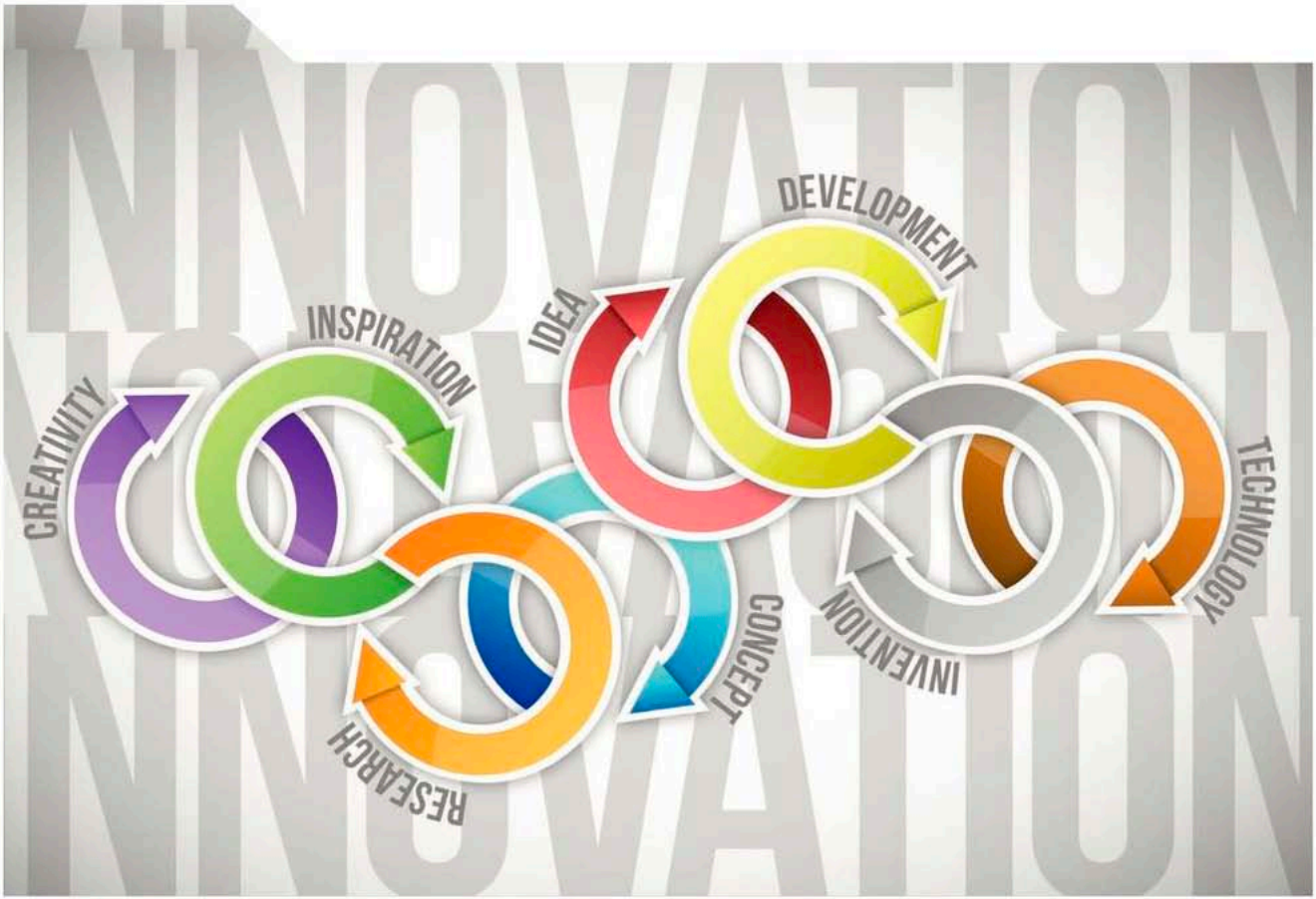
Education Innovation and Research

Innovating Education and Educating for Innovation

THE POWER OF DIGITAL TECHNOLOGIES AND SKILLS



Centre for Educational Research and Innovation

OECD

Educational Research and Innovation

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BETTER POLICIES FOR BETTER LIVES

Foreword

Digital technologies have a profound impact on economies and societies and are changing the way we work, communicate, engage in social activities and enjoy ourselves. They also drive innovation in many different spheres of life. The innovative capacity of technology is very much conditioned by the level of digital skills of the population. No wonder there is a very strong correlation between education and skills and the uptake and use of digital technologies in various spheres of life. The role of education and skills in promoting innovation is critical.

Yet, despite the huge potential of digitalisation for fostering and enhancing learning, the impact of digital technologies on education itself has been shallow. Massive investments in ICT (Information and Communication Technology) in schools have not yet resulted in the hoped for transformation of educational practices, probably because the overriding focus on hardware and connectivity has kept back equally powerful strategies for increasing teachers' ICT skills, improving teachers' professional development, reforming pedagogies and producing appropriate software and courseware.

Discussions about the potential of digital technologies in education today increasingly place the issue as part of a more comprehensive approach to innovation in education. Education systems and institutions are not averse to change in themselves, but there seem to be very powerful barriers in place that prevent digital technologies from reaching their potential in educational institutions and teaching and learning practices.

Innovation doesn't happen in a vacuum, but requires openness and interactions between systems and their environments. This is also very much the case for education. Schools cannot be left alone to make the difficult process of transformation, but need support not only through policies, but also from other actors and stakeholders. In recent years the emergent education industry has taken on a very important role. This role is not simply defined by commercial corporate interests selling products and services to schools, but is increasingly framed into a much wider concern for genuine innovation.

In order to foster a dialogue aiming to identify the best policies and practices to foster innovation in education, the Global Education Industry Summits brings together governments and leaders from the global education industry. The success of these summits very much depends on the evidence that can feed into the dialogue. That is why the OECD, as a global leader in internationally comparative data and analysis, has produced this synthesis of the available evidence, generated through its surveys and analytical work. It serves as a background document for the second Global Education Industry Summit in Jerusalem on 26-27 September 2016.

The report was prepared by Dirk Van Damme, head of the OECD Centre for Educational Research and Innovation (CERI), compiling analyses from recent OECD publications on innovation, innovation in education and technology-based innovation. In particular, the report offers a synthesis of the outcomes of different recent CERI projects, notably CERI's "Innovation Strategy for Education and Training", "Innovative Learning Environments", and "Open Education Resources". It also draws on recent publications of other programmes of the Directorate for Education and Skills (notably the OECD Programme on International Student Assessment (PISA), the OECD Programme for the International Assessment of Adult Competencies (PIAAC), the Teaching and Learning International

Survey (TALIS) and from some other OECD reports. Particular acknowledgment should be given to a forthcoming CERI publication on business-driven innovation in education, in particular to the analyses of markets and innovation in the education industry by Vincent-Lancrin, Atkinson and Kärkkäinen (Chapter 5) and business-driven innovation in education by Foray and Raffo (Chapter 6).

Other sources for the report are the following OECD publications: OECD Skills Outlook 2013: First Results from the Survey of Adult Skills (2013); Sparking Innovation in STEM Education with Technology and Collaboration: A Case Study of the HP Catalyst Initiative, OECD Education Working Papers, No. 91 (2013); Measuring Innovation in Education. A New Perspective (2014); Innovation, governance and reform in education. CERI Conference background paper (2014); Measuring the Digital Economy: A New Perspective (2014); Digital Economy Outlook (2015); The Innovation Imperative: Contributing to Productivity, Growth and Well-being (2015); E-Learning in Higher Education in Latin America (2015); Adults, Computers and Problem Solving: What's the Problem? (2015); Students, Computers and Learning. Making the Connection (2015); Education at a Glance 2015: OECD Indicators (2015); Open Educational Resources: A Catalyst for Innovation (2015); Schooling Redesigned. Towards Innovative Learning Systems (2015); Skills Matter: Further Results from the Survey of Adult Skills (2016); Getting Skills Right: Assessing and Anticipating Changing Skill Needs (2016); and Skills for a Digital World (2016).

Use has also been made of various issues of the Education Indicators in Focus (http://dx.doi.org/10.1787/22267077), PISA in Focus (http://dx.doi.org/10.1787/22260919), and Teaching in Focus (http://dx.doi.org/10.1787/23039280) series, as well as OECD Education Today blog posts (http://oecdeducationtoday.blogspot.fr/), OECD Education Working Papers (www.oecd-ilibrary.org/education/oecd-education-working-papers_19939019) and unpublished documents. Other sources have been referred to in the text.

Rachel Linden co-ordinated production of the report.

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Executive summary

This background report to the second Global Education Industry Summit, held in Jerusalem on 26-27 September 2016, covers the available evidence on innovation in education, the impact of digital technologies on teaching and learning, and the role of digital skills and the education industries in the process of innovation, using data from OECD surveys. The overall aim of the summit was to bring together ministers of education and industry leaders to start a dialogue on policies and strategies to foster innovation in education.

As in all sectors, innovation will be essential to bring about qualitative changes in education, as opposed to the quantitative expansion seen so far. These changes are needed to increase efficiency and improve the quality and equity of learning opportunities. Although education is not a change-averse sector, with improvements already taking place in classrooms, it has not managed to harness technology to raise productivity, improve efficiency, increase quality and foster equity in the way other public sectors have. At the same time education can also foster innovation in society at large by developing the right skills to nurture it. These skills, including critical thinking, creativity and imagination, can be fostered through appropriate teaching, and practices such as entrepreneurship education. Governments should develop smart innovation strategies for education with the right policy mix to give meaning and purpose to innovation, including creating an innovation-friendly culture.

The steep increase in the use of digital devices and the Internet with increasing levels of education shows that education matters in the uptake of digital technologies. This has huge implications for the role of education systems in equipping individuals with the skills they need to benefit from new technology. The "digital divide" has become a skills gap between the haves and have-nots. Digital skills generate a significant return in terms of employment, income and other social outcomes for those who have them, but set up barriers to better life opportunities for those without.

In recent years governments have invested heavily in information and communications technology (ICT) in schools. The quality of schools' educational resources, including ICT and connectivity, has increased greatly in recent years. However, international surveys have found that digital technologies have not yet been fully integrated in teaching and learning. Teachers do not feel sufficiently skilled to use ICT effectively, at best using digital technologies to complement prevailing teaching practices. As tertiary-educated professionals, teachers have relatively good ICT skills, but these fall off sharply with age, especially among the large cohort of older teachers.

Analysis of the Programme for International Student Assessment (PISA) data on the effects of ICT on students' outcomes adds to the sobering picture. The introduction of digital technologies in schools has not yet delivered the promised improvements of better results at lower cost. There is only a weak, and sometimes negative, association between the use of ICT in education and performance in mathematics and reading, even after accounting for differences in national income and socio-economic status.

Part of the explanation for this limited success lies in the focus on technology and connectivity among both suppliers and policy makers. Schools and education systems are not yet ready to realise technology's potential. Gaps in the digital skills of both teachers and students, difficulties in locating high-quality digital learning resources and software, a lack of clarity over learning goals, and insufficient pedagogical preparation on how to blend technology meaningfully into teaching, have driven a wedge between expectations and reality. Schools and governments must address these challenges or technology may do more harm than good.

Although they cannot transform education by themselves, digital technologies do have huge potential to transform teaching and learning practices in schools and open up new horizons. The challenge of achieving this transformation is more about integrating new types of instruction than overcoming technological barriers. Digital technology can facilitate:

- Innovative pedagogic models, for example based on gaming, online laboratories and real-time assessment, which have been shown to improve higher-order thinking skills and conceptual understanding and in many cases have enhanced students' creativity, imagination and problem-solving skills.
- Simulations such as remote or virtual online laboratories, providing relatively low-cost flexible access to experiential learning.
- International collaborations, overcoming barriers of geography and formal classroom hours. These give students insight into other cultures and experience multicultural communication, and closely emulate the collaborative nature of today's professional environments.
- Real-time formative assessment and skills-based assessments, allowing teachers to monitor student learning as it happens and adjust their teaching accordingly. It may also enable the active participation of more students in classroom discussions. Technology-supported assessment enables skill development to be monitored in a more comprehensive way than is possible without technology.
- E-learning, open educational resources and massive open online courses, mainly aimed at autonomous learners.

Technology-based innovations in education reshape the environments in which schools operate. In general, they tend to open up learning environments, both to the digital world and the physical and social environment. They also bring new actors and stakeholders into the educational system, not least the education industries, with their own ideas, views and dreams about what the future of education can hold. Despite fears of "marketisation", the education industry could be an essential partner in any education innovation strategy. Instead of being considered just as providers of goods and services, different relationships between schools and industry could foster an innovation-friendly environment, with a greater focus on methods over technologies.

Understanding the education industries better, including their market structures and innovation processes, would help to create a more mature relationship with the education sector. Innovation in the industry – which develops the products and services that could drive innovation in schools – does not happen in isolation from what is happening in the education sector. Only when there is an innovation-friendly culture in education systems, supported by an innovation-friendly business environment and policies, will industries start to engage in risk-intensive research and development. Governments can support this by fostering a climate of entrepreneurship and innovation in education.

Chapter 1

The innovation imperative in education

Education is sometimes perceived as a sector which is resistant to change, while at the same time it faces a crisis of productivity and efficiency. Innovation could help improve the quality of education, as well as provide more "bang for the buck" in times of budget pressures and rising demand.

This chapter considers what is meant by innovation in the context of the education sector, and how best it can be measured. Using data from international surveys, it finds that education is more innovative in some ways than other sectors and that there has been innovation across all countries, particularly in teaching methods. It considers what skills are needed to encourage innovation more widely in the economy and whether schools and universities are helping students develop those skills. Finally, it looks at national and international strategies covering innovation in education and beyond.

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Innovation in education: why and what

Innovation in education: the sense of urgency

Innovation in education is a highly contentious issue. Talking to education ministers one quickly gets the impression that education systems in general are very reluctant to innovate, and that there is strong resistance to change among teachers. Education is sometimes perceived as one of the most conservative social systems and public policy fields. But talking to teachers gives one the opposite idea – that there are too many changes imposed on them without much consultation or the necessary preconditions for successfully implementing change. In some countries, innovative change has been implemented without the care and diligence needed or the appropriate prior testing, experimentation and evaluation.

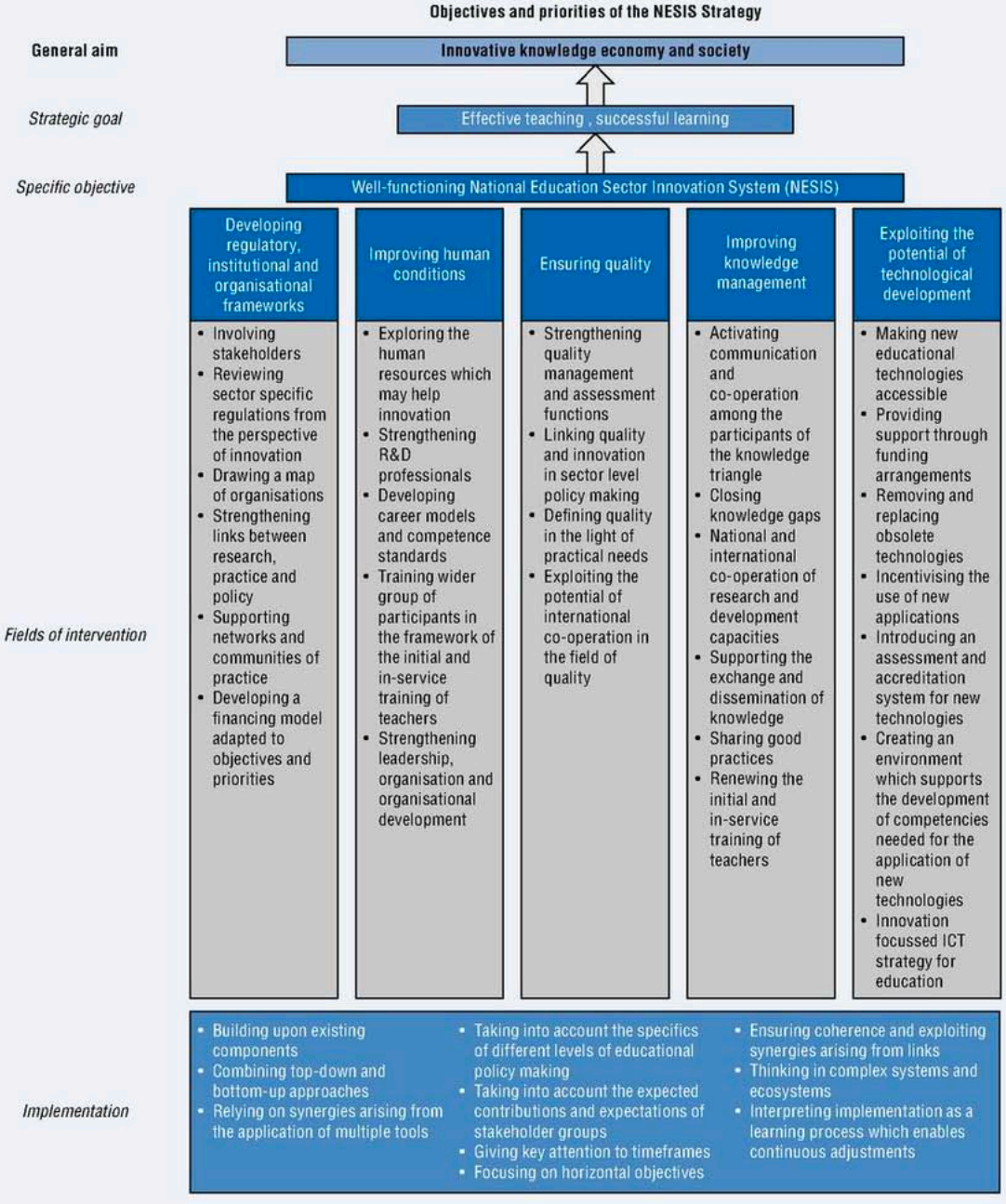
This controversy should not deter us from looking to the facts. And the facts clearly demonstrate that education systems are running up against very serious problems which, if left untouched, could result in serious risks not only for education itself but also for future economic growth, social progress and well-being. Since the mid-20th century, education systems have expanded enormously and human populations have never been more highly educated than today. Emerging economies and developing countries are now also relentlessly expanding their education systems, seeing education as an indispensable ingredient of modernisation and progress. Indeed, the benefits to individuals and societies of ever more education remain very impressive. Yet, although many policy makers may consider the continued expansion in numbers as the best route forward, a closer look into the data reveals that this may as well lead us into difficulties.

The problem education is facing is mainly one of productivity and efficiency. Here, efficiency means the balance between resources invested and the outcomes in terms of students' performance and equity. Over the past decades ever more resources have been invested in education. Looking just at school education, the average expenditure per student across OECD countries increased by no less than 17% between 2005 and 2013 in constant prices (OECD, 2016). But over roughly the same period, the Programme for International Student Assessment (PISA) data from the 2003 and 2012 surveys show no significant improvement in test scores. Instead, in most countries the percentage of top performers has declined. And, while the PISA data show some progress in equity, huge gaps remain in equality of opportunity and education outcomes between various social groups (OECD, 2013).

The problem of productivity and efficiency in education is even more striking when education is compared with other public policy sectors, which have realised enormous productivity gains in past decades. In sectors such as health, technology has been a major driver of increased productivity and efficiency with much improved outcomes even if the cost has also gone up. Many observers wonder why enormous advances in technology has not yet led to similar improvements in education. Governments have invested a lot in bringing technology, mainly information and communications technology (ICT), to schools. But, as the analysis of PISA data discussed in Chapter 3 will show, it has not yet been possible to

Box 1.7. **The Hungarian National Education Sector Innovation System (NESIS)**

In 2011 Hungary started developing its own national innovation strategy for the education sector. The NESIS is a sector-specific subsystem of the National Innovation System, representing the institutional framework of creating, sharing and using new knowledge with a view to improving education. The components of the NESIS are: theoretical and applied research aiming to improve education, development focusing on practice, innovation carried out within the education system and knowledge management. This framework is intended to provide opportunities for the specific actors in the NESIS to interact with each other as part of their work and for developing the standards and institutions which are also part of the system



Chapter 2

Digitalisation, digital practices and digital skills

As technological change continues to accelerate, the digital economy is rapidly permeating the whole of the world economy, making digital skills key for almost everyone. This chapter briefly surveys the use of the Internet and information and communications technology by businesses and individuals and the links between digital behaviour and age, education and socio-economic background. It considers how far the "digital divide" is closing for students from different countries and backgrounds.

Using data from international surveys, the chapter looks at digital skills among the adult population, and the impact they have on employment and wage levels, and national policies to foster greater skills. Finally, it examines digital skills among 15-year-olds and whether the gap between those from the richest and poorest households is closing as Internet access becomes more widespread.

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Digitalisation

The digital economy continues to gain ground

The digital economy is growing quickly (OECD, 2015). It permeates the world economy from retail (e-commerce) to transportation (automated vehicles), health (electronic records and personalised medicine), social interactions and personal relationships (social networks) and also education. Information and communications technology (ICT) is integral to peoples' professional and personal lives; individuals, businesses and governments are increasingly interconnected via a host of devices at home and at work, in public spaces and on the move. These exchanges are routed through millions of individual networks ranging from residential consumer networks to networks that span the globe. The convergence of fixed, mobile and broadcast networks, combined with the use of machine-to-machine communication, the cloud, data analytics, sensors, actuators and people, is paving the way for machine learning, remote control, and autonomous machines and systems. Devices and objects are becoming increasingly connected to the Internet of Things, leading to convergence between ICT and the economy on a grand scale.

At the same time, the growing number of computer-mediated transactions and the accelerating migration of social and economic activities to the Internet are contributing to the generation of a huge volume of (digital) data commonly referred to as "big data". Big data are now used by organisations, often in highly creative ways, to generate innovations in products, processes, organisational methods and markets. Big data could enable vast technological and non-technological innovation. The declining cost of data collection, storage and analytics, combined with the increasing deployment of smart ICT applications, generates large amounts of data, which can become a major resource for innovation and efficiency gains, as long as privacy issues can be addressed. The benefits may also include enhanced data-driven research and development (R&D). For example, the deployment of second-generation genome sequencing techniques with embedded data-mining algorithms resulted in the cost of each human-like genome sequence dropping from USD 1 million to USD 1 000 in just five years (2009-14).

However, the use of big data creates several issues for governments. Governments will need to foster investments in broadband, smart infrastructure and the Internet of Things as well as in data and analytics, with a strong focus on small and medium-sized enterprises (SMEs) and high value-added services. It will also be important to promote skills and competences in analysing data. Moreover, removing unnecessary barriers to the development of the Internet of Things, such as sector-specific regulations, could help ensure its impact across the economy.

An open and accessible Internet, with high fixed and mobile bandwidth, is essential for innovation in the 21st century. The Internet has become a platform for innovation thanks to its end-to-end connectivity and lack of gatekeepers, providing a place where creativity, the exchange of ideas, entrepreneurship and experimentation can flourish. Furthermore, an open Internet enables the management of global value chains, as companies increasingly spread production across borders.

However, governments need to strike the right balance between the social benefits of openness and private preferences for a less open system. It will be particularly important to preserve the open Internet and promote the free flow of data across the global ecosystem while also addressing individuals' concerns about privacy violations and promoting a culture of digital risk management across society. Finally, to ensure the digital economy is inclusive, governments need to assess market concentration and address barriers to competition. Box 2.1 outlines the key areas national digital economy strategies will have to address.

Box 2.1. **Key pillars of national digital economy strategies**

- Further develop telecommunications infrastructure (e.g. access to broadband and telecommunication services) and preserve the open Internet.
- Promote the ICT sector including its internationalisation.
- Strengthen e-government services including enhanced access to public sector information (PSI) and data (i.e. open government data).
- Strengthen trust (digital identities, privacy and security).
- Encourage the adoption of ICTs by businesses and SMEs in particular, with a focus on key sectors such as healthcare, transportation and education.
- Advance e-inclusion with a focus on the aging population and disadvantaged social groups.
- Promote ICT-related skills and competences including basic ICT skills and ICT specialist skills.
- Tackle global challenges such as Internet governance, climate change and development co-operation.

Source: OECD (2015a), *OECD Digital Economy Outlook*, *http://dx.doi.org/10.1787/9789264232440-en*, p. 22.

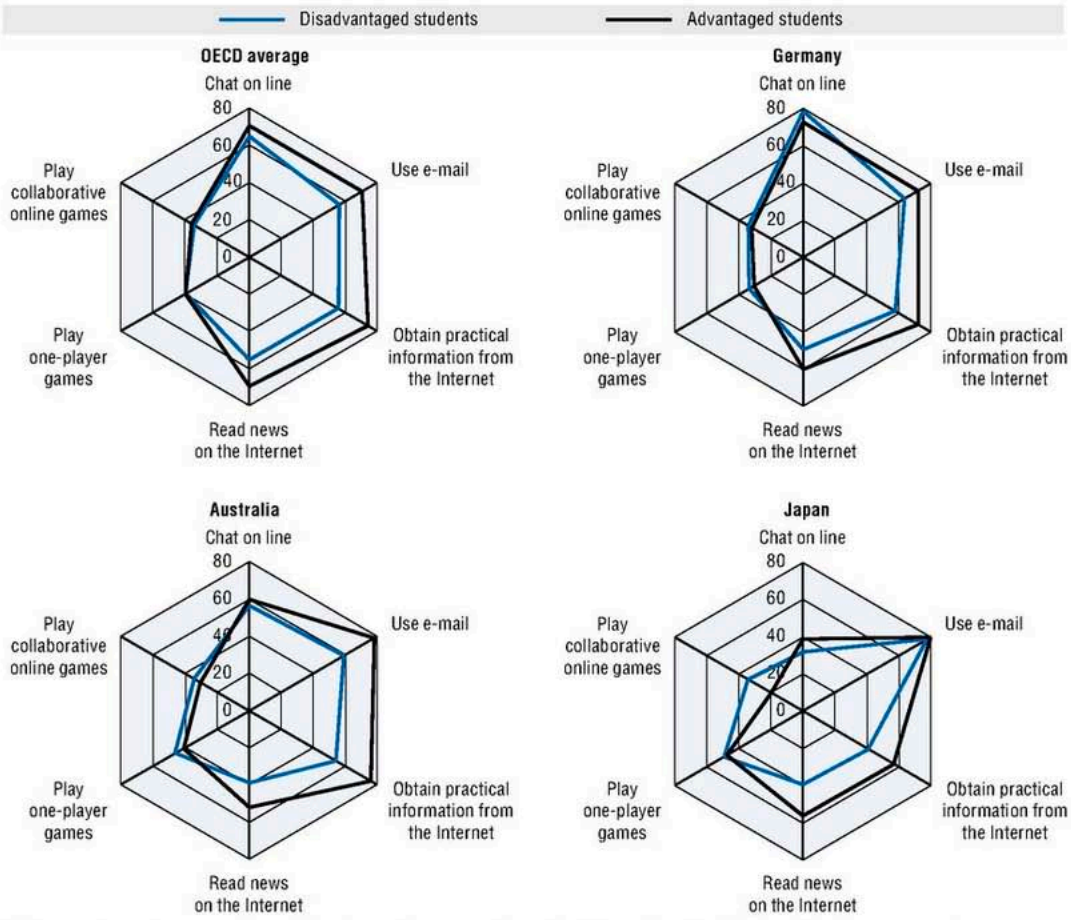
There are plenty of indicators illustrating the digitalisation of economies and societies. The number of Internet users in OECD countries increased from less than 60% of adults in 2005 to about 80% in 2013, reaching 95% among young people, although with large differences across and within countries. Fifteen-year-olds in the OECD spend about three hours on the Internet on a typical weekday, and more than 70% use the Internet at school. In OECD countries, 62% of Internet users participate in social networks and 35% use e-government services. About half of individuals in OECD countries purchase goods and services on line, and almost 20% in Denmark, Korea, Sweden and the United Kingdom use a mobile device to do so.

Almost no business today is run without the help of ICT. In 2014, almost 95% of enterprises in the OECD area had a broadband connection and 76% had a website or home page and 21% sold their products electronically. Over 80% of enterprises used e-government services. However, only 21% conducted sales on line and only 22% used cloud computing services. Overall, there are still large differences across countries in the use of ICT tools and activities within enterprises, suggesting there is much scope for further uptake and use of ICT. These differences are is closely, but not exclusively, related to differences in countries' share of smaller firms.

Higher-speed Internet, lower unit prices and smart devices have favoured new and more data-intensive applications. Wireless broadband subscriptions in the OECD area increased over twofold in just four years: by June 2014, more than three out of four individuals in the OECD area had a mobile wireless broadband subscription. Mobile broadband is also widely

Figure 2.7. **Common computer leisure activities outside of school, by students' socio-economic status**

OECD average values and values for selected countries



Notes: The figure shows the percentage of students who engage in each of the selected activities at least once a week. Socio-economically disadvantaged students refers to students in the bottom quarter of the *PISA index of economic, social and cultural status* (ESCS); socio-economically advantaged students refers to students in the top quarter of ESCS.

Source: OECD, PISA 2012 Database, Table 5.11.

StatLink http://dx.doi.org/10.1787/888933253203

Digital skills in the adult population

Proficiency in problem solving in technology-rich environments

The education gradient in various measures of internet and ICT usage raises the question about the digital skills in the population. What do we know about the adults' proficiency with technology and digital devices?

To understand how well-equipped adults are to manage information in digital environments, the Survey of Adult Skills (Box 2.4), a product of the OECD Programme for the International Assessment of Adult Competencies (PIAAC), includes an assessment of problem solving in technology-rich environments. This assessment measures adults' abilities to solve the types of problems they commonly face as ICT users in modern societies. The assessment includes problem-solving tasks that require the use of computer applications, such as e-mail, spreadsheets, word-processing applications and websites that adults often encounter in daily life. The survey also collects information on the frequency with which adults use different types of ICT applications, both at work and in their daily lives.

Chapter 3

Digital technologies in education

Education policies need to reflect the fact that computers and the Internet are increasingly ubiquitous in everyday lives. This chapter considers the potential and actual impact of information and communications technology (ICT) on teaching and learning. It finds that between 2003 and 2012, students across the world have gained greater access to computers at school, although the intensity and variety of use varies across countries. It examines the factors which encourage teachers to make more use of ICT in the classroom and what holds them back, and looks at teachers' ICT problem-solving skills in relation to their peers outside education. Finally, it considers whether investment in technology, or students' use of computers and the Internet, are related to improved educational outcomes.

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Integrating ICT in teaching and learning in schools

Computers and the Internet are increasingly part of the environment in which young adults grow and learn. Schools and education systems therefore need to reap the educational benefits of information and communications technology (ICT). Co-ordinated ICT policies are common at the school, district or national level. They help schools and teachers to keep abreast of the constant flow of technological novelty, and to manage the change and disruption that new tools may introduce.

There are several grounds for developing education policies that aim to embed ICT more deeply into schools and teachers' practices. First, as a tool, ICT devices and the Internet hold the promise of enhancing the (traditional) learning experiences of children and adolescents, and perhaps of acting as a catalyst for wider change, where such change is desired. Second, the widespread presence of ICT in society, used for everyday work and leisure activities, and the increasing number of goods and services whose production relies on ICT, create a demand for digital competencies, which are, arguably, best learned in context. Third, while learning with and about ICT may well take place outside of school, initial education can play a key role in ensuring that everyone can use these technologies and benefit from them, bridging the divide between rich and poor. Finally, school ICT policies may be based on the desire to reduce administrative and other costs. Where teacher shortages exist or can be expected, ICT policies may complement other actions taken to attract and retain teachers in the profession.

Information and communication technology can support and enhance learning. With access to computers and the Internet, students can search for information and acquire knowledge beyond what is available through teachers and textbooks. ICT also provide students with new ways to practise their skills – such as maintaining a personal webpage or online publication, programming computers, talking and listening to native speakers when learning a second language, and/or preparing a multimedia presentation, whether alone or as part of a remotely connected team. ICT devices bring together traditionally separated education media (books, writing, audio recordings, video recordings, databases, games, etc.), thus extending or integrating the range of time and places where learning can take place (Livingstone, 2011).

The widespread presence of ICT in everyday lives also creates a need for specific skills. At the very least, education can raise awareness in children and their families about the risks that they face on line and how to avoid them (OECD, 2012). As a dynamic and changing technology that requires its users to update their knowledge and skills frequently, ICT also invites the education sector to rethink the content and methods of teaching and learning. Users of ICT – as we all are today – often have to adjust to a new device or software or to new functions of their existing devices and applications. As a result, ICT users must learn, and unlearn, at a rapid pace. Only those who can direct this process of learning themselves, solving unfamiliar problems as they arise, will fully reap the benefits of a technology-rich world.

Chapter 4

The potential of technology-supported learning

As Chapter 3 showed, simply introducing digital technology into education for technology's sake does not materially improve results. Such whole-system reforms need to place teaching practice rather than technology in the driving seat. This chapter explores how innovative approaches to technology-supported learning can truly enhance education. It considers five models of how teaching can be supported by technology: 1) educational gaming, 2) online laboratories, 3) technology-enabled collaboration, 4) real-time formative assessment and 5) technological support for skills-based curricula, using examples from the Hewlett Packard Catalyst Initiative project.

It then considers other means by which technology can improve learning, whether in schools or for individuals: e-learning, where the web is to support learning; open educational resources, which provide customisable materials for teachers and learners; and new forms of online education, such as massive open online courses which potentially make education available to anyone, anywhere, at any time.

Chapter 5

Markets and innovation in the education industry

The private education resource industry is one potential source of innovation in the education sector. This chapter outlines the results from a study of the market structure of the education industry covering 14 countries. The chapter reports its findings on 1) the size of the market, segmented where possible by levels of education; 2) the number of firms and degree of market concentration; 3) the market leaders; and 4) the level of investment by those market leaders into research and development.

The chapter also considers how the information available about the education resources sector could be improved and the role of policy makers in encouraging greater innovation in the sector as part of a wider innovation strategy for education and training.

Chapter 6

Business-driven innovation in education

Innovation should offer the education sector the means to close the productivity gap by disseminating new tools as well as new practices, organisations and technology. This chapter considers why educational scientific research has done little to create a body of practical technical teaching know-how or improve practices in the classroom. It then uses patent data to analyse the state of technical innovation in the educational support market, and identifies the emergence of a specialised educational tools industry which may help to disseminate the results of scientific research into education. Although there are barriers to small innovative firms in the educational market, and patents can have a damaging effect on innovation within the classroom, it appears that the most promising markets for new educational tools lie outside the public school system – in tertiary education, corporate training and individuals undertaking lifelong learning.

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ANNEX A

Report from the 2015 Global Education Industry Summit, held in Helsinki on 19-20 October 2015

The following text provides a report, drafted by the general rapporteur and the session facilitators, of the discussions that took place at the first Global Education Industry Summit in Helsinki on 19-20 October 2015.

Summary

Discussion in each of the sessions was helpful in identifying challenges that could be addressed through collaboration between all of the parties associated with education and some of the solutions. At times different points of view highlighted tensions. Such tensions appeared, for example, where innovation reduced dependence on traditional teachers, possibly in a situation where there is limited supply of teachers pointed towards the importance of careful consideration of context.

The argument in support of analysis of context was also seen to be critical when considering taking a successful practice in one location and adopting it in another. As suggested at the summit, practice is not changed by having technology. It is not like fire. You can be warmed by simply standing next to a fire. Simply providing technology or making people aware of an innovative practice is unlikely to change anything. Greater care in management of change, perhaps through adoption of design thinking might hold greater likelihood of impact and points again to the importance of supporting communities and networks of practice to take practice forward.

Another tension lay in the tendency to view groups as homogenous. Students are students, teachers are teachers, commercial companies are commercial companies and policy makers are policy makers. Just as there seems to be increasing recognition of the benefits of personalisation for students' learning, so we should look at how to engage each of these other groups and the constraints or freedom within which they work. Those with solutions to promote, sell or share may still be excellent listeners and have the judgement to apply their creative thinking and experience to the learning challenge with which they are faced. Alternatively, they may be solely focused on their pre-prepared solution and be a less supportive party with which to collaborate. In similar ways, finding where teachers are in terms of the normal distribution curve of innovative thinking may indicate how likely they are to adopt and succeed with new ways of working and point towards the type of personal development appropriate to their circumstances.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where governments work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

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THE POWER OF DIGITAL TECHNOLOGIES AND SKILLS

OECD's Innovation Strategy calls upon all sectors in the economy and society to innovate in order to foster productivity, growth and well-being. Education systems are critically important for innovation through the development of skills that nurture new ideas and technologies. However, whereas digital technologies are profoundly changing the way we work, communicate and enjoy ourselves, the world of education and learning is not yet going through the same technology-driven innovation process as other sectors.

This report served as the background report to the second Global Education Industry Summit which was held on 26-27 September 2016. It discusses the available evidence on innovation in education, the impact of digital technologies on teaching and learning, the role of digital skills and the role of educational industries in the process of innovation. The report argues for smarter policies, involving all stakeholders, for innovation in education.

Contents

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