frequently or always. Coefficients are obtained through multilevel mixed-effects linear regressions that account for school attributes, school composition, school characteristics, teacher characteristics and country fixed effects. School attributes, school composition, school characteristics and teacher characteristics are detailed in Box 4.1. Effects of "Use of ICT for teaching not in initial teacher education, felt prepared for teaching with ICT", "Use of ICT for teaching in initial teacher education, felt not prepared for teaching with ICT", "Use of ICT for teaching in initial teacher education, felt prepared for teaching with ICT" should be interpreted with respect to the reference category "Use of ICT for teaching not in initial teacher education, felt not prepared for teaching with ICT". Effects of "ICT skills for teaching not in professional development, no high need for professional development", "ICT skills for teaching in professional development, no high need for professional development" and "ICT skills for teaching in professional development, high need for professional development' should be interpreted with respect to the reference category "ICT skills for teaching not in professional development, high need for professional development". Detailed estimation results are presented in Annex Table 4.A.1 for results in Panel A (Estimation type I) and Annex Table 4.A.2 for results in Panel B (Estimation type II). Estimations on OECD countries exclude Chile and Mexico. Bars with patterns indicate coefficients that are not statistically significant.

Source: OECD calculations based on OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

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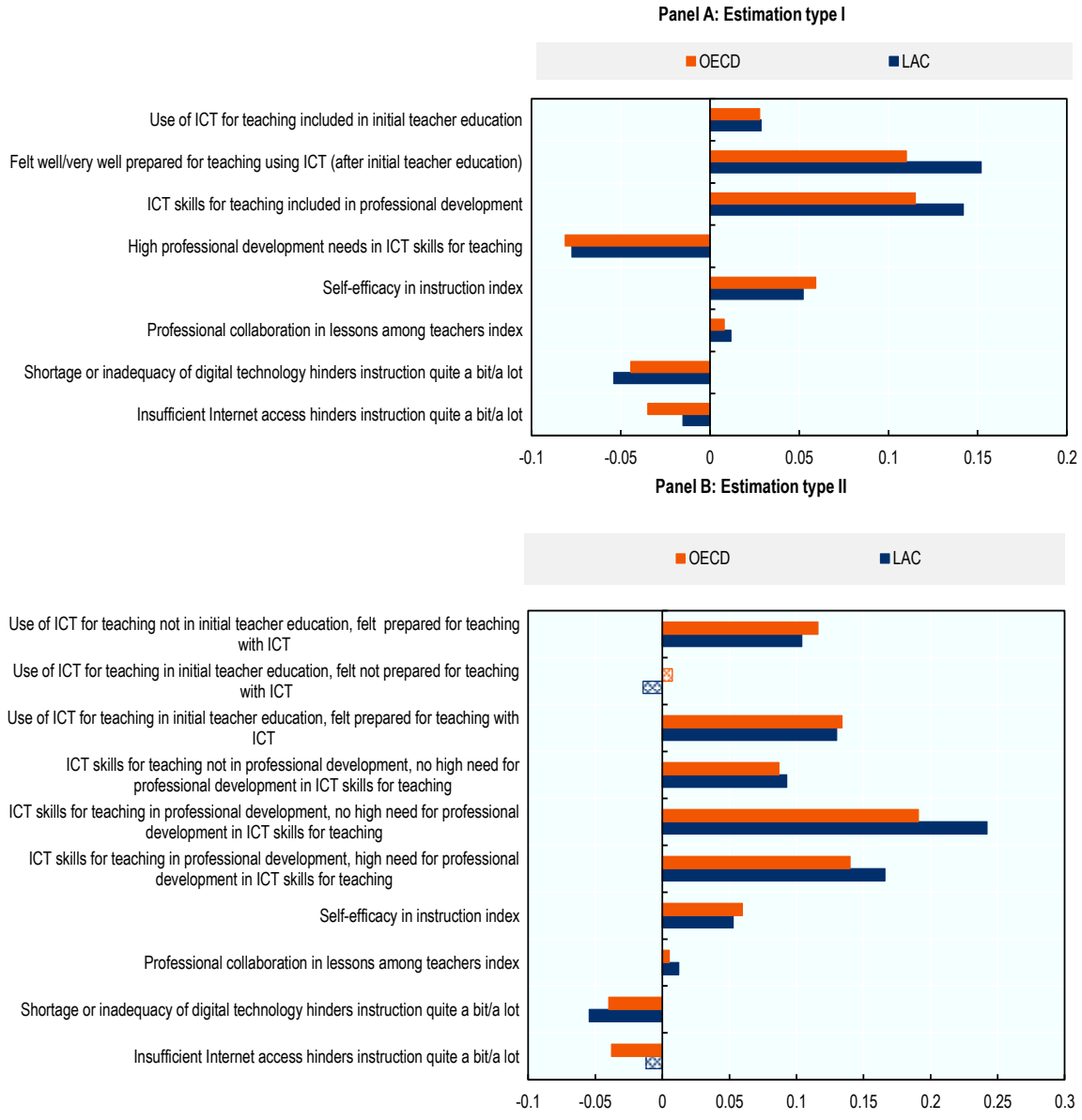
Figure 4.2. Factors related to teachers' ICT self-efficacy

Effects of each variable on teachers' ICT self-efficacy



Note: . "ICT self-efficacy" is a dummy variable equal to one if the teacher reports being able to support student learning quite a bit or a lot through the use of digital technology. Coefficients are obtained through multilevel mixed-effects linear regressions that account for school attributes, school composition, school characteristics, teacher characteristics and country fixed effects. School attributes, school composition, school characteristics and teacher characteristics are detailed in Box 4.1. Effects of "Use of ICT for teaching not in initial teacher education, felt prepared for teaching with ICT", "Use of ICT for teaching in initial teacher education, felt not prepared for teaching with ICT", "Use of ICT for teaching in initial teacher education, felt prepared for teaching with ICT" should be interpreted with respect to the reference category "Use of ICTfor teaching not in initial teacher education, felt not prepared for teaching with ICT". Effects of "ICT skills for teaching not in professional development, no high need for professional development", "ICT skills for teaching in professional development, no high need for professional development" and "ICT skills for teaching in professional development, high need for professional development' should be interpreted with respect to the reference category "ICT skills for teaching not in professional development, high need for professional development". Detailed estimation results are presented in Annex Table 4.A.1 for results in Panel A (Estimation type I) and Annex Table 4.A.2 for results in Panel B (Estimation type II). Estimations on OECD countries exclude Chile and Mexico. Bars with patterns indicate coefficients that are not statistically significant.
Source: OECD calculations based on OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

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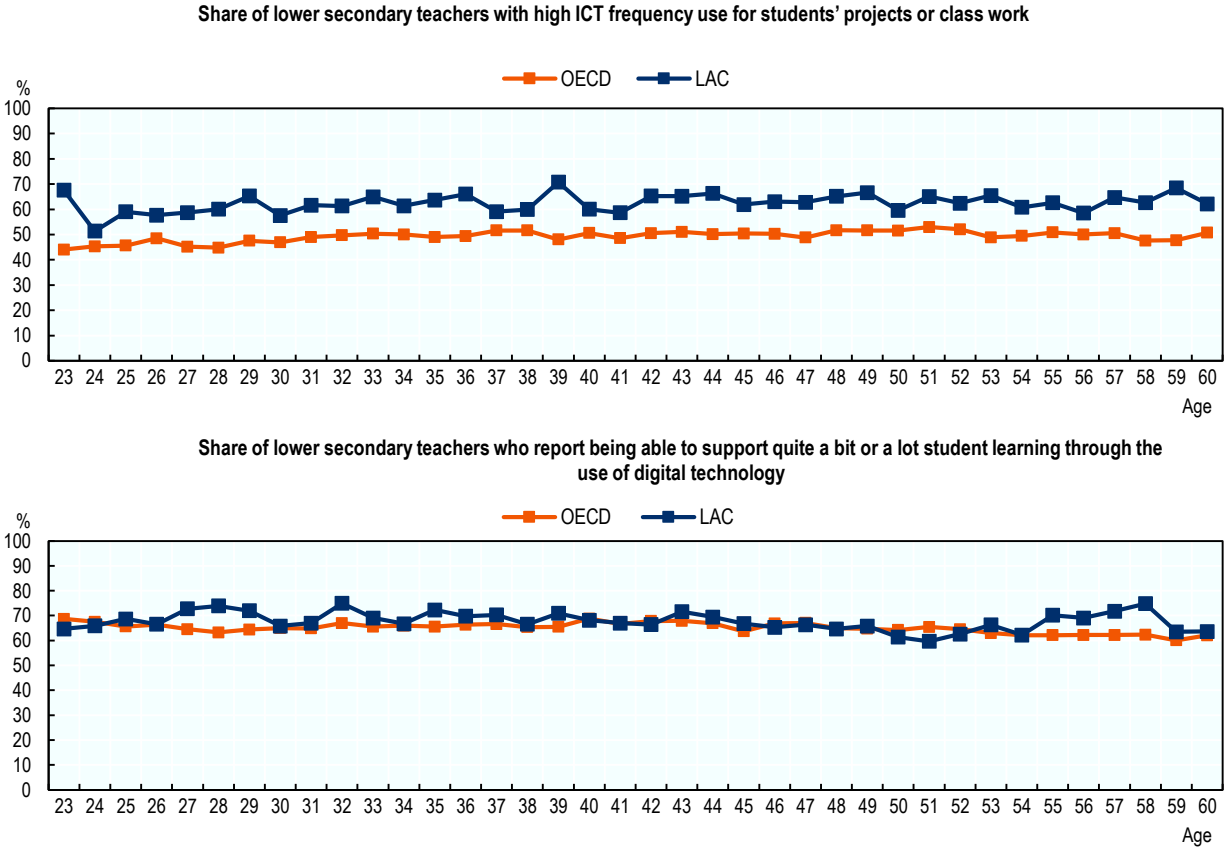
Finally, teachers' attitudes towards ICT are also likely to be related to the extent to which ICTs are present in the classroom. Students whose teachers are more positive about the usefulness of new technologies for teaching are more likely to report more frequent technology uses (European Commission, 2013[10]). Teachers who hold constructivist beliefs about how students learn (e.g. "My role as a teacher is to facilitate students' own inquiry") are equally more inclined to let their students use ICT for projects or class work with high frequency (Gil-Flores, Rodríguez-Santero and Torres-Gordillo, 2017[3]). In fact, analyses based on TALIS (2013) showed that in around 16 countries, teachers' frequency of ICT use in classrooms was associated with their constructivist beliefs (OECD, 2014[8]). However, teachers' ICT use in class and ICT-related self-efficacy do not appear to be a question of age (Figure 4.3).

Figure 4.3. Teachers' frequency of ICT use and self-confidence in supporting learning through ICT, by age

Share of lower-secondary teachers, by age



Source: OECD calculations based on OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

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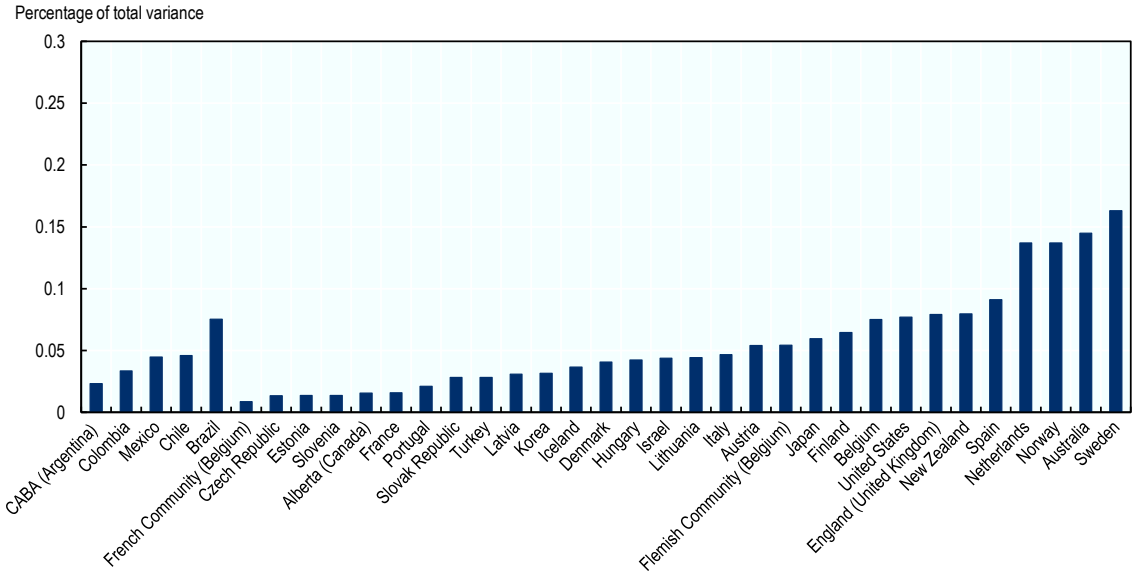
Teacher training, attitudes and collaboration with other teachers matter for ICT use in classrooms. In fact, teacher and potentially student-level factors are relatively more important in explaining the frequency of ICT use for students' projects or class work. In most Latin American and OECD countries, the use of ICT by teachers working in the same school varies greatly (Figure 4.4). On average across Latin American schools, school-level factors seem to play a very limited role in explaining the variation in teachers' frequency of ICT use. High between-school variation would indicate that teachers in the same school

approach ICT use in the same way and therefore, that school-level factors are more important in shaping teachers' use of ICT. However, in Latin American countries, the between-school variation in teachers' ICT use with high frequency represents only 4% of the total variation in teachers' ICT use with high frequency.

This pattern also holds for the majority of OECD countries. These figures are in line with findings from the econometric analysis (Annex Table 4.A.1, Annex Table 4.A.2). They are also consistent with evidence based on PISA (2012) showing that the variation in computer use in mathematics is mainly within-schools, rather than between-schools, suggesting a relatively weak association between computer use in class and school-level policies (OECD, 2015[11]).

Figure 4.4. Between-school variation in teachers' frequent use of ICT for students' projects/class work

Intra-class correlation coefficient



Note: The intra-class correlation coefficient reports the between-school variation in teachers' frequent use of ICT for students' projects/class work expressed as a percentage of the total variation in teachers' frequent use of ICT for students' projects/class work. CABA (Argentina) refers to the Ciudad Autónoma de Buenos Aires, Argentina.
Source: OECD calculations based on OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

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How prepared are Latin American teachers for teaching with new technologies?

Many Latin American teachers rely on technologies in the classroom

In Latin American countries with available data in TALIS (2018), many teachers frequently use technology in the classroom and feel quite confident about their capacity to support student learning through ICT use (Figure 4.5). TALIS data do not provide any information on the specific use teachers and students are making of new technologies, nor on the amount of time devoted to technology use (Box 4.2). As such, these data should be interpreted as providing an indication of teachers and students' exposure to new technologies and of the different factors that enable teaching practices associated with ICT.

Latin American teachers seem to use ICT in class with relatively higher frequency than their OECD counterparts, although the region hides large disparities. Colombian teachers lead the use of ICT for class work. More than 70% of them let their students use ICT frequently or always for projects or class work. In contrast, in Brazil, only 41% of lower secondary teachers display a high frequency use of ICT in class and one in five teachers never relies on ICT for class work.

Interestingly, Latin American teachers report similar levels of confidence in their capacity to support student learning using ICT as teachers across OECD countries do. Around two thirds of teachers report being able to provide such support quite a bit or a lot and Colombian and Chilean teachers appear to be most confident in their capacity to support student learning through ICT. Brazilian teachers are also relatively numerous to report being self-efficient when it comes to ICT for learning, although they use ICT the least frequently among Latin American teachers surveyed in TALIS (2018).

Box 4.2. Some data limitations

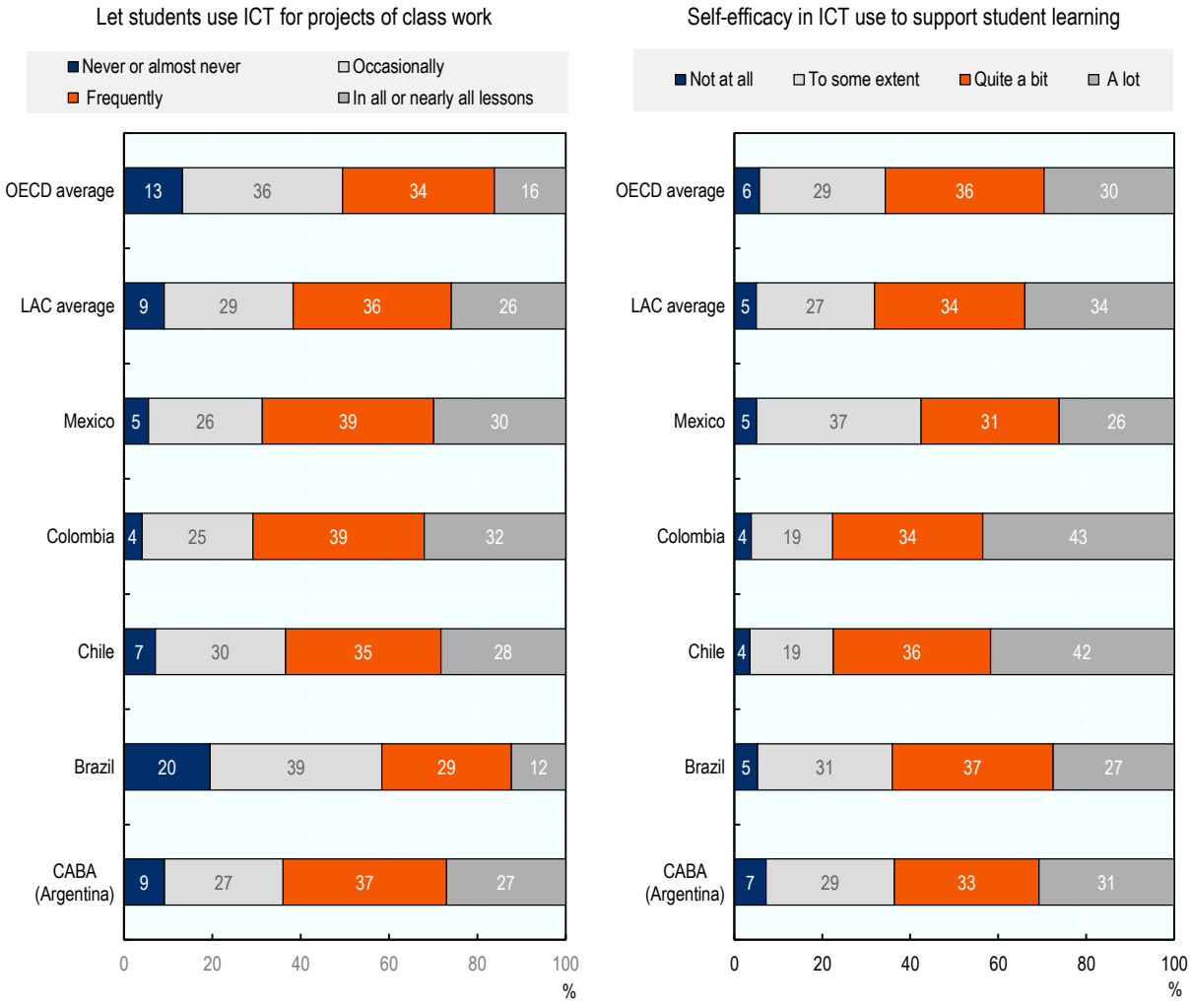
TALIS data do not allow knowing how technology is integrated into teaching practices. For instance, there is no available information on whether teachers are making innovative or simplistic uses of ICT in class. The analyses carried out in this chapter are informative with respect to the exposure of Latin American teachers and students to new technologies, and to the factors associated with more frequent reliance on ICT in the classroom and higher teacher self-confidence. However, given data limitations, it is not possible to derive conclusions on whether Latin American teachers' frequency of technology use translates into better student outcomes Additional data on teachers and students' specific use of new technologies would be needed to make inferences about the extent to which specific uses can support student outcomes.

In addition, TALIS data are based on teachers' self-reports and as such, reflect their own perceptions, opinions and evaluations about the learning environment and their own teaching practices (OECD, 2019[6]; OECD, 2019[5]). Teachers' self-confidence in their capacity to support student learning using new technologies (or ICT-related self-efficacy) is based on self-evaluative questions. This can make cross-country comparison difficult as teachers in different countries could potentially evaluate themselves against different standards of teaching self-efficacy.

Source: OECD (2019[6]), *TALIS 2018 Results (Volume I): Teachers and School Leaders as Lifelong Learners*, https://dx.doi.org/10.1787/1d0bc92a-en; OECD (2019[5]), *TALIS 2018 Technical Report*.

Figure 4.5. Latin American teachers' use of ICT in the classroom and self-efficacy

Percentage of lower-secondary teachers



Note: CABA (Argentina) refers to the Ciudad Autónoma de Buenos Aires, Argentina.
Source: OECD calculations based on OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

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A relatively high share of teachers receive training in ICT skills for teaching

Many Latin American teachers report having received training in the use of ICT for teaching as part of their formal education or training, or professional development in ICT skills for teaching (Figure 4.11). On average, the inclusion of ICT use for teaching in teachers' initial education appears to be more widespread in Latin American countries than across OECD countries. In Chile, Colombia and Mexico, for instance, more than 70% of lower-secondary teachers report having trained in the area of ICT skills for teaching during their initial teacher education or training.

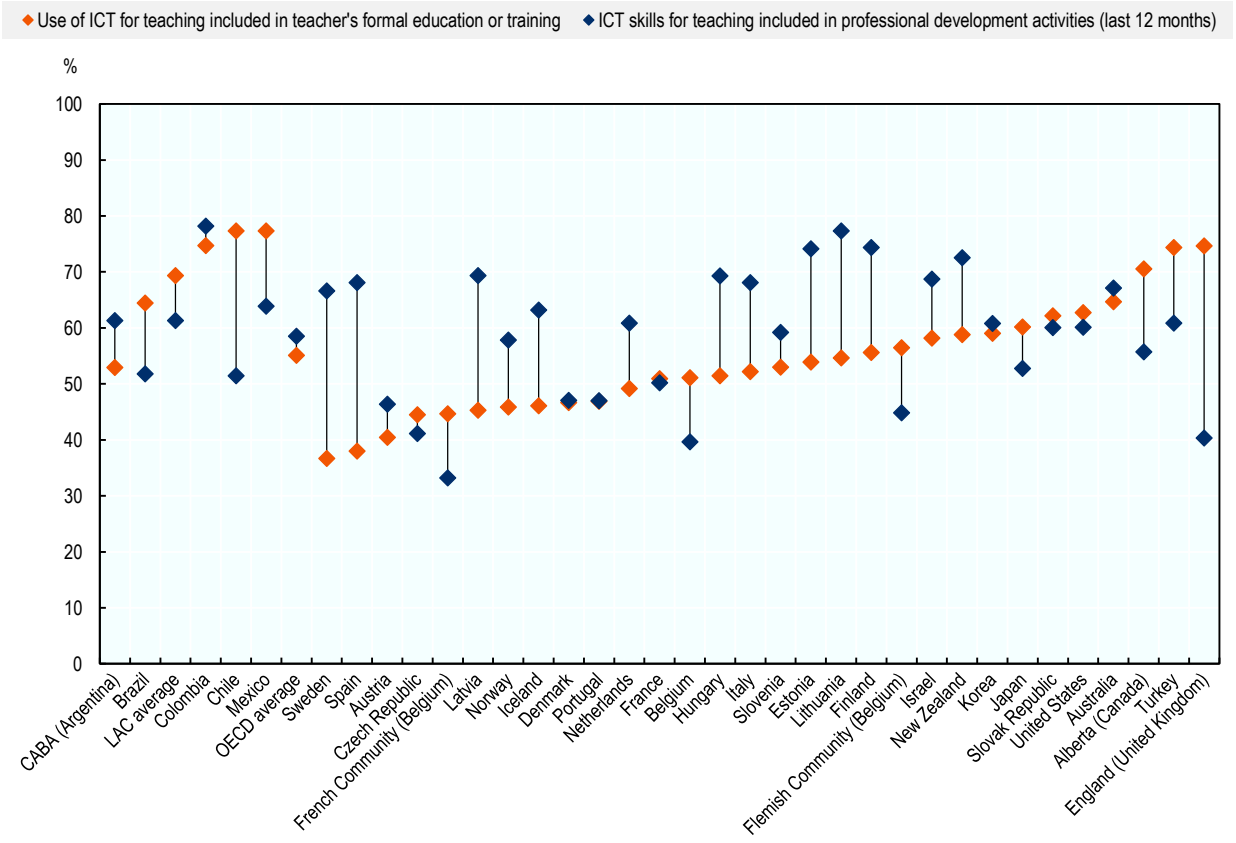
Participation in professional development activities related to ICT skills for teaching is similar in OECD and Latin American regions. Among countries for which data are available in the region, Colombia displays one of the largest shares of teachers who have engaged in professional development in ICT skills for teaching

in the year preceding the survey (78%). Latin American countries have also relatively high levels of teacher participation in professional development activities in general (Figure 4.7), although not on a par with OECD countries.

Latin American teachers are numerous to receive training in teaching with ICT as part of their initial teacher education, or professional development activities. However, these figures do not reflect the type or quality of the training they receive. If many Latin American teachers receive, in fact, basic ICT training, such training may not be necessary in many OECD countries, where teachers and adults are likely to be more digitally literate. Differences in the type and quality of training provision may therefore explain the relatively high shares of teachers receiving ICT-related training in their initial teacher education, or professional development activities. That being said, investments made in ICT infrastructure in many Latin American countries have often been accompanied by more training for teachers in this area.

Figure 4.6. Inclusion of the use of ICT for teaching in initial teacher education and of ICT skills for teaching in professional development activities

Share of lower-secondary teachers



Note: CABA (Argentina) refers to the Ciudad Autónoma de Buenos Aires, Argentina.
Source: OECD calculations based on OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

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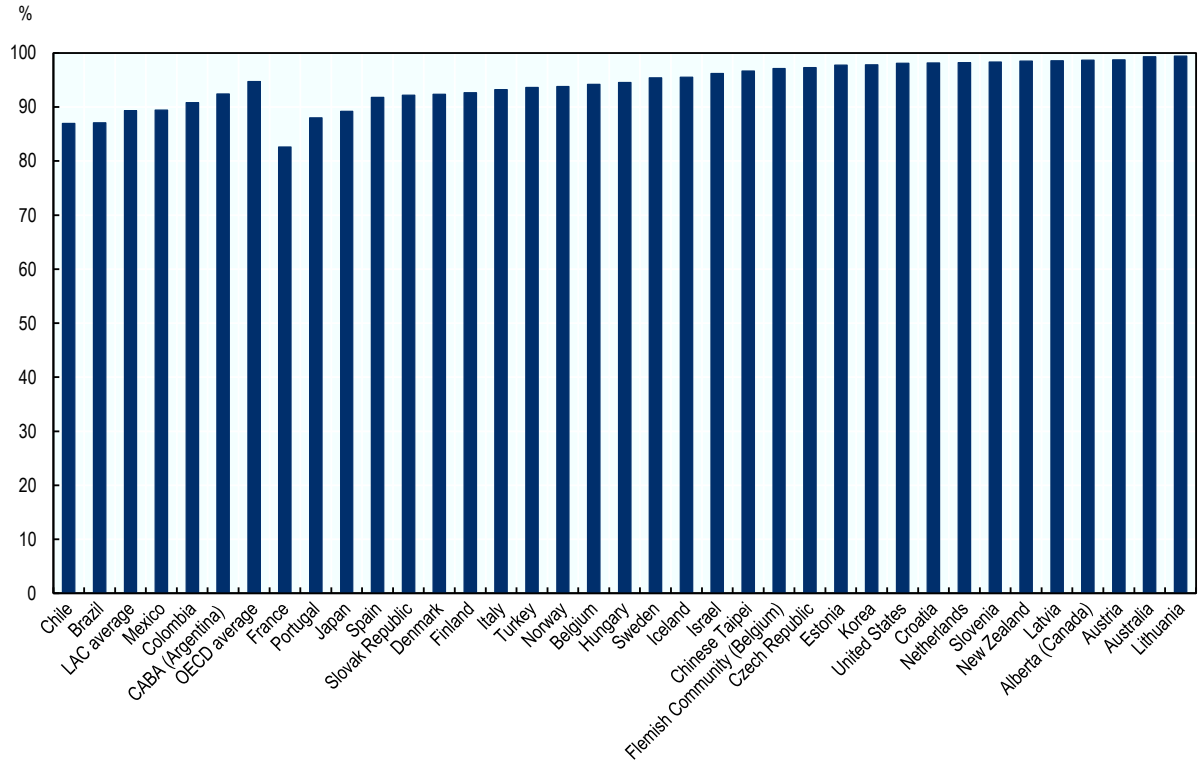
Figure 4.7. Participation in professional development

Share of lower-secondary teachers who participated in professional development activities in the 12 months prior to the survey



Note: CABA (Argentina) refers to the Ciudad Autónoma de Buenos Aires, Argentina. Professional development activities include: "Courses/seminars attended in person", "Online courses/seminars", "Education conferences where teachers and/or researchers present their research or discuss educational issues", "Formal qualification programme (e.g. degree programme)", "Observation visits to other schools", "Observation visits to business premises, public organisations or non-governmental organisations", "Peer and/or self-observation and coaching as part of a formal school arrangement", "Participation in a network of teachers formed specifically for the professional development of teachers", "Reading professional literature" or any other activity ("Other").
Source: Adapted from OECD (2018[9]), TALIS 2018 Database, Table I.5.1; http://www.oecd.org/education/talis/.

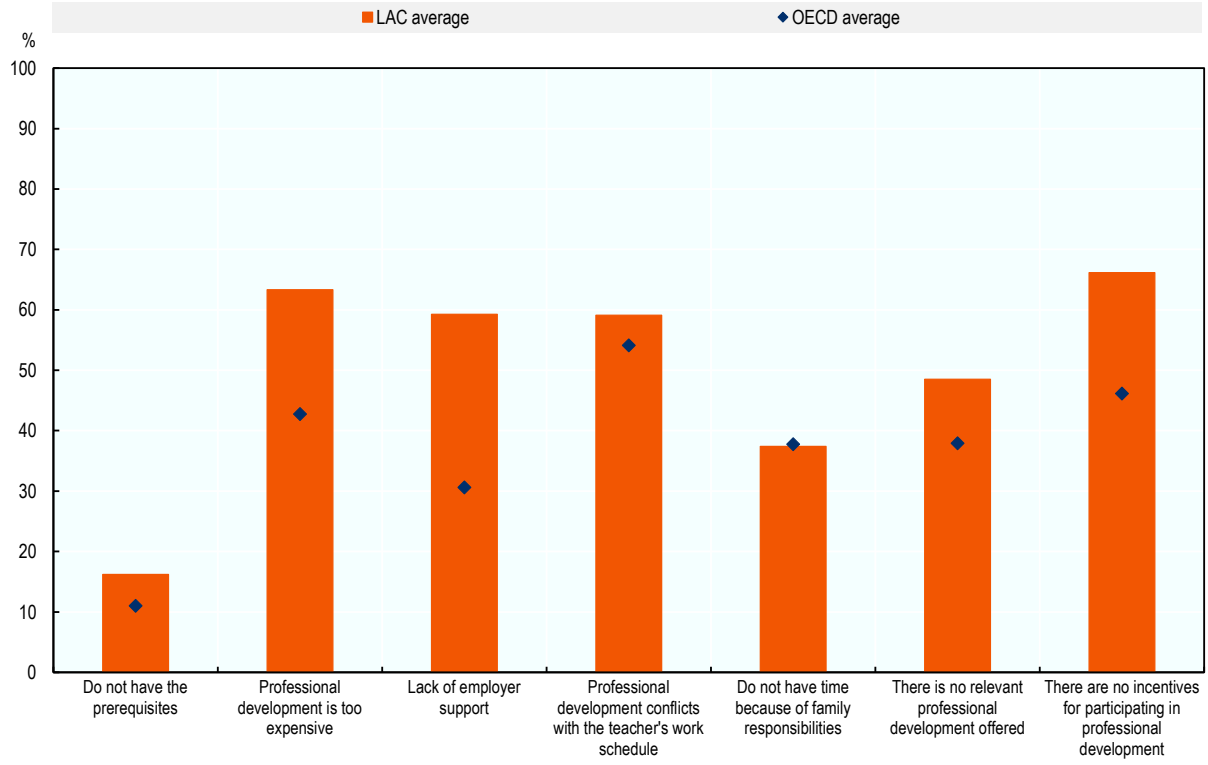
StatLink https://doi.org/10.1787/888934135775

Teachers in Latin America train through technology

In Latin America, teachers are numerous to report costs as a barrier to participation in professional development (Figure 4.8).[3] New technologies can open the door to diverse ways of learning for individuals and teachers. Digital resources, massive open online courses (MOOCs) or other online learning activities, for instance, expand opportunities for developing skills and acquiring knowledge with limited costs and from anywhere, and provide potential alternative sources for skills development for teachers in Latin America.

Figure 4.8. Barriers to teachers' participation in professional development

Share of lower-secondary teachers



Note: The figure displays shares of teachers who agree, or strongly agree, that the following elements present barriers to their participation in professional development.
Source: Adapted from OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/, Table I.5.36.

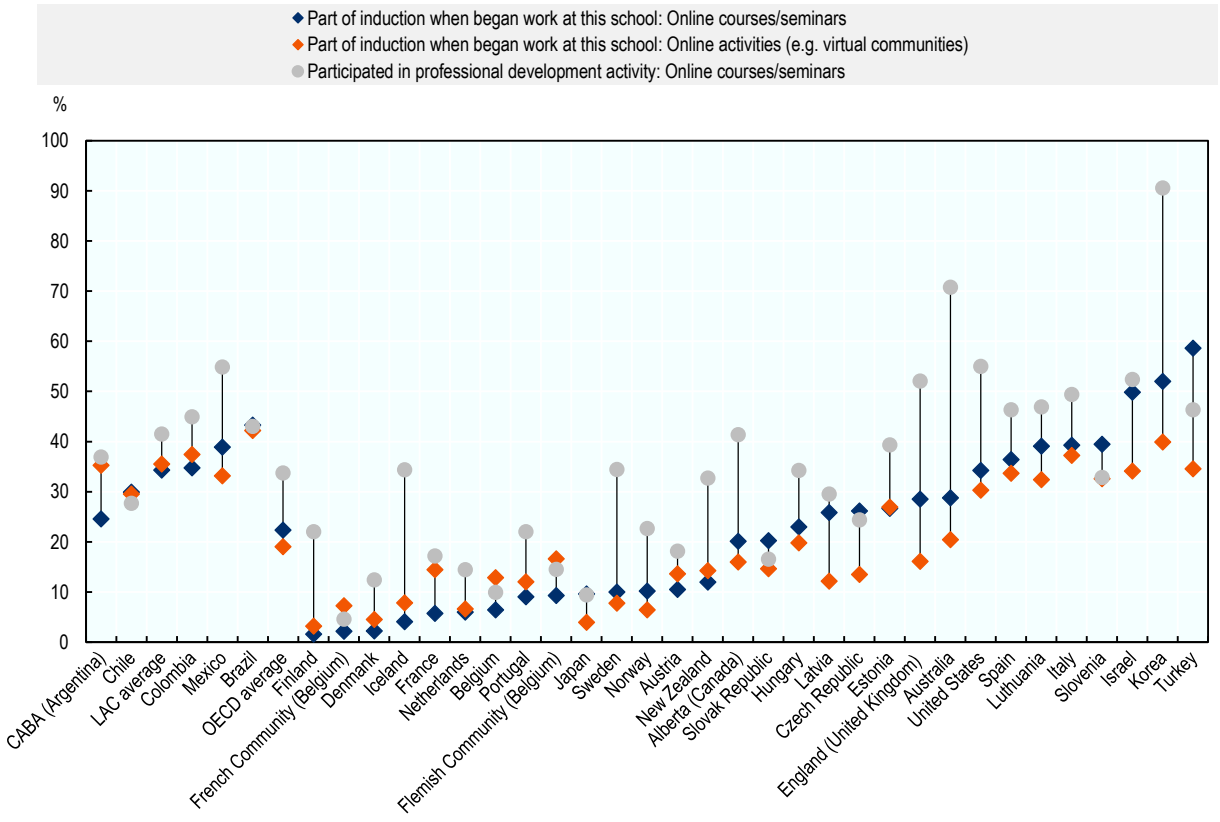
StatLink https://doi.org/10.1787/888934135794

Indeed, enhanced access to online resources for teacher training has often accompanied the extensive investments in ICT infrastructure made in many Latin American countries. A relatively high share of teachers in Latin American countries, in fact, train through technology (Figure 4.9). On average across Latin American countries with available data in TALIS (2018), around 40% of lower-secondary teachers have participated in online courses or seminars as part of their professional development activities. A similar share have engaged in online activities (e.g. virtual communities) or online courses as part of their induction programme at their current school.

MOOCs are also becoming increasingly widespread and provide new sources of knowledge and learning and teachers from Latin American countries are likely to be engaging as well in these new learning opportunities. Early survey data from MITx MOOCs indicated that as many as 28% of survey respondents reported to be past or present teachers and 6% reported to be teaching the topic they were following (Seaton, Coleman and Daries, 2014[12]). Moreover, teachers were actively engaged in MOOC related activities, as they were overrepresented in terms of comments in the MOOC discussion forum. This pattern of teacher participation in MOOCs continued in later years: in 2017, 32% of HarvardX and MITx MOOC survey respondents identified themselves as current or past teachers and 19% reported teaching on the same topic as the MOOC. In addition, less than a third of all surveyed MOOC participants came from the United States (Chuang, 2017[13]), suggesting that Latin American teachers were potentially engaging in these opportunities as well.

Figure 4.9. Participation in online induction and professional development activities

Share of lower-secondary teachers



Note: CABA (Argentina) refers to the Ciudad Autónoma de Buenos Aires, Argentina.
Source: OECD calculations based on OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

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While the use of technology made by teachers in Latin America has the potential to help them get access to professional training opportunities at a low cost this strategy may not be a panacea. Evidence shows, in fact, that fewer teachers engage in similar induction and professional development activities in OECD countries. These patterns of participation suggest that teachers in OECD countries may have access to other types of induction activities that are potentially lacking in Latin American countries and that the use of digital resources has tried to compensate for. Teachers in other OECD countries may have access to better professional development opportunities than those offered by MOOCs, but for teachers in Latin American countries, MOOCs may be a comparatively good quality source of professional development.

Admittedly, the effectiveness of participation in technology-based training activities is largely dependent on the quality of the learning material and on the extent to which these opportunities reach those most in need of training (Chapter 5).

More research is needed to understand how effective digital training activities are relative to more traditional professional development activities. In particular, data are still scarce on the quality of MOOC resources, especially as most experimental evaluations have rather focused on behavioural interventions meant at enhancing completion rates and participation of disadvantaged groups (Escueta et al., 2017[14]).

At the same time, self-reported training needs in ICT skills for teaching remain high

The mere availability of many training opportunities (being these traditional or digital) and the statistics reporting high engagement of teachers may mask severe quality issues with the training received by teachers in Latin America. Despite relatively high levels of engagement of teachers in training geared to the development of ICT skills, in fact, teachers in Latin America still report further training needs (Figure 4.10).

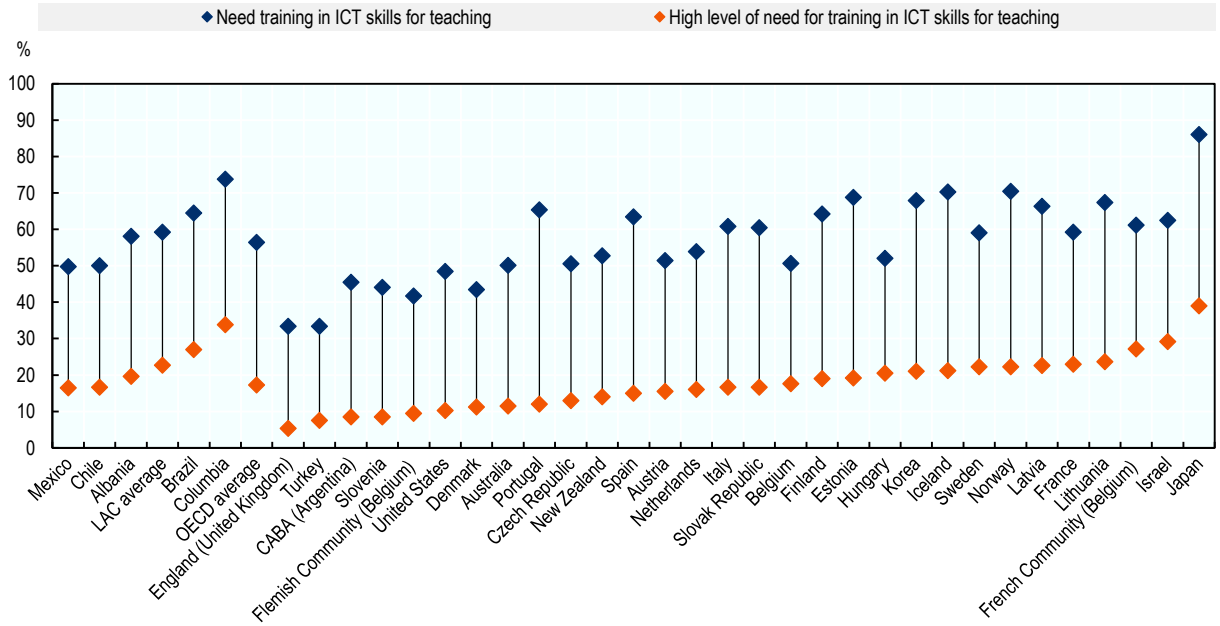
To start with, as many as 60% of Latin American teachers report the need for further professional development in ICT skills for teaching and for 22% the need is substantial. In Colombia, 77% of teachers still need further training and 33% report a high level of need.

The need to reinforce the quality of ICT training to teachers in Latin America is even more evident as TALIS data show that when they already received training in ICT skills for teaching in the year prior to the survey, a relatively large share of Latin American teachers still report high levels of need in professional development (Figure 4.11). In Colombia, the level of self-reported need for further training in this area is much larger than in the majority of OECD countries, irrespective of whether teachers have already participated or not in professional development activities in ICT skills for teaching. In Brazil and Buenos Aires (Argentina), more than 30% of lower-secondary teachers did not participate in ICT-related professional development activities and report a high level of need in this area.

In addition, the share of teachers who engaged in professional development and display a high level of need in Latin American countries (17.4%) is similar to that of teachers who did not engage in professional development in OECD countries (17.2%). This suggests that the quality and content of professional development programmes in ICT skills for teaching in Latin American countries with available data is also likely to be problematic and should become a policy focus.

Figure 4.10. Self-reported training needs in ICT skills for teaching

Share of lower-secondary teachers



Note: Teachers who need training in ICT skills for teachers are teachers who report any need for professional development in ICT skills for teaching, whether low, moderate or high. CABA (Argentina) refers to the Ciudad Autónoma de Buenos Aires, Argentina.
Source: OECD calculations based on OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

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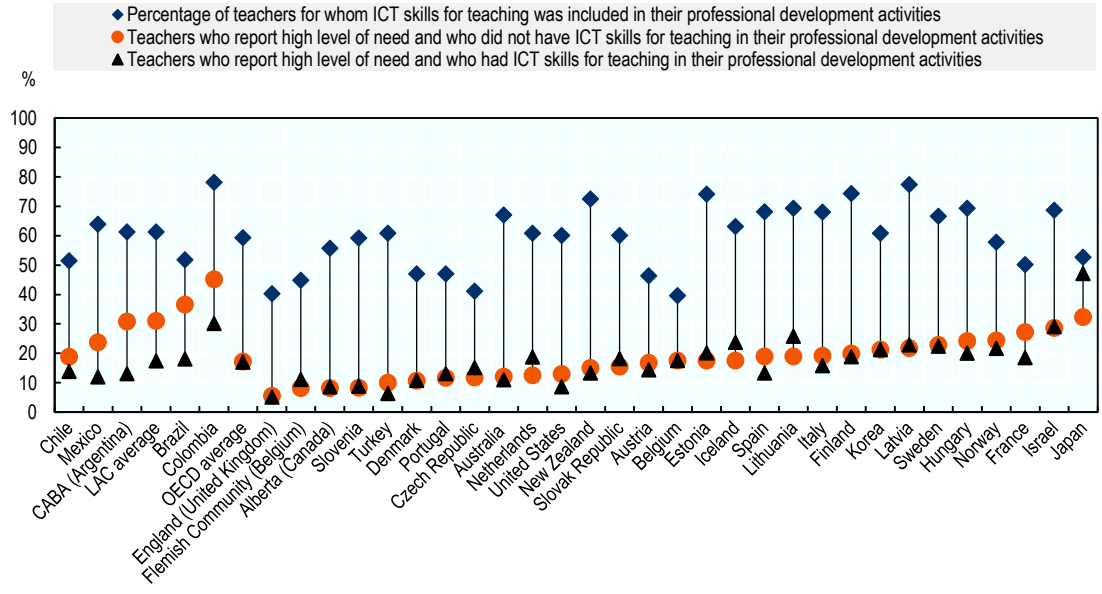
High training needs in ICT skills for teaching may, therefore, reflect that teachers have not received any training or that the training received was insufficient or ineffective. More generally, even if teachers may have already participated in ICT-related training in the past, newer technologies will eventually enter their classroom or new topics such as well-being challenges of technology use or digital citizenship (Burns and Gottschalk, 2019[15]) and teachers will continue needing training. As societies and economies go digital, demands for enhancing teachers' digital competence are also increasing. Lifelong learning and continuous skill development will be of paramount importance for all. This is a key challenge for all countries, and even more so for Latin America as new technologies are expected to rapidly spread in the near future.

Most OECD countries display no difference in teachers' training needs between those who have participated in professional development activities in ICT skills for teaching and those who did not. Instead, in Latin American countries, the average high level of need for professional development in ICT skills for teaching is coupled by a large gap in needs between teachers who participated in professional development and those who did not.

Teachers who have not engaged in professional development in ICT skills for teaching are at high risk of being left behind by the increasing use of new technologies. Strengthening access to professional development activities is therefore crucial.

Figure 4.11. Participation in and need for professional development in ICT skills for teaching

Share of lower-secondary teachers



Note: CABA (Argentina) refers to the Ciudad Autónoma de Buenos Aires, Argentina.
Source: Adapted from OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/, Table I.5.24.

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It is clear that uptake of professional development opportunities does not necessarily translate into better skills if the quality of these activities is low or the content is not aligned with teachers' needs. There are other hints of that the quality of professional training received by Latin American teachers should be reinforced. On the one hand, as mentioned above, in Latin American countries, teacher participation in professional development is similar to participation levels in OECD countries (Figure 4.6, Figure 4.7).

On the other hand, spending on high-quality professional development for teachers is considered a highly important spending priority for many more Latin American teachers than for teachers in OECD countries (Figure 4.12), pointing to the need to reinforce quality, more than quantity of teachers' training.

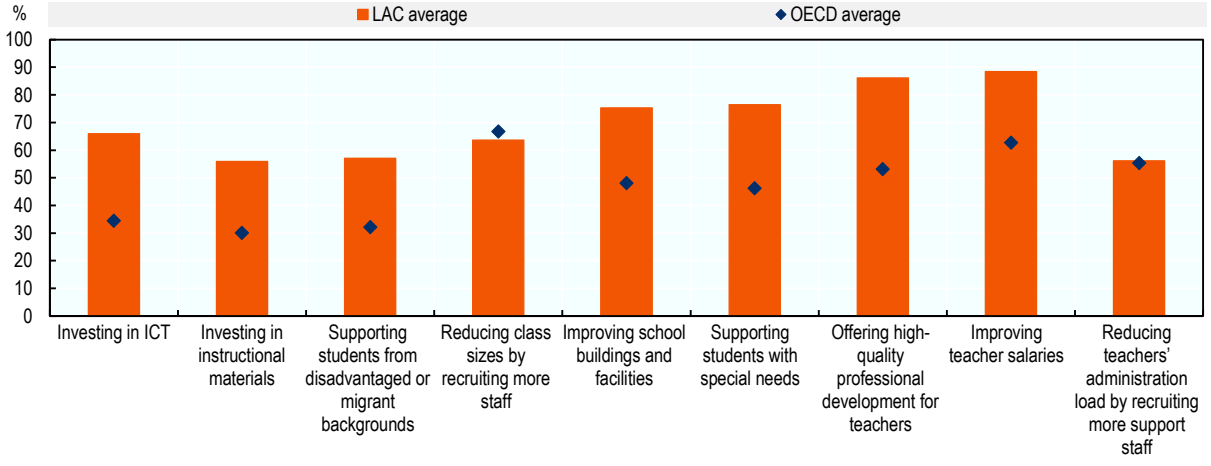
If the education budget were to increase, 86% of Latin American teachers consider that spending on the provision of high-quality professional development is of high importance. The only other spending priority that gathers the assent of a larger number of Latin American teachers relates to improvements in teachers' salaries (88% of teachers).

In addition, in none of the Latin American countries covered in TALIS does investment in ICT appear as a number one spending priority. The share of lower-secondary teachers reporting that investing in ICT is highly important spending priority goes from 48% in Chile to 74% in Colombia. In all Latin American countries, other areas of spending are of greater concern.

To put it differently, evidence suggests that in many Latin American countries, the accessibility and quality of professional development programmes should instead be the a major focus for policy intervention. Investing in ICT only will unlikely result in more effective ICT uses in classrooms, if teachers do not benefit from the appropriate training and support in this area.

Figure 4.12. Spending priorities in education, according to teachers

Share of lower-secondary teachers who reported a specific spending priority to be of high importance



Note: Respondents were able to attribute "high importance" to all spending priorities, they were not asked to prioritise.
Source: Adapted from OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/, Table I.3.66.

StatLink https://doi.org/10.1787/888934135870

There is a need to revisit how teachers are trained for teaching with ICT

In an increasingly digitalised world, teachers will need more than just digital skills in their jobs to be effective. Digitalisation raises the need for children to develop a range of skills in schools, from being able to rely on and make critical uses of digital technologies for specific activities, to being resilient and having a good set of social and emotional skills that allow dealing with well-being challenges[4] on line (Burns and Gottschalk, 2019[15]). To help develop such skills in students, teachers themselves need to be equipped with a relevant range of digital and non-digital skills.

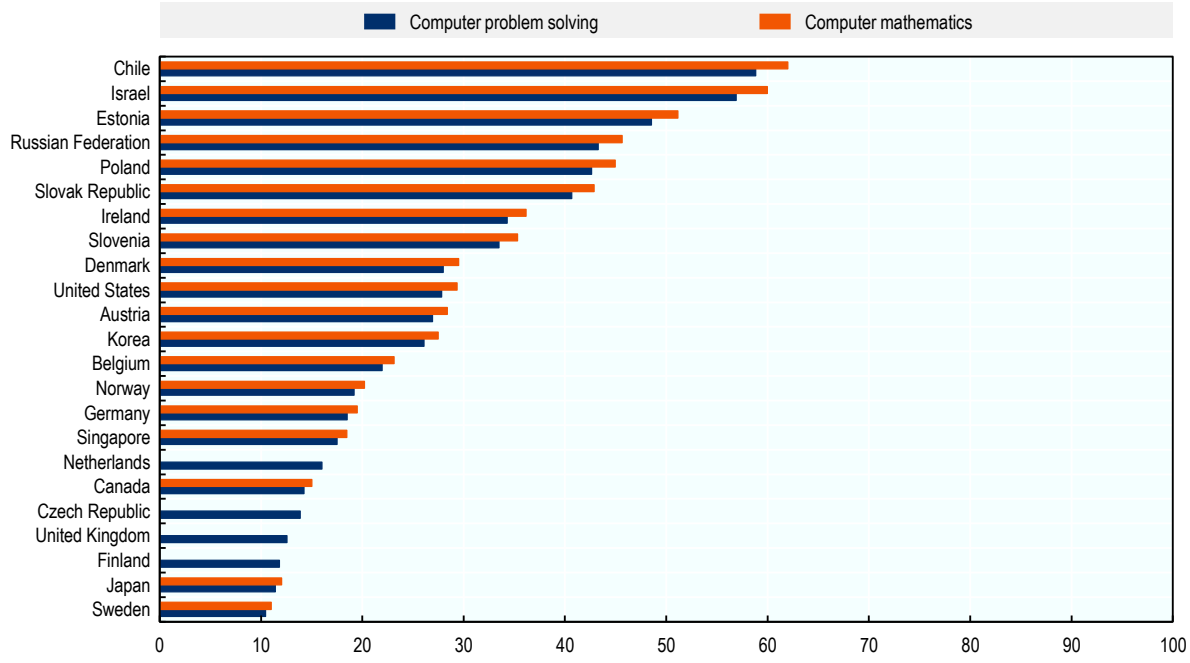
Simply mastering the use of computers in classrooms and enabling students to go on line or use software is not enough. Beyond knowing how to use digital tools, teachers need to be able to know how to use them in innovative ways that serve their teaching purposes and support students when they encounter risks online. Equally important, teachers should be able to assess and determine in which circumstances it may be better not to use technology because technology risks distracting students or replacing activities that are more efficient.

International differences in student performance are strongly related to differences in teacher cognitive skills (Hanushek, Piopiunik and Wiederhold, 2014[2]). In the case of technology use, the better teachers perform in problem solving in technology-rich environments, the better their students' skills in computer problem solving and mathematics will be (Figure 4.13).

Regression analysis shows that substantial gains in student performance can be obtained by strengthening teachers' skills. For example, increasing Chilean teachers' problem-solving skills in technology-rich environments to the level of Australian teachers (the highest performing in the sample), would translate into a substantial increase in students' outcomes.

Figure 4.13. Potential increase in computer problem solving and mathematics student scores linked to an increase in teachers' skills to the level of top performers

Increase in students' test scores (in % of international standard deviation) from an increase in teachers' problem-solving skills in technology-rich environments to the level of teachers from Australia



Note: Each bar displays the increase in student performance (expressed in % of standard deviation across all countries covered) in the respective field if teachers' problem-solving skills in technology-rich environments were raised to the level of Australian teachers (the highest performing teachers in the sample). Computations are based on the estimated coefficients for the relationship between teachers' skills in problem solving in technology-rich environments [from the OECD Survey of Adult Skills (PIAAC)] and students' scores in computer problem solving and computer mathematics (from PISA). The international standard deviation is the mean value of the country-level standard deviations (of student scores) for countries included in the sample in each field (computer problem solving and computer mathematics). It is equal to 96.05 PISA points for computer problem solving and to 89.28 PISA points for computer mathematics. The computer-based assessment of mathematics was offered as an option to countries in PISA (2012): the Czech Republic, Finland, the Netherlands and the United Kingdom do not have data on student performance in computer mathematics. The empirical analysis is based on the methodology of Hanushek, Piopiunik and Wiederhold, (2014[2]). In the Survey of Adult Skills (PIAAC): data for Belgium refer only to Flanders and data for the United Kingdom refer to England and Northern Ireland jointly. Also, in the Survey of Adult Skills (PIAAC): Chile, Israel, Singapore and Slovenia: year of reference 2015; all other countries- year of reference 2012.

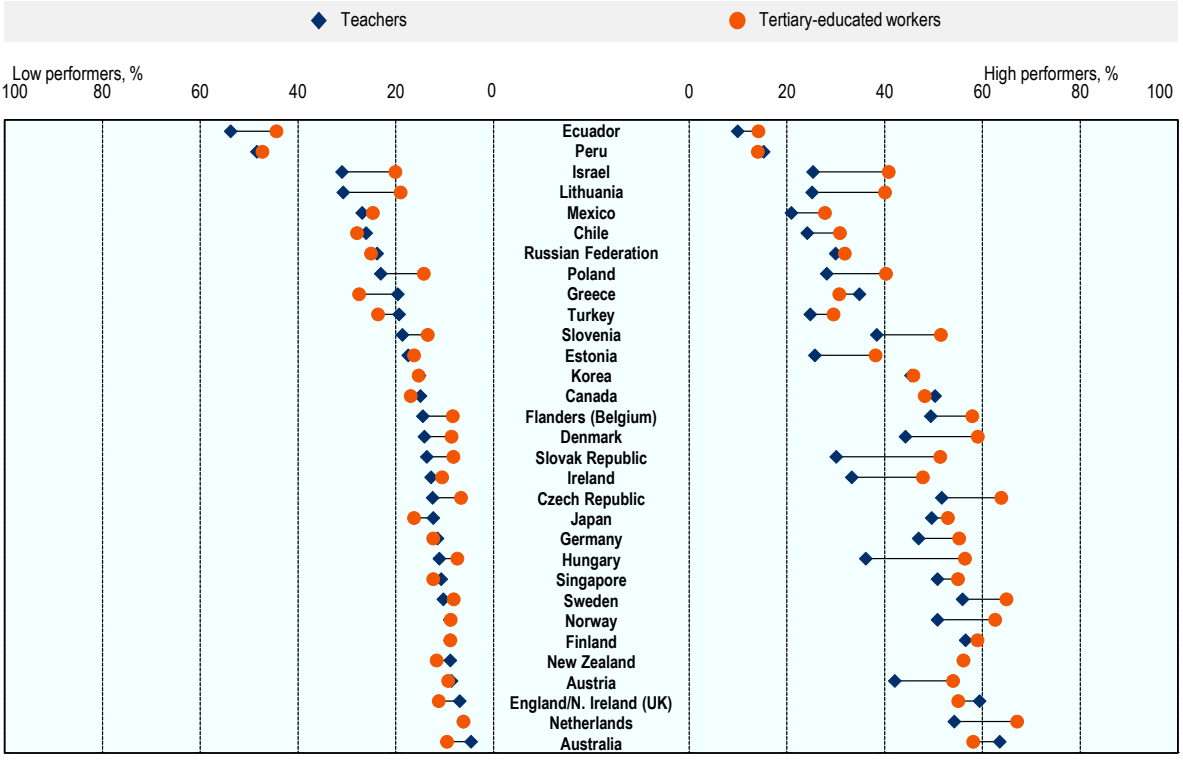
Source: OECD (2019[16]), *OECD Skills Outlook 2019 : Thriving in a Digital World*, https://dx.doi.org/10.1787/df80bc12-en.

StatLink https://doi.org/10.1787/888934135889

The OECD Survey of Adult Skills (PIAAC) defines problem solving in technology-rich environments as "using digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks" (OECD, 2012[17]). Problem-solving skills in technology-rich environments are thus not equivalent to ICT skills for teaching. Yet, the assessment gives an indication of adults', including teachers' "abilities to solve problems for personal, work and civic purposes by setting up appropriate goals and plans, and accessing and making use of information through computers and computer networks" (OECD, 2012[17]).

Figure 4.14. Teachers' problem solving in technology-rich environment proficiency

Share of poor and top performing teachers and tertiary-educated workers in problem solving in technology-rich environments, by country (%)



Note: Indicator developed based on (OECD, 2019[16]). Teachers and tertiary-educated workers are defined based on the population of adults aged 25-65. Teachers are adults self-reporting working in the following two-digit occupations as classified by the International Standard Classification of Occupations (ISCO-08): Teaching Professionals (ISCO 23). Tertiary-educated workers are all adults in employment with a tertiary education as defined by 1997 International Standard Classification of Education (ISCED): Tertiary (ISCED 5B, 5A, 5A/6). Poor performers are defined as scoring at most Below Level 1 (inclusive) in problem solving (including failing ICT core and having no computer experience), while top performers score at least Level 2 (inclusive). Chile, Greece, Israel, Lithuania, New Zealand, Singapore, Slovenia and Turkey: Year of reference 2015. Ecuador, Hungary, Mexico, Peru and 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 (2017[18]), Survey of Adults Skills (PIAAC) (2012, 2015, 2017), (database), http://www.oecd.org/skills/piaac/.

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Teachers in Latin American countries with available data in the OECD Survey of Adult Skills (PIAAC) perform poorly in problem solving in technology-rich environments (Figure 4.14). In Ecuador and Peru, around half of teachers are low performers. The share of teachers with low problem solving skills in technology-rich environments varies across countries from less than 5% in Australia to around 54% in Ecuador. Contrasting teachers with tertiary-educated workers shows that in many countries, teachers are as likely as tertiary-educated workers are to be low performers in this area, but in Ecuador, teachers are more numerous to perform poorly. In addition, few Latin American teachers are top performers in the assessment in comparison to teachers in other OECD countries.

Box 4.3. Providing support to teachers – evidence from Australia

Relative to their OECD peers, Australian teachers are top performers in problem solving in technology-rich environments and in Australia, more extensive uses of ICT at school are associated with enhanced student performance (OECD, 2019[16]). In the Australian curriculum, students develop an ICT capability when they "learn to use ICT effectively and appropriately to access, create and communicate information and ideas, solve problems and work collaboratively in all learning areas at school and in their lives beyond school" (Australian Curriculum, Assessment and Reporting Authority (ACARA), n.d.[19]). ICT capability is developed in all curricular areas, but digital technologies puts the strongest focus on ICT. A number of initiatives aim to support teachers in the implementation of the digital technologies curriculum.

The Computer Science Education Research Group (CSER) at the University of Adelaide provides free online MOOCs, paired with professional learning events for teachers and a national lending library. MOOCs offer "background knowledge about concepts and topics in the curriculum, as well as practical examples that can be tried in the classroom", going from courses on algorithms and data representation to integrating programming into science, English or mathematics or teaching artificial intelligence in class (for primary or lower secondary teachers) (CSER Digital Technologies, 2019[20]).

In September 2019, more than 32 000 teachers were engaged in the MOOC programme, with a large share of teachers coming from remote areas or from schools with many students from low socio-economic backgrounds. Free professional learning that accompanies MOOCs is also provided in person to teachers in order to support them adapt to the requirements of the curriculum in the area of digital technologies and to make the most of the CSER digital learning resources. This in person support is especially targeted at disadvantaged schools. Finally, the national lending library allows teachers to borrow educational equipment that comes jointly with lesson plans, in line with the national curriculum (CSER Digital Technologies, 2019[20]).

The Digital Technologies in Focus project seeks to foster collaboration within and between schools in order to support the implementation of the digital technologies component in the Australian curriculum in socio-economically disadvantaged schools (Australian Curriculum, Assessment and Reporting Authority (ACARA), 2019[21]). The project has reached so far more than 160 schools. Curriculum officers provide support to clusters of schools and lead workshops for school leaders and teachers as each school prepares a research project related to how they intend to implement the digital technologies curriculum. Teachers exchange with the curriculum officer and other teachers from the school cluster they belong to and obtain feedback on the projects and changes occurred in the school. Workshops are also carried out for the teachers participating in the project on topics related to the understanding of the digital technologies curriculum, computational thinking, resources for elaborating teaching and learning plans, or exploration of activities that link digital technologies with other curricular areas (Australian Curriculum, Assessment and Reporting Authority (ACARA), 2019[21]). Workshops are tailored to the needs of each school and are complemented by online mentoring. Between 2018 and 2020, the project is undergoing an external evaluation.

The Digital Technologies Hub (Education Services Australia, 2019[22]), developed for the Australian Department of Education, is another platform offering learning resources related to the implementation of the digital technologies curriculum for teachers, students, parents and school leaders. In this platform, teachers are given ideas for lessons targeted at different age groups and subjects integrating new technologies. Similarly, they examine case studies based on other schools and teachers or obtain advice on professional development in the area. Suggested resources for professional learning include online courses, webinars or online communities in which teachers can engage and exchange with other professionals (Education Services Australia, 2019[22]).

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA) (n.d.[19]), Information and Communication Technology (ICT) Capability, https://www.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/information-and-communication-technology-ict-capability/; Australian Curriculum, Assessment and Reporting Authority (ACARA) (2019[21]), Digital Technologies in Focus, https://www.australiancurriculum.edu.au/resources/digital-technologies-in-focus/; CSER Digital Technologies (2019[20]), Available MOOCs - (Massively Open Online Courses), https://csermoocs.adelaide.edu.au/available-moocs; Education Services Australia (2019[22]), Digital Technologies Hub, https://www.digitaltechnologieshub.edu.au/footer/about-dth; OECD (2019[16]), *OECD Skills Outlook 2019 : Thriving in a Digital World*, https://dx.doi.org/10.1787/df80bc12-en.

Providing high quality, comprehensive and appropriate training to teachers in order to support them integrate digital technologies in classrooms is crucial (Box 4.3). Many Latin American teachers engage in professional development in ICT skills for teaching, but analyses in this chapter show that there is scope for further strengthening the quality and accessibility of training in the area. Moreover, while many teachers in Latin America use ICT in class and are self-confident about it, technology use does not appear to have reached its full potential in initial education. Chapter 3 emphasised that there is still leeway for more efficient integration of ICT in teaching and learning activities. Better-trained teachers, who engage more in collaboration with other teachers in the school, who are more self-confident in their instruction abilities, are indeed more inclined to use technology in their teaching and to feel confident in their capacity to support student learning through technology. However, making the use of technology more widespread is not sufficient to achieve better student outcomes and policies should not aim at simply increasing teachers' use of technology. In Latin American countries, investments in ICT infrastructure have been high, students and teachers tend to use technology frequently, and many teachers train in the use of ICT for teaching. Yet, student performance is lagging behind that of OECD countries and evidence from PISA as well as from the research literature on the relationship between ICT use and student performance remains mixed (Chapter 3). In this context, Latin American governments need to rethink how to embed technology in teaching and learning activities and, very importantly how to support teachers and strengthen their digital competence.

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Annex 4.A. Estimations

Annex Table 4.A.1. Factors related to teachers' frequent use of ICT for students' projects/class work and self-efficacy in supporting student learning through ICT use – estimation type I

	LAC		OECD	
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	Frequent ICT use	ICT self-efficacy	Frequent ICT use	ICT self-efficacy
Positive impact of professional development on teaching practice	0.0230	0.00373	0.0272***	0.0299***
	(0.0206)	(0.0202)	(0.00728)	(0.00708)
Job satisfaction index	-0.00383	-0.00569	-0.00154	-0.000159
	(0.00426)	(0.00387)	(0.00145)	(0.00141)
Personal utility value index	0.00152	0.00500**	-0.00392***	-0.000158
	(0.00284)	(0.00246)	(0.00124)	(0.00121)
Social utility value index	-0.00528	-0.0129***	0.00378***	-0.000140
	(0.00469)	(0.00428)	(0.00127)	(0.00140)
Use of ICT for teaching included in initial teacher education or training	0.0296*	0.0286*	0.0210***	0.0279***
	(0.0175)	(0.0153)	(0.00634)	(0.00537)
Felt well/very well prepared for teaching using ICT (after initial teacher education or training)	0.119***	0.152***	0.0803***	0.110***
	(0.0168)	(0.0154)	(0.00705)	(0.00619)
ICT skills for teaching included in professional development	0.111***	0.142***	0.106***	0.115***
	(0.0153)	(0.0144)	(0.00609)	(0.00533)
High professional development needs in ICT skills for teaching	-0.0359**	-0.0774***	0.00295	-0.0811***
	(0.0163)	(0.0156)	(0.00791)	(0.00689)
Self-efficacy in classroom management index	-0.00680	-0.00374	-0.00882***	-0.00522***
	(0.00452)	(0.00441)	(0.00174)	(0.00176)
Self-efficacy in instruction index	0.0230***	0.0523***	0.0280***	0.0593***
	(0.00445)	(0.00406)	(0.00171)	(0.00183)
Self-efficacy in student engagement index	0.00952**	0.00335	0.0130***	0.0102***
	(0.00455)	(0.00447)	(0.00178)	(0.00181)
Professional collaboration in lessons among teachers index	0.0172***	0.0117***	0.0157***	0.00804***
	(0.00286)	(0.00311)	(0.00159)	(0.00147)
Teacher-student relations index	0.00791**	0.0105***	0.00407**	0.00369**
	(0.00332)	(0.00325)	(0.00159)	(0.00149)
Teachers perceived disciplinary climate index	-0.00276	-0.00211	-0.00322**	-0.000713
	(0.00416)	(0.00354)	(0.00153)	(0.00146)
Percentage of students. with first language different from instruction language	0.0117	-0.00446	0.00142	-0.00422
	(0.00980)	(0.00782)	(0.00402)	(0.00398)
Percentage of students with behavioural problems	0.0184**	0.00322	-0.00308	-0.00335
	(0.00931)	(0.00847)	(0.00433)	(0.00402)
Percentage of. students who are low academic achievers	-0.0318***	-0.00925	-0.0105**	-0.00892**
	(0.00862)	(0.00865)	(0.00424)	(0.00394)
Percentage of students with special needs	0.0179*	0.0129	0.0262***	0.0236***
	(0.0102)	(0.00990)	(0.00413)	(0.00369)

	LAC		OECD	
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	Frequent ICT use	ICT self-efficacy	Frequent ICT use	ICT self-efficacy
Percentage of students from socio-economically disadvantaged homes	0.00702	-0.0143**	0.00673	0.00397
	(0.00617)	(0.00630)	(0.00433)	(0.00382)
Percentage of academically gifted students	0.0122	0.00675	0.00906**	-0.00368
	(0.00751)	(0.00715)	(0.00359)	(0.00321)
Percentage of. students from socio-economically disadvantaged homes (school level)	-0.000989	0.000946	-0.00438	0.00303
	(0.00695)	(0.00587)	(0.00470)	(0.00448)
Percentage of. students who are immigrants or with migrant background (school level)	-0.00449	-0.00656	-0.00263	-0.00252
	(0.0116)	(0.0107)	(0.00510)	(0.00518)
Experiences as a teacher (in total)	-0.000723	-0.00182*	2.40e-05	-0.000566
	(0.00108)	(0.00109)	(0.000495)	(0.000440)
Teacher age	0.00310***	0.00158	0.00128**	-0.000908**
	(0.00100)	(0.00104)	(0.000505)	(0.000432)
Female	0.0439***	-0.0100	0.0155**	-0.00253
	(0.0128)	(0.0108)	(0.00646)	(0.00639)
Employment status at this school: permanent employment	0.0146	0.00724	0.0121	0.0210***
	(0.0174)	(0.0149)	(0.00857)	(0.00800)
Privately-managed school	-0.00212	0.0244	-0.00379	-0.00716
	(0.0231)	(0.0190)	(0.0100)	(0.00928)
School location: rural	0.0743***	0.0448*	0.0206**	0.0247***
	(0.0275)	(0.0259)	(0.0103)	(0.00949)
Teacher can determine course content, including national. regional curricula	0.00520	-0.0172	-0.0136*	-0.00522
	(0.0201)	(0.0169)	(0.00818)	(0.00754)
Teacher can choose which learning materials are used	-0.0222	0.0140	0.0117	-0.00159
	(0.0182)	(0.0177)	(0.00953)	(0.00894)
Shortage or inadequacy of digital technology hinders instruction quite a bit/a lot	-0.0409*	-0.0539***	-0.0215**	-0.0444***
	(0.0225)	(0.0206)	(0.00939)	(0.00909)
Insufficient Internet access hinders instruction quite a bit/a lot	-0.0332	-0.0152	-0.0226*	-0.0349***
	(0.0223)	(0.0184)	(0.0119)	(0.0111)
Team innovativeness index	-0.00245	-0.00303	-0.00200	0.00349**
	(0.00301)	(0.00314)	(0.00171)	(0.00150)
Organisational innovativeness index	0.00437	0.00249	0.00481***	0.00189
	(0.00385)	(0.00296)	(0.00175)	(0.00144)
Constant	-0.130	-0.224**	-0.161***	-0.393***
	(0.131)	(0.114)	(0.0510)	(0.0476)
Country dummies	Yes	Yes	Yes	Yes
Observations	6 856	6 877	51 921	54 418

Note: "Frequent ICT use" is a dummy for letting students us ICT for projects or class work frequently or always. "ICT self-efficacy" is a dummy variable equal to one if the teacher reports being able to support student learning quite a bit or a lot through the use of digital technology. Estimations obtained through multilevel mixed-effects linear regressions. Estimations on OECD countries exclude Chile and Mexico. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: OECD calculations based OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

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Annex Table 4.A.2. Factors related to teachers' frequent use of ICT for students' projects/class work and self-efficacy in supporting student learning through ICT use - estimation type II

	LAC		OECD	
	(1)	(2)	(3)	(4)
VARIABLES	Frequent ICT use	ICT self-efficacy	Frequent ICT use	ICT self-efficacy
Positive impact of professional development on teaching practice	0.0242	0.00279	0.00827	0.0116
	(0.0202)	(0.0193)	(0.00834)	(0.00769)
Job satisfaction, overall, teacher / Metric (All)	-0.00298	-0.00461	-0.000159	-0.00168
	(0.00407)	(0.00371)	(0.00159)	(0.00152)
Personal utility value / Metric (All)	0.000841	0.00494**	-0.00324**	0.000470
	(0.00279)	(0.00241)	(0.00143)	(0.00140)
Social utility value / Metric (All)	-0.00396	-0.0119***	0.00186	0.000310
	(0.00438)	(0.00416)	(0.00158)	(0.00144)
Use of ICT for teaching not in initial teacher education or training, felt prepared for teaching with ICT	0.108***	0.104***	0.0667***	0.116***
	(0.0262)	(0.0241)	(0.0129)	(0.0113)
Use of ICT for teaching in initial teacher education or training, felt not prepared for teaching with ICT	0.0141	-0.0143	0.00570	0.00743
	(0.0233)	(0.0208)	(0.00819)	(0.00780)
Use of ICT for teaching in initial teacher education or training, felt prepared for teaching with ICT	0.115***	0.130***	0.0955***	0.134***
	(0.0167)	(0.0144)	(0.00815)	(0.00723)
ICT skills for teaching not in professional development, no high need for professional development in ICT skills for teaching	0.0680***	0.0928***	0.000749	0.0870***
	(0.0263)	(0.0199)	(0.0110)	(0.0132)
ICT skills for teaching in professional development, no high need for professional development in ICT skills for teaching	0.181***	0.242***	0.0965***	0.191***
	(0.0251)	(0.0199)	(0.0105)	(0.0130)
ICT skills for teaching in professional development, high need for professional development in ICT skills for teaching	0.163***	0.166***	0.0935***	0.140***
	(0.0290)	(0.0256)	(0.0136)	(0.0140)
Self-efficacy in classroom management index	-0.00774*	-0.00107	-0.00502***	-0.00200
	(0.00426)	(0.00442)	(0.00183)	(0.00184)
Self-efficacy in instruction index	0.0245***	0.0527***	0.0226***	0.0596***
	(0.00432)	(0.00392)	(0.00185)	(0.00212)
Self-efficacy in student engagement index	0.00924**	0.00263	0.0133***	0.00598***
	(0.00440)	(0.00450)	(0.00214)	(0.00198)
Professional collaboration in lessons among teachers index	0.0157***	0.0122***	0.0145***	0.00518***
	(0.00280)	(0.00295)	(0.00171)	(0.00150)
Teacher-student relations index	0.00837***	0.0120***	0.00330*	0.000578
	(0.00324)	(0.00316)	(0.00182)	(0.00159)
Teachers perceived disciplinary climate index	-0.00236	-0.00137	-0.000365	0.00201
	(0.00390)	(0.00340)	(0.00174)	(0.00146)
Percentage of students with first language different from instruction language	0.00586	-0.00631	0.00359	-0.00136
	(0.00990)	(0.00771)	(0.00438)	(0.00400)
Percentage of students with behavioural problems	0.0169*	0.00502	0.000243	0.00294
	(0.00915)	(0.00810)	(0.00480)	(0.00452)
Percentage of. students who are low academic achievers	-0.0358***	-0.0100	-0.0164***	-0.0136***
	(0.00828)	(0.00829)	(0.00434)	(0.00411)
Percentage of students with special needs	0.0225**	0.0117	0.0285***	0.0258***
	(0.0102)	(0.00917)	(0.00500)	(0.00434)

	LAC		OECD	
	(1)	(2)	(3)	(4)
VARIABLES	Frequent ICT use	ICT self-efficacy	Frequent ICT use	ICT self-efficacy
Percentage of students from socio-economically disadvantaged homes	0.00457	-0.0176***	0.00391	0.00214
	(0.00609)	(0.00611)	(0.00461)	(0.00405)
Percentage of academically gifted students	0.0112	0.00691	0.0131***	0.000551
	(0.00706)	(0.00684)	(0.00413)	(0.00333)
Percentage of students from socio-economically disadvantaged homes (school level)	-0.00147	0.00434	-0.00902*	0.00398
	(0.00669)	(0.00580)	(0.00546)	(0.00513)
Percentage of. students who are immigrants or with migrant background (school level)	-0.00514	-0.00826	-0.00546	-0.00566
	(0.0113)	(0.0107)	(0.00602)	(0.00512)
Experiences as a teacher (in total)	-0.000749	-0.00187*	0.000386	0.000336
	(0.00105)	(0.00105)	(0.000572)	(0.000523)
Teacher age	0.00303***	0.00118	0.000463	-0.00209***
	(0.000986)	(0.00100)	(0.000569)	(0.000548)
Female	0.0441***	-0.0110	0.0147**	-0.0281***
	(0.0123)	(0.0104)	(0.00628)	(0.00645)
Employment status at this school: permanent employment	0.00674	0.00390	0.0262***	0.0141
	(0.0166)	(0.0144)	(0.00982)	(0.00855)
Privately-managed school	-0.0120	0.0242	0.00579	0.0185*
	(0.0216)	(0.0185)	(0.0111)	(0.0100)
School location: rural	0.0642**	0.0425*	0.00270	0.00158
	(0.0279)	(0.0242)	(0.0152)	(0.0139)
Teacher can determine course content, including national regional curricula	0.00277	-0.0123	-0.0147	0.00159
	(0.0196)	(0.0162)	(0.0103)	(0.00795)
Teacher can choose which learning materials are used	-0.0198	0.00809	0.0169	-2.43e-06
	(0.0182)	(0.0171)	(0.0108)	(0.00865)
Shortage or inadequacy of digital technology hinders instruction quite a bit/a lot	-0.0424*	-0.0546***	-0.0267***	-0.0400***
	(0.0222)	(0.0199)	(0.00930)	(0.00882)
Insufficient Internet access hinders instruction quite a bit/a lot	-0.0222	-0.0122	-0.0174	-0.0380***
	(0.0212)	(0.0179)	(0.0107)	(0.0102)
Team innovativeness index	-0.00191	-0.00271	-0.000777	0.00548***
	(0.00283)	(0.00299)	(0.00171)	(0.00175)
Organizational innovativeness index	0.00522	0.00203	0.00471***	0.00344**
	(0.00372)	(0.00297)	(0.00180)	(0.00170)
Constant	-0.172	-0.337***	-0.0889	-0.400***
	(0.132)	(0.108)	(0.0543)	(0.0519)
Country fixed effects	Yes	Yes	Yes	Yes
Observations	7 421	7 443	55 696	58 327
Number of groups	193	193	398	398

Note: "Frequent ICT use" is a dummy for letting students us ICT for projects or class work frequently or always. "ICT self-efficacy" is a dummy variable equal to one if the teacher reports being able to support student learning quite a bit or a lot through the use of digital technology. Estimations obtained through multilevel mixed-effects linear regressions. Estimations on OECD countries exclude Chile and Mexico. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: OECD calculations based on OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

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Annex Table 4.A.3. Factors related to teachers' frequent use of ICT for students' projects/class work, by country

Dependent variable- dummy for letting students us ICT for projects or class work frequently or always

	(1) Ciudad Autonoma de Buenos Aires (Argentina)	(2) Brazil	(3) Colombia	(4) Chile	(5) Mexico
Positive impact of professional development on teaching practice	0.128**	0.0485	0.0368	0.0402	-0.0281
	(0.0648)	(0.0328)	(0.0390)	(0.0368)	(0.0306)
Job satisfaction index	-0.00743	-0.00654	-0.00218	-0.00162	0.00565
	(0.00926)	(0.00857)	(0.00713)	(0.00809)	(0.00809)
Personal utility value index	-0.00688	-0.00269	-0.00451	0.00474	0.0103*
	(0.00635)	(0.00538)	(0.00406)	(0.00605)	(0.00595)
Social utility value index	-0.0143**	-0.00188	-0.00533	0.00386	-0.0125
	(0.00708)	(0.00671)	(0.0109)	(0.0108)	(0.0101)
Use of ICT for teaching included in initial teacher education or training	0.120***	-0.0107	0.0470	0.0358	0.0297
	(0.0334)	(0.0348)	(0.0319)	(0.0426)	(0.0315)
Felt well/very well prepared for teaching using ICT (after initial teacher education or training)	0.0521	0.160***	0.105***	0.0852**	0.180***
	(0.0368)	(0.0306)	(0.0258)	(0.0372)	(0.0363)
ICT skills for teaching included in professional development	0.100***	0.0550*	0.135***	0.165***	0.0557**
	(0.0290)	(0.0334)	(0.0318)	(0.0286)	(0.0258)
High professional development needs in ICT skills for teaching	-0.0499	0.0301	-0.0420*	-0.0186	-0.0954***
	(0.0414)	(0.0307)	(0.0247)	(0.0419)	(0.0347)
Self-efficacy in classroom management index	-0.00972	-0.0192*	0.00980	-0.0247**	0.00336
	(0.00937)	(0.0100)	(0.0116)	(0.00966)	(0.00799)
Self-efficacy in instruction index	0.0450***	0.0246***	0.0441***	0.0250**	0.0129
	(0.00995)	(0.00864)	(0.00979)	(0.00973)	(0.00857)
Self-efficacy in student engagement index	0.0145	0.0240**	0.00520	0.0143	0.00381
	(0.0111)	(0.00960)	(0.0106)	(0.00928)	(0.00831)
Professional collaboration in lessons among teachers index	-0.0138**	0.0242***	0.0163***	0.0157**	0.0307***
	(0.00695)	(0.00685)	(0.00503)	(0.00779)	(0.00560)
Teacher-student relations index	0.0103	0.00223	0.00772	0.0101	-0.000970
	(0.00773)	(0.00770)	(0.00541)	(0.00771)	(0.00632)
Teachers perceived disciplinary climate index	0.0105	-0.00804	-0.00277	-0.00415	0.00187
	(0.00898)	(0.00823)	(0.00736)	(0.00783)	(0.00746)
Percentage of students with first language different from instruction language	0.00260	-0.00501	0.00735	0.0383*	0.00812
	(0.0164)	(0.0207)	(0.0155)	(0.0207)	(0.0174)
Percentage of students with behavioural problems	-0.00747	0.0520***	-0.0158	0.00703	0.0113
	(0.0234)	(0.0170)	(0.0176)	(0.0229)	(0.0153)
Percentage of students who are low academic achievers	-0.0460**	-0.0164	0.00447	-0.0281	-0.0505***
	(0.0228)	(0.0175)	(0.0159)	(0.0219)	(0.0150)
Percentage of students with special needs	0.0116	0.0378	0.0336*	-0.00331	0.0341*
	(0.0289)	(0.0248)	(0.0192)	(0.0222)	(0.0202)
Percentage of students from socio-economically disadvantaged homes	0.0623***	-0.0153	0.0250*	0.0212	-0.00408
	(0.0203)	(0.0131)	(0.0137)	(0.0151)	(0.0131)
Percentage of academically gifted students	0.0216	0.0301	-0.00863	0.000188	0.00156
	(0.0149)	(0.0203)	(0.0129)	(0.0148)	(0.0134)

	(1) Ciudad Autonoma de Buenos Aires (Argentina)	(2) Brazil	(3) Colombia	(4) Chile	(5) Mexico
Percentage of students from socio-economically disadvantaged homes (school level)	-0.0182	-0.0205	-0.0132	-0.00448	0.00420
	(0.0261)	(0.0164)	(0.0140)	(0.0119)	(0.0154)
Percentage of students who are immigrants or with migrant background (school level)	-5.76e-05	-0.0262	-0.0111	0.0228	0.000170
	(0.0224)	(0.0274)	(0.0261)	(0.0245)	(0.0212)
Experiences as a teacher (in total)	-0.00150	-0.00101	0.000972	-0.000669	-0.000236
	(0.00234)	(0.00232)	(0.00179)	(0.00327)	(0.00164)
Teacher age	0.00272	0.00164	0.000300	0.00497*	0.00393**
	(0.00216)	(0.00217)	(0.00169)	(0.00268)	(0.00156)
Female	-0.00238	0.0658**	0.0257	0.0325	0.0588***
	(0.0319)	(0.0263)	(0.0231)	(0.0308)	(0.0219)
Employment status at this school: permanent employment	0.0747	-0.0203	-0.0387	0.00724	0.0149
	(0.0461)	(0.0426)	(0.0386)	(0.0384)	(0.0272)
Privately-managed school	-0.00622	0.00213	0.00297	-0.00434	0.0361
	(0.0614)	(0.0502)	(0.0456)	(0.0362)	(0.0506)
School location: rural		0.0197	0.0688	0.138***	0.0669
		(0.0651)	(0.0434)	(0.0488)	(0.0458)
Teacher can determine course content, including. national regional curricula	-0.0305	0.00425	0.0154	-0.00942	0.0394
	(0.0511)	(0.0382)	(0.0342)	(0.0366)	(0.0401)
Teacher can choose which learning materials are used	0.0369	-0.0596*	-0.00473	-0.00278	-0.0152
	(0.0524)	(0.0328)	(0.0345)	(0.0389)	(0.0281)
Shortage or inadequacy of digital technology hinders instruction quite a bit/a lot	-0.0805*	-0.0208	0.00872	-0.00173	-0.0497
	(0.0485)	(0.0492)	(0.0309)	(0.0731)	(0.0348)
Insufficient Internet access hinders instruction quite a bit/a lot	0.0455	-0.0777*	-0.0444	-0.0415	0.00598
	(0.0517)	(0.0456)	(0.0343)	(0.0508)	(0.0379)
Team innovativeness index	0.00174	-0.00827	-0.00964*	-0.00816	0.00655
	(0.00783)	(0.00691)	(0.00517)	(0.00665)	(0.00523)
Organisational innovativeness index	0.00288	0.00131	0.00177	0.00923	-0.00500
	(0.00804)	(0.00759)	(0.00586)	(0.00795)	(0.00813)
Constant	-0.191	-0.144	-0.292	-0.338	-0.234
	(0.266)	(0.233)	(0.229)	(0.250)	(0.249)
Observations	1 135	1 456	1 543	971	1 751

Note: The dependent variables is a dummy for letting students us ICT for projects or class work frequently or always Estimations obtained through multilevel mixed-effects linear regressions. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: OECD calculations based on OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

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Annex Table 4.A.4. Factors related to teachers' self-efficacy in supporting student learning through ICT use, by country

Dependent variable: Support student learning through the use of digital technology quite a bit or a lot

	(1) Ciudad Autonoma de Buenos Aires (Argentina)	(2) Brazil	(3) Colombia	(4) Chile	(5) Mexico
Positive impact of professional development on teaching practice	0.0124	-0.00184	0.0548	0.00673	-0.00336
	(0.0622)	(0.0370)	(0.0358)	(0.0290)	(0.0336)
Job satisfaction index	-0.00364	-0.00425	-0.00705	0.00526	-0.00887
	(0.0100)	(0.00669)	(0.00572)	(0.00724)	(0.00920)
Personal utility value index	0.00432	0.00452	0.00931**	0.00548	-0.00405
	(0.00540)	(0.00537)	(0.00376)	(0.00483)	(0.00562)
Social utility value index	-0.00952	-0.0173**	-0.00708	-0.00947	-0.0174*
	(0.00650)	(0.00707)	(0.00896)	(0.00808)	(0.0104)
Use of ICT for teaching included in initial teacher education or training	0.0523	0.00415	0.109***	0.0363	0.0263
	(0.0401)	(0.0298)	(0.0300)	(0.0400)	(0.0288)
Felt well/very well prepared for teaching using ICT (after initial teacher education or training)	0.0817**	0.210***	0.0573**	0.122***	0.226***
	(0.0351)	(0.0288)	(0.0226)	(0.0352)	(0.0312)
ICT skills for teaching included in professional development	0.126***	0.0940***	0.171***	0.111***	0.151***
	(0.0361)	(0.0298)	(0.0260)	(0.0253)	(0.0268)
High professional development needs in ICT skills for teaching	-0.130***	-0.0870***	-0.0775***	-0.0591*	-0.0578*
	(0.0412)	(0.0283)	(0.0216)	(0.0347)	(0.0318)
Self-efficacy in classroom management index	-0.0127	-0.0215**	0.00969	-0.00415	-0.00240
	(0.00977)	(0.00870)	(0.0102)	(0.00851)	(0.00867)
Self-efficacy in instruction index	0.0585***	0.0623***	0.0521***	0.0499***	0.0533***
	(0.00934)	(0.00852)	(0.00961)	(0.00919)	(0.00730)
Self-efficacy in student engagement index	0.0112	0.0180**	0.00208	0.00551	-0.00384
	(0.0106)	(0.00899)	(0.00827)	(0.00954)	(0.00830)
Professional collaboration in lessons among teachers index	0.00504	0.0204***	0.00948**	-0.00481	0.0155***
	(0.00692)	(0.00537)	(0.00454)	(0.00642)	(0.00586)
Teacher-student relations index	0.00817	0.00698	0.0146***	-0.00852	0.0197***
	(0.00679)	(0.00715)	(0.00521)	(0.00625)	(0.00600)
Teachers perceived disciplinary climate index	0.0114	0.00157	-0.00374	0.000741	0.00294
	(0.00840)	(0.00683)	(0.00732)	(0.00606)	(0.00715)
Percentage of students with first language different from instruction language	-0.0226	0.0363**	-0.0215	-0.00347	-0.0137
	(0.0159)	(0.0170)	(0.0149)	(0.0178)	(0.0183)
Percentage of students with behavioural problems	0.00530	-0.00339	-0.00536	0.00672	0.000377
	(0.0199)	(0.0167)	(0.0149)	(0.0166)	(0.0144)
Percentage of students who are low academic achievers	-0.0468**	0.00849	0.00898	-0.00260	-0.0181
	(0.0186)	(0.0143)	(0.0141)	(0.0158)	(0.0161)
Percentage of students with special needs	-0.00155	0.00380	-0.0298**	0.0207	0.0229
	(0.0264)	(0.0196)	(0.0149)	(0.0170)	(0.0220)
Percentage of students from socio-economically disadvantaged homes	0.0470**	-0.0161	-0.0179*	-0.00770	-0.0222*
	(0.0188)	(0.0135)	(0.00975)	(0.0125)	(0.0120)
Percentage of academically gifted students	0.0125	0.0278	-0.00772	0.0142	0.0128
	(0.0158)	(0.0185)	(0.0114)	(0.0127)	(0.0151)

	(1) Ciudad Autonoma de Buenos Aires (Argentina)	(2) Brazil	(3) Colombia	(4) Chile	(5) Mexico
Percentage of students from socio-economically disadvantaged homes (school level)	-0.0362	-0.0119	-0.0228**	0.00752	0.0170
	(0.0296)	(0.0136)	(0.0115)	(0.0100)	(0.0140)
Percentage of students who are immigrants or with migrant background (school level)	-0.00824	-0.0328	-0.0236	-0.0145	0.0228
	(0.0238)	(0.0295)	(0.0210)	(0.0193)	(0.0231)
Experiences as a teacher (in total)	-0.00338	-0.000851	0.000505	-0.00133	-0.00283*
	(0.00258)	(0.00210)	(0.00157)	(0.00265)	(0.00169)
Teacher age	0.00188	-0.00136	-0.00114	0.00216	0.00345**
	(0.00246)	(0.00187)	(0.00166)	(0.00231)	(0.00173)
Female	-0.0765**	0.0344	0.0364*	-0.0130	-0.0341
	(0.0297)	(0.0254)	(0.0213)	(0.0236)	(0.0225)
Employment status at this school: permanent employment	0.112***	-0.0493	-0.0216	-0.00434	0.0505
	(0.0416)	(0.0317)	(0.0310)	(0.0307)	(0.0310)
Privately-managed school	0.0145	0.0911**	-0.0583	-0.0135	0.0927*
	(0.0603)	(0.0396)	(0.0388)	(0.0313)	(0.0484)
School location: rural		0.0219	-0.0142	0.0665*	0.0587
		(0.0481)	(0.0343)	(0.0384)	(0.0523)
Teacher can determine course content, including national regional curricula	0.0154	-0.00475	-0.00218	-0.0476	0.0332
	(0.0373)	(0.0346)	(0.0232)	(0.0304)	(0.0404)
Teacher can choose which learning materials are used	-0.0129	-0.00351	-0.0187	0.0229	-0.0182
	(0.0392)	(0.0331)	(0.0249)	(0.0326)	(0.0285)
Shortage or inadequacy of digital technology hinders instruction quite a bit/a lot	-0.0160	-0.0780**	-0.0212	0.0337	-0.0960***
	(0.0554)	(0.0390)	(0.0326)	(0.0639)	(0.0335)
Insufficient Internet access hinders instruction quite a bit/a lot	-0.0142	0.0761**	-0.0375	-0.0687	-0.0151
	(0.0490)	(0.0365)	(0.0304)	(0.0530)	(0.0339)
Team innovativeness index	0.00763	-0.00248	-0.00907*	0.00664	-0.00704
	(0.00736)	(0.00693)	(0.00478)	(0.00529)	(0.00573)
Organizational innovativeness index	0.00539	0.00464	-0.00165	0.0157**	-0.00367
	(0.00858)	(0.00633)	(0.00511)	(0.00669)	(0.00793)
Constant	-0.434*	-0.288	0.0456	-0.250	-0.372
	(0.259)	(0.194)	(0.234)	(0.234)	(0.238)
Observations	1 139	1 462	1 549	973	1 754

Note: The dependent variable is a dummy variable equal to one if the teacher reports being able to support student learning quite a bit or a lot through the use of digital technology. Estimations obtained through multilevel mixed-effects linear regressions. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: OECD calculations based on OECD (2018[9]), TALIS 2018 Database, http://www.oecd.org/education/talis/.

StatLink https://doi.org/10.1787/888934135984

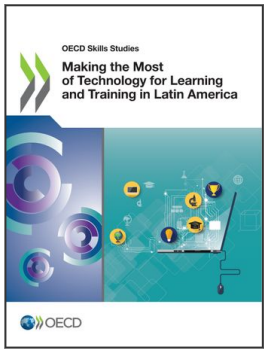
Notes

[1] Results are confirmed also when looking at teachers perceptions on their need for professional development. High levels of need for professional development in ICT skills for teaching are, in fact, associated with a lower likelihood to use ICT frequently and lower self-efficacy in the area.

[2] Teacher collaboration is also often associated with the use of more cognitive activation and active learning strategies, which in turn have been shown to be positively related to student performance (in mathematics) (Le Donné, Fraser and Bousquet, 2016[4]).

[3] A similar share mention the lack of incentives and employer support, in contrast to OECD countries where teachers are most numerous to report conflicts with work schedule as an obstacle to training.

[4] E.g. cyberbullying, excessive use of digital devices, exposure to pornographic content.



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