Organisation for Economic Co-operation and Development

G20 Argentina 2018

The Future of Skills: as prepared by the OECD for the G20 Education Working Group

1.1. Introduction

1. Argentina has placed a timely focus on the Future of Work as a key theme of its G20 Presidency in 2018. The topic features across the various work streams, notably the Employment Working Group, the new Working Group on Education, the Digital Economy Task Force and the Finance track. For example, the Presidency has tasked the OECD with deliverables on the future of skills, the governance of skills systems and making efficient investments in education and skills. It is also exploring outputs that seek to deepen our understanding of the digital transformation and its impact on education and skills systems.

2. The future of work necessitates a discussion on the future for skills. Considering the leadership role that the G20 is taking under the Argentinian Presidency to establish education as one of the main thematic areas of the G20 fora, and the international community's commitment to ensuring inclusive and quality education for all under the Education Sustainable Development Goal (SDG 4), now is an opportune moment to discuss the important role that education plays in promoting social cohesion and preparing individuals for success in work and life in the new technological era.

1.2. Digitalisation and the changing landscape of skill needs

3. There is no doubt that among all the mega-trends impacting the future of skills, digitalisation is one of the most important. Information and communications technologies (ICT), advances in artificial intelligence (AI) and robotics are profoundly changing the way people work, communicate, and live. Most people now regularly use digital tools like computers, smartphones and/or tablets both at work and at home. Digital technologies have also enabled the rise of the "platform economy", which has introduced new ways to create value, work, and socialise.

1.2.1. Digitalisation and the world of work

4. The world of work has undergone important changes that have major implications for the skills workers need and can develop on the job. In 2015, 57% of EU28 workers regularly used a computer or smartphone at work, a 20-percentage point surge compared to only 10 years ago (Eurofund and the International Labour Office, 2017). Even for those who do not use ICTs, the nature of their work is changing as some tasks become increasingly automated.

5. Digitalisation brings immense economic potential. Digital technology can generate productivity gains, spurring growth and creating new jobs. It can enrich the content of some occupations by allowing workers to increasingly focus on non-routine tasks, such as problem solving or creative and complex communications activities. It can also enable individuals around the world to market their ideas much more easily, boosting opportunities for entrepreneurship.

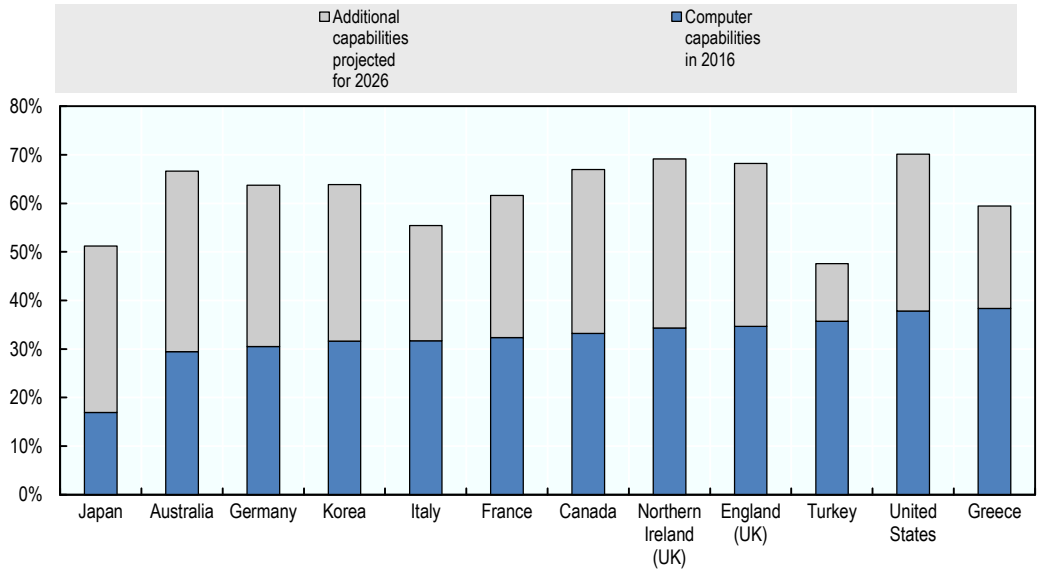
6. Nevertheless, there are fears about the consequences of digitalisation for labour markets. Digital technology is profoundly transforming what people do on the job, how and where they work, and by extension the mix of skills they need to be successful in their careers and life. It also leads to a restructuring of labour markets: some jobs will disappear as a result of automation, while new ones will be created.

7. Estimates of the risk of automation provide some indication of the share of workers who might see the nature of their job change because the tasks they are doing

could be automated. While these estimates vary and raise considerable uncertainties, the OECD's Survey of Adult Skills (PIAAC), suggests that, on average across countries that participated in the survey, some 14% of workers face a high risk that their jobs will be automated, and another 34% face major changes in the tasks that will be required in their job as a result of automation (Nedelkoska and Quintini, 2018).

8. This implies that the demand for people with higher levels of non-routine high level cognitive skills will increase, since the tasks they can perform are less likely to be automated. However, a major OECD survey found that when a group of foundation skills tested by the Survey of Adult Skills (PIAAC) is considered, around 30% of the current workforce has general cognitive skills (literacy and numeracy) at or below the level of computer capabilities. By 2026, these computer capabilities are expected to have increased to a level that matches the skills of 60% to 70% of workers today (Elliott, 2017) (Figure 1).

Figure 1. Proportion of workforce using general cognitive skills at or below level of computer capabilities, historical and projected



Note: The grey bar reflects the share of the workforce who is expected to have general cognitive skills at or below the level of computers as a result of expected progress in computer capabilities by 2026.
Source: Elliott, S.W. (2017), Computers and the Future of Skill Demand, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264284395-en

9. The skills required for emerging jobs are not the same as the ones for jobs that are disappearing due to technological change. On one hand, high-skilled workers are more likely to benefit as their skills complement technology to perform non-routine tasks. On the other hand, some groups of workers risk being left behind; especially those with low levels of skills. The latter face increasing competition from middle-skilled workers whose jobs have been primarily affected by the digital transformation. Low skilled workers are also less likely to be able to adapt to the new technologies and working practices provided by digitalisation.

10. As a result, many countries have experienced labour market polarisation in the past two decades whereby the share of employment in high-skilled - and to some extent in low-skilled - jobs has increased, as the share of employment in middle-skilled jobs has

decreased (OECD, 2017a). It is possible that this polarisation presents a threat to social cohesion in several countries (OECD, 2017f).

11. The digital transformation may also exacerbate inequalities between cities/regions, as new jobs are not necessarily created in the same places where jobs have been destroyed. Evidence from the United States shows that new jobs making high use of computers since the 1980s have mainly appeared in urban areas with a large share of high-skilled workers (Berger and Frey, 2016). At the same time, technology facilitates the adoption of work practices that take advantage of ICT, such as remote working.

12. Workers need to have the right mix of skills to successfully manage the transition to a digital world of work. This mix of skills includes strong general cognitive skills, like literacy and numeracy which can provide a solid foundation to pursue lifelong learning. It also includes basic ICT skills, analytical skills and a range of complementary skills like creativity, problem-solving, and critical thinking. Interpersonal and communication skills, as well as emotional skills like self-awareness and the ability to manage stress and change, are also increasingly important.

13. The future of employment, growth and equality depends on policies that accompany and shape the development of technology and its use in our economies and societies. For example, policies may promote technologies and business models that can enhance human activities rather than replace them. Those that affect skills development and skills use – the so-called skills policies – have a crucial role to play in this comprehensive policy package:

- Workers with strong foundation skills will find it easier to adapt to new requirements on the job and feel better prepared to change jobs, industries or geographic location if needed. They will be better-positioned to acquire new knowledge and develop other sets of skills, such as analytical, social and emotional skills, and will be prepared to continue learning throughout life.
- Workers with the right mix of skills will find it easier to realise the productivity gains enabled by technology, benefit from the new opportunities like those emerging from the platform economy, and innovate in technology-rich environments.
- A skilled workforce enables the adoption of frontier technology and helps realise their productivity gains.

1.2.2. Digitalisation and societies

14. The digital transformation goes far beyond the world of work, affecting many aspects of daily life. ICT is now more than an infrastructure that can facilitate access to information and to private and public services. It affects the way people interact, communicate, learn, build trust in others, purchase goods, participate in the democratic process, and simply spend their free time. The time people spend on their smartphones and the implications this may have on their social life and overall well-being have become crucial questions.

15. Young people are at the forefront of these new behaviours. On average across OECD countries, students in 2015 were spending more than two hours online during a typical weekday after school, and more than three hours online during a typical weekend. Participating in social networks was the most popular online leisure activity reported across OECD countries, followed by chatting on line. More than half of girls and boys

aged 15 said they feel bad when no Internet connection is available (on average in OECD countries).

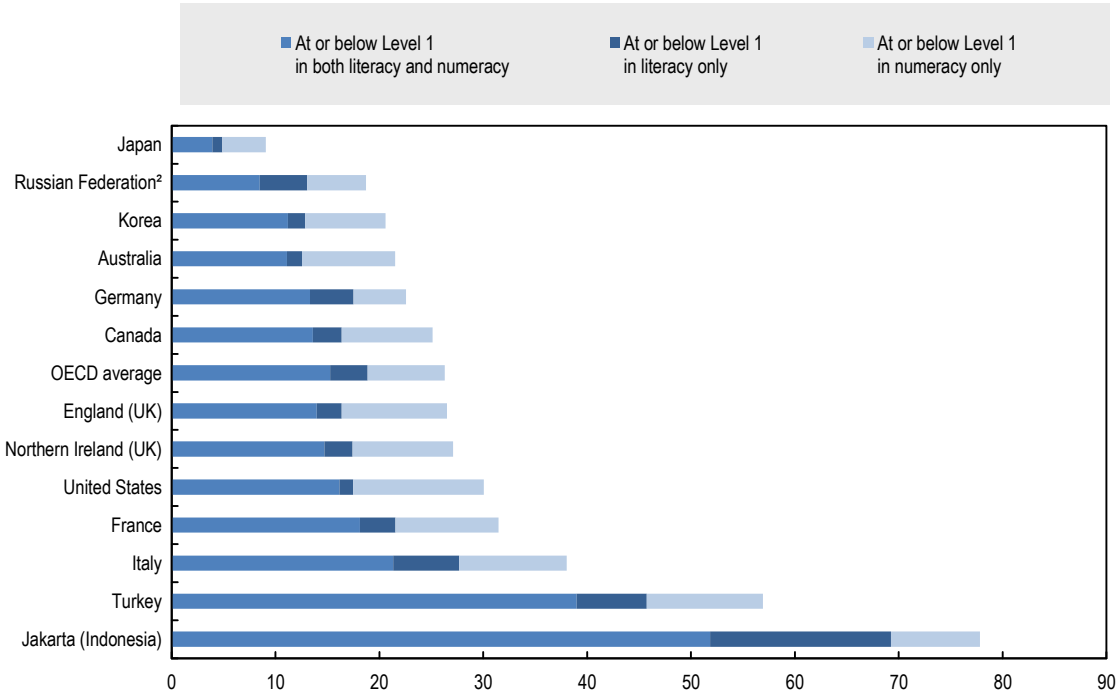
16. The types of activities citizens are able to perform on the Internet and the outcomes of Internet use, for instance in terms of security, privacy and well-being, are mainly driven by the skills people have. At a time when online networks, social media and interactive technologies make it easy to spread fake news, it is critical to ensure that all individuals have the necessary skills to make effective and responsible use of the Internet in their everyday lives, and to protect themselves from digital risks (Scheerder, van Deursen and van Dijk, 2017). This is important as digitalisation offers a large potential for knowledge diffusion, improved political engagement, and increased efficiency of public services. Effective skills policies can help all individuals benefit from digitalisation:

- Skilled individuals can make informed and balanced use of the Internet to benefit from the opportunities of digitalisation on various aspects of their lives.
- Skilled parents can inform their children about the risks associated with online activities while helping them to make the most of technology as a learning tool.

1.2.3. Preparation of countries and regions for these changes

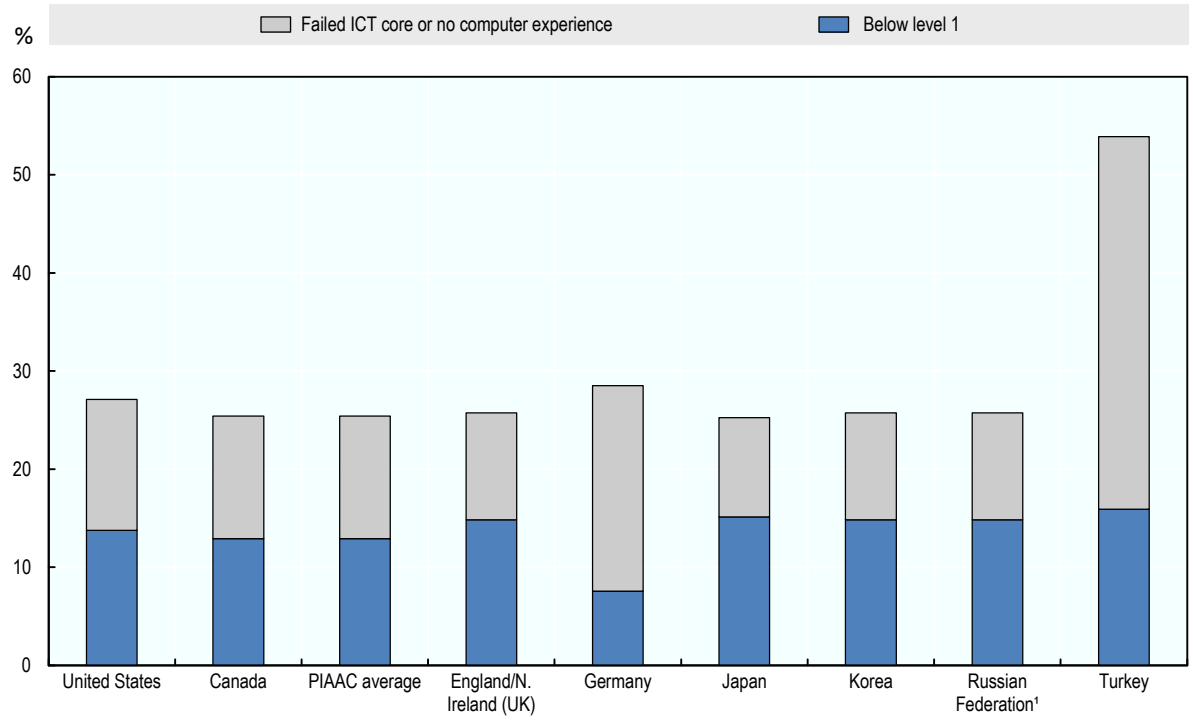
17. In most countries, a significant part of the population lacks the skills to face the challenges digitalisation poses to economies and societies. The Survey of Adult Skills (PIAAC) shows that on average in the OECD, more than 20% of adults are low performers in literacy and/or numeracy (**Error! Reference source not found.**2). And around 15% of adults either reported having no prior computer experience or lacked basic ICT skills; and another 14% were found to have low problem solving skills in technology rich-environments (Figure 3).

Figure 2. The proportion of low performing adults in literacy and/or numeracy



Note: Low performers are defined as those who score at or below Level 1 in either literacy or numeracy according to the Survey of Adult Skills. Chile, Greece, Israel, New Zealand, Slovenia and Turkey: Year of reference 2015. 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 (2016), The Survey of Adult Skills: Reader's Companion, Second Edition, OECD Skills Studies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264258075-en; OECD (2013), OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, OECD Publishing, **Error! Hyperlink reference not valid.**

Figure 3. The proportion of low performing adults in problem-solving skills using a computer



Note: Low performers in problem solving skills using a computer are adults with no computer experience, or who failed the ICT core test, or who score below Level 1.
Source: OECD (2016a), The Survey of Adult Skills: Reader's Companion, Second Edition, OECD Skills Studies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264258075-en; OECD (2013), OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, OECD Publishing, http://dx.doi.org/10.1787/9789264204256-en

18. Youth are generally better prepared than older generations to face the challenges of the digital transformation. In most countries participating in the Survey of Adult Skills (PIAAC), youth have higher cognitive and ICT skills. However, PISA 2015 shows that, on average across OECD countries, 28% of students were only able to solve straightforward computer-based collaborative problems, if any at all (OECD, 2017c).

19. Within the same country, regions are not equally prepared to face the impact of the digital transformation. In countries with important geographic differences in skill endowments, fast-growing and high-tech firms - and thereby job creation - are more likely to be found in regions with large concentrations of highly-skilled workers. In these countries, low-skilled workers may have an even harder time moving to more productive regions as they would need to compete with higher skilled workers. This may contribute to overall inequalities.

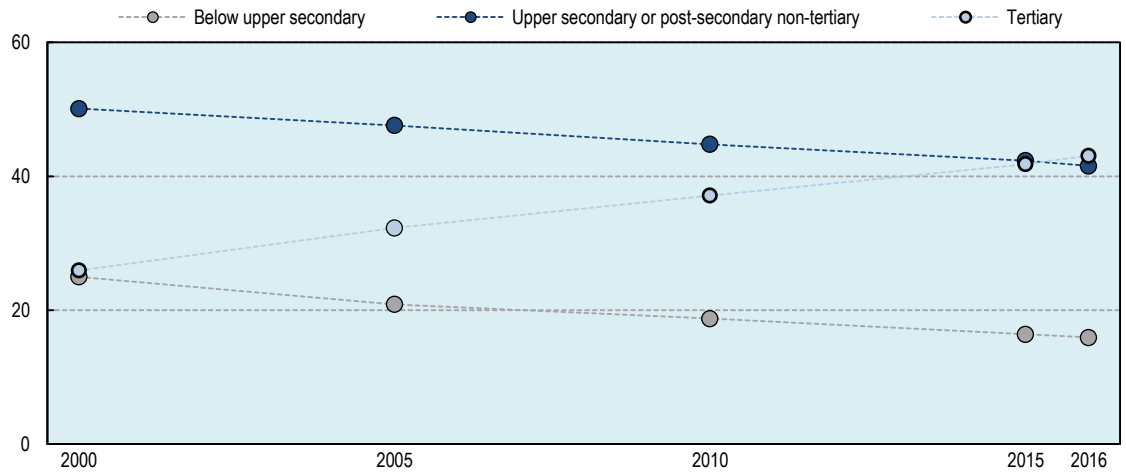
1.3. Trends in educational attainment and skills

20. In recent decades, populations have become more highly educated. The share of youth aged 25-34 holding a tertiary degree in OECD countries has steadily increased to over 42% in 2015 compared to 35% in G20 countries (**Error! Reference source not found.**). Yet, on average, about 60% of the youth workforce expected to spend the next

30 to 40 years in the labour market do not have a tertiary degree, underlying the need for high-quality secondary and post-secondary non-tertiary programmes, as well as lifelong learning opportunities.

Figure 4. Trends in educational attainment of 25-34 year-olds

Share of 25-34 years olds in the OECD by educational attainment, 2000-2016

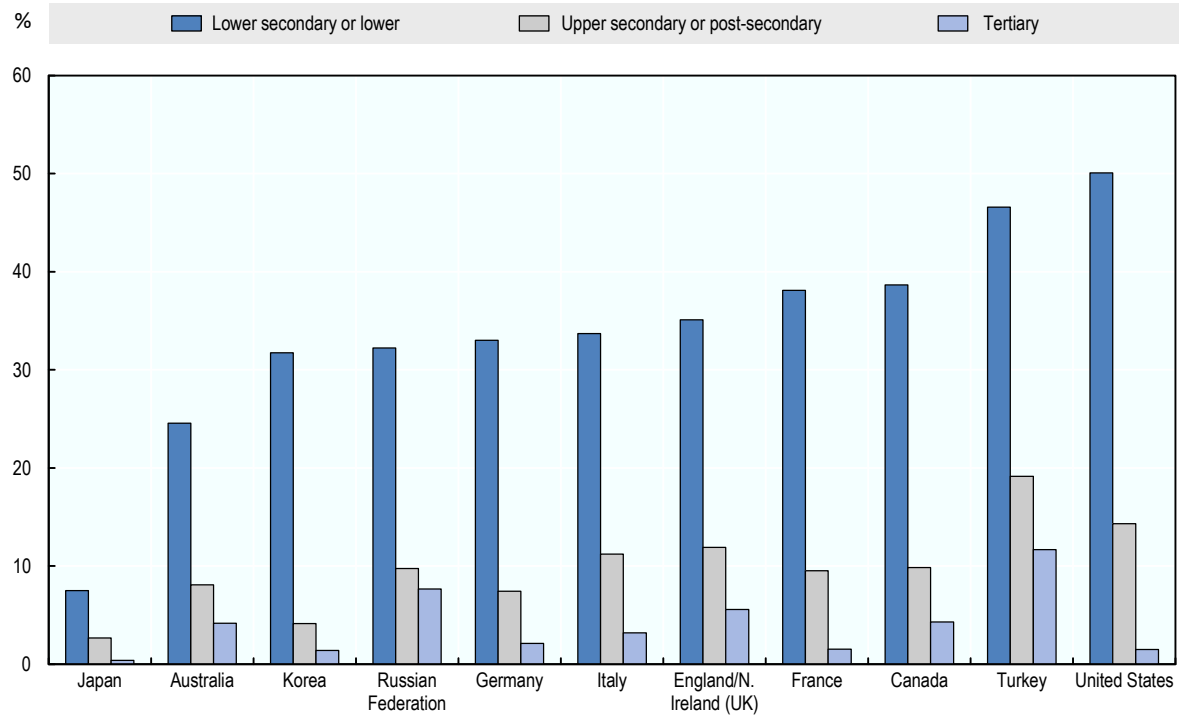


Note: Each line represents the evolution of the share of 25-34 year olds, on average across the OECD, that reach a certain level of education. Education levels follow the 2011 International Standard Classification of Education (ISCED): Below upper secondary (ISCED 0, 1, 2), Upper secondary or post-secondary non-tertiary (ISCED 3, 4), Tertiary (ISCED 5, 6, 7, 8).
Source: OECD (2017d), Education at a Glance 2017: OECD Indicators, OECD Publishing, Paris, http://dx.doi.org/10.1787/eag-2017-en

21. Nevertheless, holding a tertiary degree does not automatically imply a high level of skills as there are large quality differences across programmes. For example, data from the Survey of Adult Skills (PIAAC) reveals that on average, Japanese 25-34 year-olds who have only completed high school easily outperform Italian or Spanish university graduates of the same age (OECD, 2013). As seen in Figure 5, several countries have large shares of young tertiary graduates who graduate with low literacy and numeracy skills.

Figure 5. Large shares of tertiary graduates lack basic skills

Share of 20-34 year olds lacking basic skills, by country and education level (%)

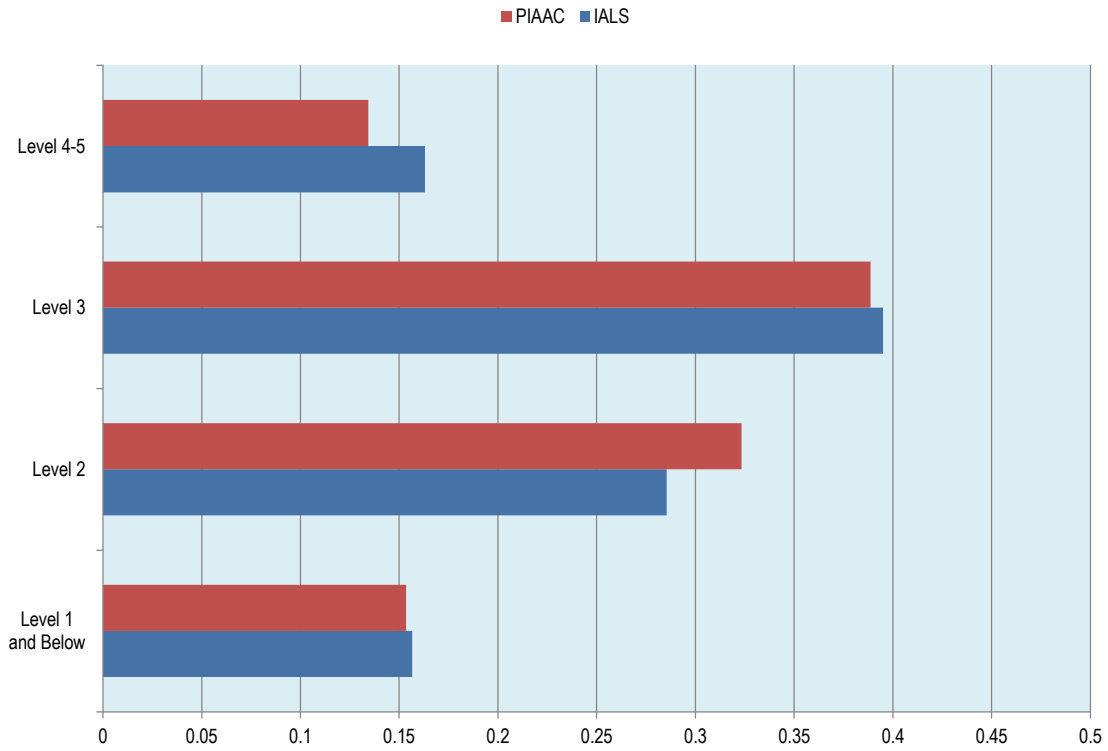


Note: Individuals lacking basic skills score at most Level 1 (inclusive) in literacy and numeracy. The shares are calculated, by country, from the sample of individuals aged 20-34 years old in the Survey of Adult Skills excluding those for whom there is no observation for any one of the two assessed skills (due to literacy-related non-response). The three education categories are constructed from the 1997 International Standard Classification of Education (ISCED): 1) Lower secondary or less (ISCED 1, 2, 3C short or less), 2) Upper secondary or post-secondary (ISCED 3A-B, C long, 4A-B-C), 3) Tertiary (ISCED 5B, 5A, 5A/6). Chile, Greece, Israel, New Zealand, Slovenia and Turkey: Year of reference 2015. All other countries: Year of reference 2012.

Source: OECD (2016a), The Survey of Adult Skills: Reader's Companion, Second Edition, OECD Skills Studies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264258075-en; OECD (2013), OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, OECD Publishing, http://dx.doi.org/10.1787/9789264204256-en

22. The rise in higher levels of educational attainment has not had the expected returns in terms of improved skills proficiency. As shown in Figure 6, in the twenty years between the International Adult Learning Survey (IALS) and the PIAAC Survey of Adult Skills, the proportion of adults with top-level literacy skills has decreased, while the proportion with a medium level of literacy has increased, despite an increase in educational attainment. This phenomenon also presents a challenge for labour market polarisation: more people are found to have medium level skills but there are fewer medium-skilled jobs available.

Figure 6. Distribution of the workforce by level of literacy, IALS (1990s) and PIAAC (2010s)



Source: Elliott, S.W. (2017), Computers and the Future of Skill Demand, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264284395-en

23. The disconnect between the gradual expansion of educational attainment and the lower than expected returns in terms of improved skills proficiency, in addition to changes in the workplaces caused by digitalisation, implies that raising the educational attainment of the population alone is not enough. Adults need to continuously update and adapt their skills to move from one job to another, or to remain in jobs where their tasks become increasingly automated. Thus, a paradigm shift is needed: countries can no longer rely solely on formal education to help individuals develop the right mix of skills for success in work and life, a lifelong effort is needed to continuously raise the skills of the working population. Thus, life-long learning will become the predominant model of education and skills systems in the future.

1.4. Skills for the future

24. To thrive and contribute to future societies, students will need to exercise agency, in their own education and throughout life. Agency implies a sense of responsibility to participate in the world and, in so doing, to influence people, events and circumstances for the better. It requires the ability to frame a guiding purpose, understand others' intentions, actions and feelings, anticipate the short and long-term consequences of what they do, and identify actions to achieve a goal. To do this successfully, young people need a broad set of knowledge, skills, attitudes and values; in short they need to be competent workers and citizens.

25. Competency entails more than just the acquisition of knowledge and skills; it involves the mobilisation of knowledge, skills, attitudes and values to meet complex demands. Future-ready students will need to apply their knowledge and skills in unknown and evolving circumstances. This involves the following components:

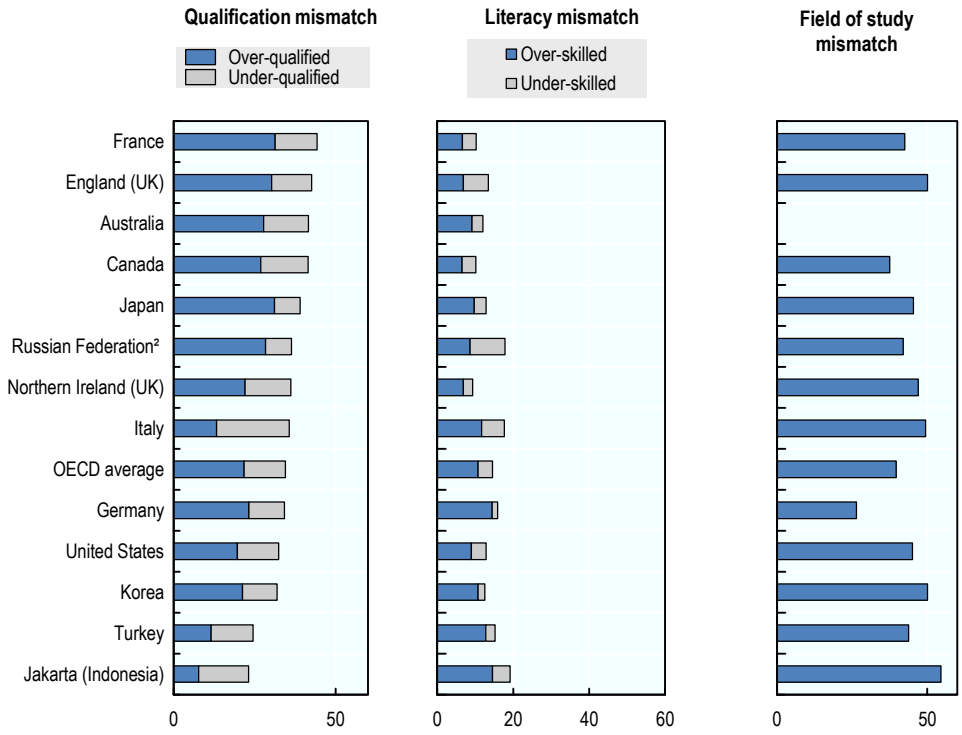
- General and specialized knowledge, with sufficient transfer potential to be applicable in new, yet unknown fields.
- Foundation skills, including literacy, numeracy and digital literacy that will have to be mastered at a high level.
- Cognitive and meta-cognitive skills such as critical thinking, creative thinking, learning to learn and self-regulation.
- Social and emotional skills such as conscientiousness, responsibility, empathy, self-efficacy and collaboration.
- Practical and physical skills.
- Attitudes and values (e.g. motivation, trust, respect for diversity and virtue), that mediate the mobilisation and use of knowledge and skills, giving meaning and direction to human agency.

26. The specific mix of knowledge and skills an individual needs will depend on their unique context and circumstances. However, most education systems find it difficult to prepare students for the future in a world that is highly unpredictable, especially since the routine cognitive skills to which many education systems and curricula are aligned, are becoming easier to automate. In a context of rapid change, mismatches can easily occur between the sets of skills workers have and those the labour market needs.

27. Recent analyses of skills mismatches suggest that on average across OECD countries with available data, some 20% of the workforce is over-qualified for the jobs they are in. Another 40% have a field-of-study mismatch (meaning they are working in a different occupation or field than the one they have studied for), but only around 10% is over-skilled (Figure 7).

28. Mismatches do not necessarily indicate a serious problem and can merely be signs of flexible labour markets with high mobility rates. However, they can also indicate inappropriate investments in education which could exert a downward pressure on labour productivity. Mismatches suggest that education systems must become more flexible and demand-sensitive to emerging skill needs. Rebalancing educational investments over the life-course can be part of that answer.

Figure 7. Qualification, literacy and field-of-study mismatch, percentage of mismatched workers, by type of mismatch



Note: OECD calculations based on the OECD Survey of Adult Skills (PIAAC) data (2012, 2015).
Source: OECD (2016a), The Survey of Adult Skills: Reader's Companion, Second Edition, OECD Skills Studies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264258075-en; OECD (2013), OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, OECD Publishing, http://dx.doi.org/10.1787/9789264204256-en

1.5. The imperative of a lifelong learning approach

29. Education and training policies have an important role to play to ensure that children, youth and adults can adapt their skills throughout their lifetime. To achieve this, high-quality initial education and training systems should be complemented by investments and interventions later in life. This implies a shift from a front-loaded model whereby education only takes place from early childhood to youth, towards a model of lifelong learning for the whole population. This represents a major change that will require re-designing models of governance and financing for more complex skills systems in addition to more flexible education and labour arrangements so that individuals can access and engage in learning opportunities. Unlike most education systems today, investment needs to be re-oriented towards both ends of the educational trajectory, from early childhood education and care and to adult learning.

1.5.1. Early Childhood Education and Care

30. Research shows that what a child learns in their early years can help predict a range of life outcomes, including educational attainment, employment, income, health, social adjustment and wellbeing (OECD, 2016a; Schoon et. al, 2015). Early childhood

education and care (ECEC) can help reduce poverty and foster intergenerational social mobility. And affordable early childhood services remain a key factor for parents' participation in the workforce, especially for women (OECD, 2012; OECD, 2017a).

31. Later life outcomes are predicted by a bundle of skills such as self-regulation, self-awareness, emotional stability, executive function, collaboration, motivation, and social skills (Schoon et al., 2015). Early childhood services can support children in developing these skills, with high social and economic returns. However, children from disadvantaged backgrounds are less likely to have attended ECEC despite standing to benefit the most: ECEC institutions may be the primary environment for disadvantaged children to acquire the skills needed for lifelong learning – unlike more privileged children who are expected have a more supportive home-learning environment.

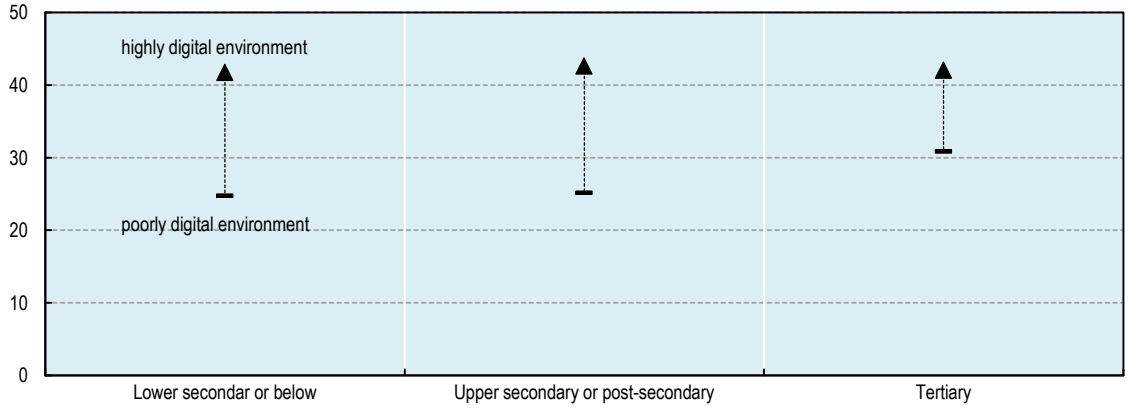
32. Another concern is that the benefits of rising participation in pre-school could be lost if quality is not ensured (OECD, 2016b). Investments in early childhood provision should be built on a better understanding of key factors for high-quality ECEC environments, for instance the relevance of staff training, working conditions and monitoring for quality improvement (OECD, 2012; OECD, 2015a).

1.5.2. Adult learning

33. Unleashing the potential of adults is crucial to their individual fulfilment and to the prosperity of their countries. Adults without jobs include the unemployed, those displaced from their previous jobs by economic restructuring, people who have had caring responsibilities who wish to work or return to work, those working in the informal sector, new migrants, and many older workers who are still active but have left the labour market prematurely. These adults need the training and opportunities to continue their participation in the workforce. Even among the adult population with jobs, many could make fuller and better use of their skills and potential.

Figure 8. Share of workers reporting needing training by educational attainment

Share of workers in highly and poorly digital work environments reporting needing further training to do their job, by education level



Note: OECD calculations based on the Survey of Adult Skills (PIAAC) (2012, 2015).
Source: OECD (2016a), The Survey of Adult Skills: Reader's Companion, Second Edition, OECD Skills Studies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264258075-en; OECD (2013), OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, OECD Publishing, http://dx.doi.org/10.1787/9789264204256-en

34. Workers today need to keep learning across their life-course to face the changes and seize the opportunities brought about by the digital transformation. Working in a digital environment requires regularly updating and developing new skills. The share of workers who declare needing further training is greater for those who are more exposed to digitalisation (Figure 8).

35. Countries must find efficient ways to develop their populations' skills across their life-course, but also to break the vicious cycle between being low-skilled and not participating in adult learning. To do this, the obstacles to adult education need to be removed. This could include re-designing tax systems to facilitate adult learning and targeted supports to alleviate the costs of learning for those who need help. It could also mean providing more flexible opportunities for adults to upgrade their skills, including easing access to formal education and improving the recognition of skills acquired after initial education, and enhancing career guidance. Engaging employers and other stakeholders in the design of learning opportunities that are relevant to the labour market is also important.

36. Tackling severe literacy and numeracy weaknesses and upskilling adults is a considerable challenge. Often low-skilled adults will have performed poorly at school, and have a very negative perception of education and learning; they may also lack awareness of their deficiencies (Bynner and Parsons, 2006). Lack of motivation is therefore a serious obstacle. Even for those who want to tackle their weaknesses, interest needs to be translated into action. Adults with busy working and family lives often find it hard to make space for learning. But there is an emerging body of evidence on that works best in adult teaching and learning.

37. A number of OECD countries have concluded that programmes designed to address weak basic skills among adults, and programmes to upskill adults throughout their lives, are a key part of their broader systems for education and skills. In several countries, adult learning is, like other types of formal education and training, supported by quality assurance mechanisms, strong governance and effective financing mechanisms. Those countries tend to have not only good economic outcomes, such as low unemployment and a high rate of innovation in firms, but also lower levels of income and skill inequality (Desjardins, 2017).

38. Building awareness of the implications of weak basic skills or outdated skills, and of the economic and social returns of higher skills levels, is important both for the adults directly concerned, and their immediate contacts – employers, family and friends. Strong teachers and appropriate career guidance staff are needed to assist learners, but the low salary of these professions can be a barrier. Finally, teaching adult learners often requires specific approaches adapted to the needs of this population, such as formative assessment and contextual learning.

39. An increasing share of the skills needed for the future labour market is likely to be developed beyond upper secondary school, but university is not the only route to acquire high-level skills. Youth who go through VET programmes need to develop a broad range of skills in addition to occupation-specific skills and require pathways to further education. Quality on-the-job training and the ability to use skills at work are also critical to update and upgrade the skills of adults throughout their working life.

1.6. The imperative of fostering equitable opportunities and outcomes

40. Socio-economic background continues to have a strong influence on student performance in many countries. Evidence combining data from PISA and PIAAC shows that the difference in literacy proficiency for individuals whose parents did not obtain a tertiary degree and individuals with at least one parent who obtained a tertiary degree is generally large at the age of 15 and tends to widen in young adulthood (Borgovini et al., 2017).

41. Policies aiming to reduce inequalities of opportunity among children and schools are important to ensure that all young adults are equipped with the skills they need for successful careers in a changing world of work but also to better embrace the impact technology may have on their careers. These policies must target the most vulnerable groups in our societies: early school leavers; those not in employment, education or training (NEETs); unemployed youth; the long-term unemployed; and adults with low levels of skills. Addressing the barriers to adult learning, especially for low-skilled individuals, requires working on various fronts such as increasing incentives for investments in training, developing mechanisms to allow the portability of training rights between employers, fostering motivation and removing time and other constraints.

42. The gender dimension deserves particular attention. PISA 2015 data shows that boys and girls now show similar levels of science performance. However gender differences emerge in boys' favour among the highest-achieving students in test questions which require students to explain phenomena scientifically, or refer to physical systems that require knowledge of the structure and properties of matter. On the other hand, girls are generally less likely to appear amongst the lowest-achieving students, and are more proficient in evaluating and designing scientific enquiry, and have more interest in knowing how scientists enquire and develop scientific theories. These differences come on top of gender disparities in mathematics performance among the highest achieving students, reinforced by the fact that many girls hold negative attitudes about their mathematics abilities and express high levels of mathematics anxiety (OECD, 2015b).

43. This can have serious implications not only for higher education, where young women are already under-represented in the science, technology, engineering and mathematics (STEM) fields of study, but also later on, when they enter the labour market. In 2015, women only accounted for 30% of all students graduating in natural sciences, engineering, and ICT fields at tertiary level, across OECD countries (OECD, 2017a). Furthermore, women represent only 20% of tertiary graduates in ICT-related studies – fields which are particularly relevant in the digital era. However, emerging economies show encouraging counter-trends: with more than 260 000 female tertiary ICT graduates in 2015, India is the country closest to gender parity in this field, followed by Indonesia.

44. Policy makers across the OECD are increasingly aware of gender stereotyping at school and the effect that it may have on future education and career choices and many countries have initiated efforts to address these stereotypes and further bridge the divide.

1.7. The imperative of redesigning teaching and pedagogy

45. The forces of digitalisation are connecting people, cities, countries and continents, bringing together a majority of the world's population in ways that vastly

increase our individual and collective potential. But the same forces have also made the world more volatile, more complex and more uncertain, and education will be a key differentiator for how the next decades will play out for individuals, nations and the planet. Indeed, when we can access content on line and routine cognitive skills are being digitised and outsourced, the focus of education must shift to preparing students for their uncertain future, enabling them to become lifelong and life-wide learners. Educational success is no longer mainly about reproducing content knowledge, but rather about extrapolating from what we know, applying that knowledge creatively in novel situations, synthesising different fields of knowledge, making connections between ideas, and collaborating with others to mobilise and integrate knowledge and take collective action.

46. These new skills demands have elevated the role of social and emotional skills. However, developing such knowledge, skills and character qualities requires a very different approach to learning and teaching and a different calibre of teachers. Today, teaching is being transformed into a profession of advanced-knowledge workers; this shift is paradigm to transform schooling at scale. Indeed, preparing education systems to deliver the skills that matter in the future will require a qualitative change in teaching strategies and pedagogy. Across countries, there are teachers and schools that have successfully transitioned to a 21st century approach to education, but this movement is far from being widespread. Ensuring high quality pedagogy at all levels of education, from early childhood education to tertiary education and vocational education and training, matters for the future of skills.

1.7.1. Teaching

47. How teachers teach at school can make a big difference for students. Education systems, schools and teachers need to decide how much emphasis is given to learning concepts and facts, applying knowledge and solving problems using what students have learnt. Teaching methods could affect student performance and students' beliefs. Even if there is no single 'best' way of teaching, students need teachers who are challenging and innovative in the way they combine different instructional practices, and who can reach all types of learners.

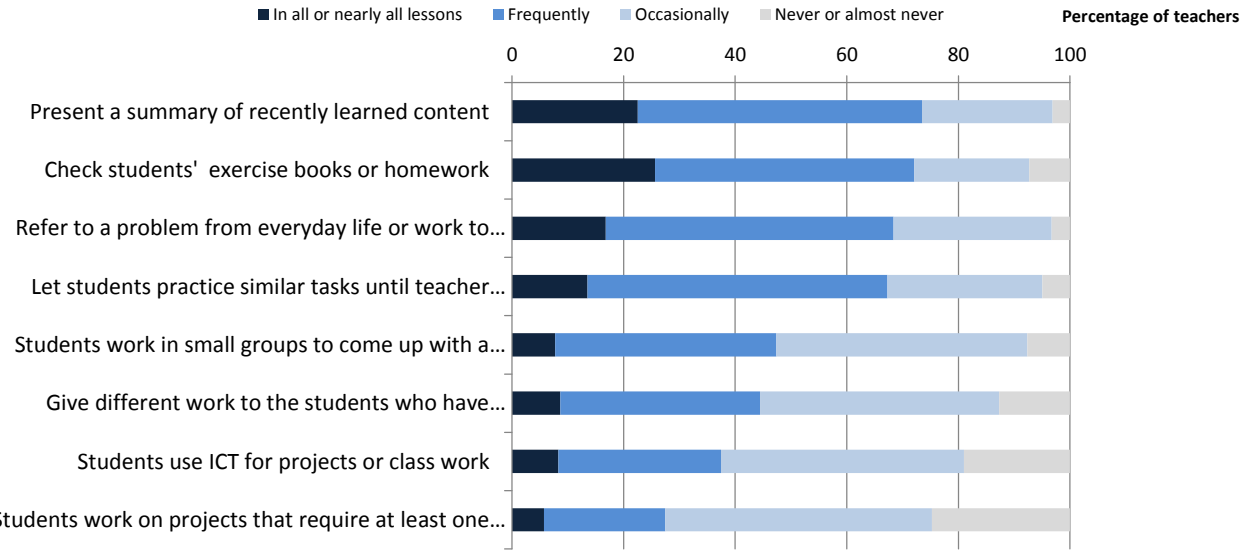
48. The results of PISA 2012 demonstrated that, to perform at the top in mathematics, students cannot rely on memory alone. They need to approach mathematics strategically and creatively to succeed in the most complex problems. Most teaching strategies, including student-oriented instruction, have a role to play in the classroom. To varying degrees, students need to learn from teachers, be informed about their progress and work independently and collaboratively; above all, they need to be constantly challenged (Echazarra et al, 2016).

49. PISA 2015 shed more light on effective teaching strategies. It showed that students who reported that their science teachers frequently use teacher-directed instruction (i.e. to explain or demonstrate a scientific idea) and adapt their teaching to meet students' needs score higher in science, show stronger beliefs about the value of scientific enquiry, and are more likely to expect to pursue a science-related career than students who reported that their teachers use these methods less frequently (OECD, 2016d). But PISA also showed that on average across OECD countries, teachers in advantaged schools use more teacher-directed instruction, and do so more frequently than their peers in disadvantaged schools, thus exacerbating equity issues.

50. TALIS 2013 allows better understanding of how teachers teach and the extent to which they use active, co-operative and project-based learning strategies which have been found to improve student learning (OECD, 2014). Nearly half (47%) of the teachers who participated in TALIS 2013 reported frequently using practices involving students working in small groups. In contrast, just over a third of teachers on average (37%) reported using practices involving ICT frequently, and just over one-quarter (27%) reported using practices involving projects that required at least one week to complete (Figure 9).

Figure 9. Teaching practices

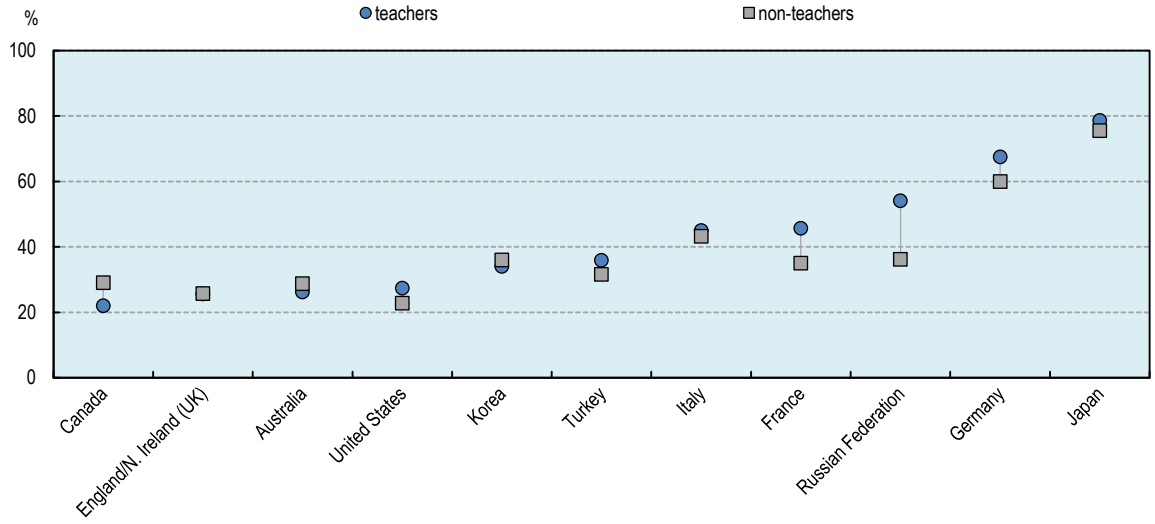
Percentage of lower secondary education teachers who report using the following teaching practices[1]



Notes: 1. These data are reported by teachers and refer to a randomly chosen class they currently teach from their weekly timetable. Items are ranked in descending order, based on the percentage of lower secondary education teachers who use the following teaching practices "frequently" or "in all or nearly all lessons". *Source*: OECD (2018), TALIS 2013 Database, OECD Stat, http://stats.oecd.org/, Tables 6.1 and 6.1.Web.

51. These findings suggest that teachers may be insufficiently prepared to adopt more active, co-operative and project-based learning strategies in their teaching, and to implement a broader repertoire of teaching practices more generally. This is evidenced by the Survey of Adult Skills (PIAAC), whose results show that in most countries more than 30% of teachers declare needing further training to perform their duties. Interestingly, in those countries where the need for training among high-skilled workers is the largest (Austria, Chile, Germany, Lithuania, Slovenia), teachers are more likely than tertiary-educated workers who are non-teachers to report a need for training (Figure 10).

Figure 10. Share of tertiary-educated teachers and non-teachers reporting needing training



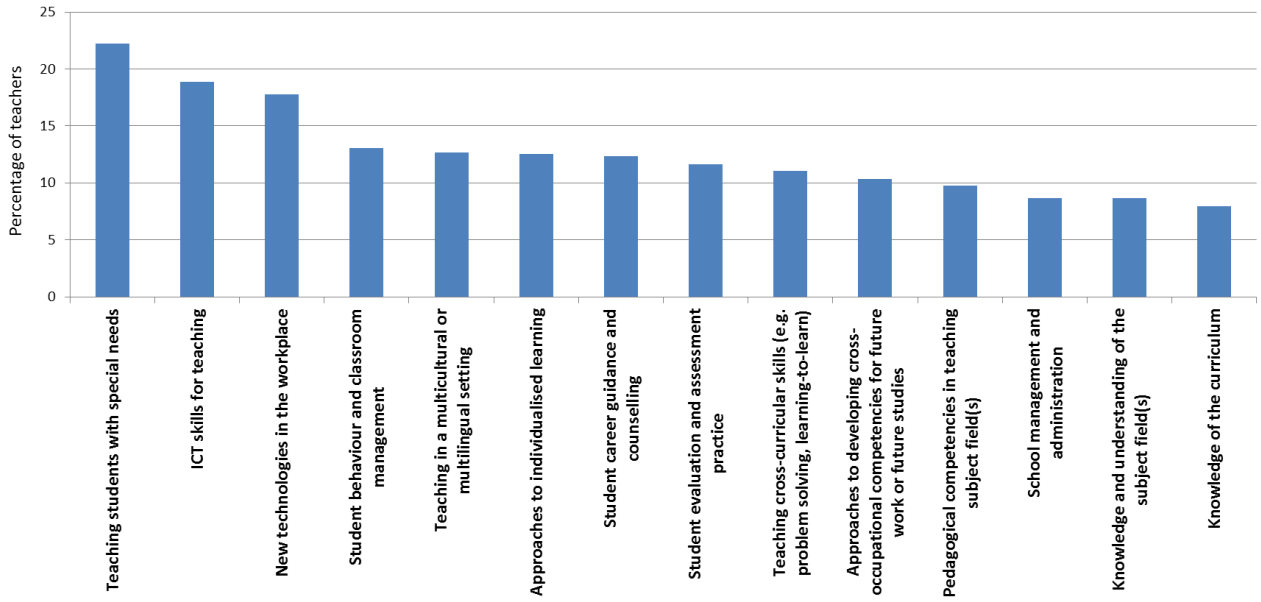
Note: OECD calculations based on the Survey of Adult Skills (PIAAC) (2012, 2015).
Source: OECD (2016a), The Survey of Adult Skills: Reader's Companion, Second Edition, OECD Skills Studies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264258075-en; OECD (2013), OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, OECD Publishing, http://dx.doi.org/10.1787/9789264204256-en

52. This highlights that teachers' ability to use appropriate and innovative pedagogical tools play an important role in the development of the skills set needed for the future. Teachers whose formal education included content, pedagogy and practical components for the subjects they teach feel better prepared for their work than their colleagues whose formal education did not contain these elements (OECD, 2014). Yet, TALIS also shows that only 68% and 69% of teachers reported that their teacher education included respectively pedagogy of and practice in all the subjects they teach (OECD, 2014).

53. System and school policies should thus focus on supporting teachers through both initial teacher education for incoming teacher cohorts, but also through adequate in-service professional development to develop the skills and competencies of current teachers in order to encourage the spread of innovative pedagogies at scale. TALIS sheds light on promising strategies in this respect: professional development activities which take place in the school, and involve teacher collaboration and active learning during an extended period of time have greater reported impacts on teaching practice (Opfer, 2016; Barrera-Pedemonte, 2016). TALIS also highlights priority areas for professional development efforts, with teaching students with special needs and developing information and communication technology (ICT) skills for teaching being the most critical areas of professional development need reported by teachers (Figure 11). Teachers' ability to effectively use new technologies is of particular relevance as many innovative pedagogical tools and methods rely on technology (OECD, 2016d)

Figure 11. Teachers' needs for professional development

Percentage of lower secondary education teachers indicating they have a high level of need for professional development in the following areas.



Note: Items are ranked in descending order, based on the percentage of teachers indicating they have a high level of need for professional development.
Source: OECD (2018), TALIS 2013 Database, OECD Stat, http://stats.oecd.org/, Table 4.12.

1.7.2. Making the most of digital technologies in pedagogy

54. New technologies can enhance learning and help develop skills for the 21st century. Many new pedagogical approaches make use of technology. Examples of such pedagogical methods are numerous and include gamification, which integrates the pedagogical principles of play and games (including video games) in formal learning, or flipped classes where students are required to learn content, usually provided through ICT material, before the class. Digital tools favour personalised instruction, allowing students to progress at their own pace and teachers to spend more time with learners who lag behind.

55. Technology also changes the content and sources of knowledge: traditional textbooks and curriculum may be supplemented by educational software, online courses or digital textbooks. These expand the opportunities young learners have to both find information and to practice the digital competencies required for a sustainable use of new technologies (OECD, 2016a). At different levels of education in school, new digital devices allow for the exchange of teaching practices, collection of better student data to facilitate more rapid and better-targeted student feedback, and the dissemination of instruction and teaching to isolated areas.

56. More generally, digital tools extend the learning universe outside of the physical premises of educational and training institutions. Workers in particular can easily learn on the job through the Internet and employers can propose online training programmes that can be adjusted around time constraints. Massive Open Online Courses (MOOC) offer new learning opportunities and can be used as a way for students or workers to signal specific interest or knowledge in some areas.

57. However, evidence regarding the impact of technology use in schools on student performance has been mixed. Investment in ICT in the form of computers, tablets or Internet connection has failed to translate into higher academic achievement for students, even though such investments did not crowd out resources allocated to other inputs (Bulman and Fairlie, 2016).This suggests that the way technology is used matters: both students and teachers need to be motivated and prepared to use technology so that it has a positive impact on learning. In addition, people need a range of skills to benefit from the learning opportunities brought by technology. For example, using MOOCs may require good ICT skills but also time management skills and an ability to be a self-motivated learner.

1.8. Conclusions

58. Digitalisation is profoundly transforming the way in which people study, work, and communicate. While new technologies may generate productivity gains, spur growth and create new jobs, they also bring new challenges, such as cyber-crime and the automation of existing jobs at a very fast pace.

59. Against this backdrop, the demand for knowledge, skills and abilities is constantly changing. In addition to strong foundational skills – in literacy and numeracy – there is an increasing demand for complementary skills, such as creativity, problem-solving, and critical thinking. However, despite raising educational attainment levels, PIAAC results show that a large proportion of the population lacks the skills needed to face the challenges digitalisation poses to G20 economies and societies. On average in the OECD, more than 20% of adults are low performers in literacy and/or numeracy, around 15% of adults either reported having no prior computer experience or lacked basic ICT skills; and another 14% were found to have low problem solving skills in technology rich-environments. Nonetheless, youth are generally better prepared than older generations to face the challenges of the digital transformation as they have higher cognitive and ICT skills.

60. In light of a changing landscape, education systems must evolve. Working in a digital environment requires adults to continuously update and adapt their skills to move from one job to another, or to remain in jobs where their tasks become increasingly automated. This entails a shift from a front-loaded model whereby education only takes place from early childhood to youth, towards a model of lifelong learning for the whole population. It will also require re-designing models of governance and financing for more complex skills systems in addition to more flexible education and labour arrangements. This change will require a different approach to learning and teaching and a different calibre of teachers. New technologies can play an important role in enhancing learning and helping develop skills for the 21st century. However, research suggests that the way in which these new tools are used matters. Both students and teachers will need to be supported to fully benefit from the new learning opportunities introduced by technology.

61. In a context of growing labour market polarisation, countries also face the important challenge of reducing inequalities to ensure that all individuals are equipped with the skills they need for successful careers in a changing world of work and to better embrace the impact technology may have on their careers and lives. Policies should target the most vulnerable groups in our societies, including early school leavers; those not in employment, education or training (NEETs); unemployed youth; the long-term unemployed; and adults with low levels of skills, while also bridging the gender gap.

2. References

Barrera-Pedemonte, F. (2016), "*High-Quality Teacher Professional Development and Classroom Teaching Practices: Evidence from Talis 2013*", OECD Education Working Papers, No. 141, OECD Publishing, Paris, http://dx.doi.org/10.1787/5jlpszw26rvd-en

Berger, T. and C. Frey (2016), "Structural Transformation in the OECD: Digitalisation, Deindustrialisation and the Future of Work", OECD Social, Employment and Migration Working Papers, No. 193, OECD Publishing, Paris, http://dx.doi.org/10.1787/5jlr068802f7-en

Borgonovi, F., et al. (2017), "*Youth in Transition: How Do Some of The Cohorts Participating in PISA Fare in PIAAC?*", OECD Education Working Papers, No. 155, OECD Publishing, Paris, http://dx.doi.org/10.1787/51479ec2-en

Bulman, G. and R. Fairlie (2016), Technology and Education: Computers, Software, and The Internet, NBER Working Paper Series, NBER, Cambridge, http://www.nber.org/papers/w22237

Bynner, J. and S. Parsons (2006), New light on literacy and numeracy: full report, NRDC, London.

Desjardins (2017), Quebec's tightening labour market, Perspective, Economic Studies, https://www.desjardins.com/ressources/pdf/per1017e.pdf

Echazarra, A. et al. (2016), "*How teachers teach and students learn: Successful strategies for school*", OECD Education Working Papers, No. 130, OECD Publishing, Paris. http://dx.doi.org/10.1787/5jm29kpt0xxx-en

Elliott, S. (2017), Computers and the Future of Skill Demand, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264284395-en

Eurofund and the International Labour Office (2017), Working anytime, anywhere: The effects on the world of work, Publications Office of the European Union, Luxembourg, and the International Labour Office, Geneva.

Kautz, T. et al. (2014), "*Fostering and Measuring Skills: Improving Cognitive and Non-cognitive Skills to Promote Lifetime Success*", OECD Education Working Papers, No. 110, OECD Publishing, Paris, http://dx.doi.org/10.1787/5jxsr7vr78f7-en

Nedelkoska, L. and G. Quintini (2018), "Automation, skills use and training", OECD Social, Employment and Migration Working Papers, No. 202, OECD Publishing, Paris, http://dx.doi.org/10.1787/2e2f4eea-en

OECD (2018), TALIS 2013 Database, OECD Stat, http://stats.oecd.org/Index.aspx?datasetcode=talis_2013%20 (Accessed online 15 March 2018)

OECD (2017a), OECD Skills Outlook 2017: Skills and Global Value Chains, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264273351-en

OECD (2017b), PISA 2015 Results (Volume III): Students' Well-Being, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264273856-e

OECD (2017c), PISA 2015 Results (Volume V): Collaborative Problem Solving, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264285521-en

OECD (2017d), Education at a Glance 2017: OECD Indicators, OECD Publishing, Paris, http://dx.doi.org/10.1787/eag-2017-en

OECD (2016a), The Survey of Adult Skills: Reader's Companion, Second Edition, OECD Skills Studies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264258075-en.

OECD (2016b), Enhancing Child Well-Being To Promote Inclusive Growth, OECD. Retrieved from: http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DELSA/ELSA(2016)7/REV1&doclanguage=en

OECD (2016c), PISA 2015 Results (Volume I): Excellence and Equity in Education, PISA, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264266490-en

OECD (2016d), PISA 2015 Results (Volume II): Policies and Practices for Successful Schools, PISA, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264267510-en.

OECD (2015a), Starting Strong IV: Monitoring Quality in Early Childhood Education and Care, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264233515-en

OECD (2015b), The ABC of Gender Equality in Education: Aptitude, Behaviour, Confidence, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264229945-en

OECD (2014), TALIS 2013 Results: An International Perspective on Teaching and Learning, TALIS, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264196261-en

OECD (2013), OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, OECD Publishing,

OECD (2012), Starting Strong III: A Quality Toolbox for Early Childhood Education and Care, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264123564-en

Opfer, D. (2016), "*Conditions and Practices Associated with Teacher Professional Development and Its Impact on Instruction in TALIS 2013*", OECD Education Working Papers, No. 138, OECD Publishing, Paris, http://dx.doi.org/10.1787/5jlss4r0lrg5-en

Scheerder, A., A. van Deursen, and J. van Dijk, (2017). *Determinants of Internet skills, use and outcomes: A systematic review of the second- and third-level digital divide*, Telematics and informatics, Vol. 34(8), pp. 1607-1624, http://dx.doi.org/10.1016/j.tele.2017.07.007

Schoon, I. et al. (2015), The Impact of Early Life Skills on Later Outcomes, OECD Directorate for Education and Skills, Education Policy Committee.