



INTERNATIONAL LABOUR ORGANIZATION
UNITED NATIONS EDUCATIONAL, SCIENTIFIC
AND CULTURAL ORGANIZATION



CEART/13/2018/3

Joint ILO–UNESCO Committee of Experts on the Application of the Recommendations concerning Teaching Personnel (CEART)

The future of work and the teaching profession

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Report submitted to the 13th Session of the Joint ILO–UNESCO Committee of Experts
on the Application of the Recommendations concerning Teaching Personnel (CEART)

Geneva, 2018



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The future of work and the teaching profession, by
Areum Jang and Christopher Weller

This report served as a background study for the 13th session of the Joint ILO/UNESCO Committee of Experts on the Application of the Recommendations concerning Teaching Personnel (CEART), held in Geneva, 1-5 October 2018.

Also available in French: *L'avenir du travail et la profession d'enseignant*

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Introduction

Education systems are understood to prepare students for both work and life in general. While much progress has been made in increasing enrolments in primary and secondary education, the data shows that many learners leave school unprepared for the modern and changing world of work. More than 387 million children of primary school age, or 56 per cent, are not achieving the minimum proficiency level in reading. At the same time, most adults in low- and middle-income countries do not have even basic computer skills (UNESCO, 2017a). Due to skills mismatches between what is learned in school and the demands of the labour market, many high school and university graduates have difficulty finding work following the completion of their studies.

Calls have been made for policies that better support education systems and that enable teachers to deliver quality education by taking into account factors that are reshaping both education and the teaching profession. Globalization, climate change, and technological and demographic trends are transforming the world of work and producing demands for different skill sets, and impacting education in general. These changes have produced a “future of work” anxiety, drawing attention to the question of how to educate children for work in the future, and prompting both a rethinking of current education practices and an exploration of new teaching–learning models.

This background paper focuses on the impact of new technologies on the teaching profession in the context of the future of work, and explores emerging skills needs, new pedagogical approaches, and the future management and governance of teachers. The paper aims to showcase trends and examples from all geographic regions; however, due to limited literature and research on the topic, it draws primarily from industrialized countries.

1. Background: Social, economic and technological trends

Technology is advancing at an unprecedented rate, affecting the way people both live and work. Automation, in particular, has raised concerns about “technological unemployment”. While unskilled labour is being displaced, the demand for labour that cannot be easily automated is growing. A 2016 report by the World Economic Forum noted that “65% of children entering primary school today will ultimately end up working in completely new job types that don’t yet exist” (p. 1). The pace of change will accelerate by the fusion of advanced intelligent information and communication technologies (ICTs), which blur the boundaries between physical, digital and biological spheres.

With the onset of the Fourth Industrial Revolution, employment in agriculture and manufacturing is likely to decline, whereas the services sector, including health care and education, is expected to expand. In this context, the question arises as to how to align student learning with the changing needs of society (United States Department of Labor, 2015).

Demographic shifts and migration are also impacting education systems, with some societies experiencing shrinking school-aged populations due to low birth rates, and others undergoing rapid population expansion. Due to conflict, climate change and economic strains, many people are migrating in search of better living conditions, with the number of international migrants expected to grow to around 400 million people by 2050. At the same time, large-scale urbanization is pulling potential students from rural areas and increasing the number of students in urban centres (Education Commission, 2018). Given these shifting demographics, education systems need to be better designed to cope with fluctuating student populations.

1.1. New forms of schooling

As education systems and teachers face more demands to incorporate technology into curricula, technology is also facilitating new forms of schooling that could potentially alleviate some of the challenges regarding both quality and quantity in education. New forms of schooling, with the advent of new technology, have gradually evolved and proliferated. In the United States, state virtual schools have significantly expanded since 1997. In the beginning, these schools were created to provide online learning opportunities for primary and secondary school students to supplement in-class instruction. Over time, they broadened their online learning services and management systems, allowing for extensive programmes and practices beyond the provision of supplemental online courses (Evergreen Education Group, 2016).

Online charter schools are tuition-free, independent public schools that utilize remote online instruction to provide full-time learning. The replacement of face-to-face learning through online charter schools has raised concerns due to limited interaction with teachers and the problem of verifying the authenticity of student work under unsupervised conditions. These concerns led to the creation of “hybrid” schools, which combine traditional schooling and online classes (Moe, 2012). For example, students can attend a physical school to interact with teachers and other students, study art and music and participate in sports, while also undertaking a large portion of their academic classes online.

1.2. The changing world of teachers' work

In order to prepare students for the digital world, teachers will need to be equipped with skills and knowledge in areas such as digital literacy¹ and computational thinking². The 11th Session of the Joint ILO–UNESCO Committee of Experts on the Application of the Recommendations concerning Teaching Personnel (CEART) noted that the profound changes brought about by digital technology require that teachers be capable of developing continuously through training and lifelong professional development, including by taking into account the new ways of learning for students in the digital age (ILO, 2012).

In addition to computational thinking, twenty-first century skills such as creativity and innovation, critical thinking, communication, collaboration, ICT and digital literacy, global awareness, and civic literacy are crucial for students living and working in a rapidly changing society. New innovative pedagogies require reformed curricula for teaching these skills. Teachers not only need to be equipped with computational thinking and twenty-first century skills, but also must identify how to teach these skills to students in the context of evolving learning expectations and needs.

¹ Digital literacy is often defined as “the ability to use information and communication technologies to find, understand, evaluate, create, and communicate digital information, an ability that requires both cognitive and technical skills” (Office for Information Technology Policy, 2013).

² Computational thinking is generally defined as the ability to use the concepts of computer science – abstraction, algorithm, automation, decomposition, debugging and generalization – to formulate and solve problems (European Commission, 2016a).

2. What teachers teach

2.1. Teaching skills for the future

Computational thinking and coding are increasingly being recognized as new basic skills necessary for employability and economic opportunity, and are now being taught as early as primary school. In some European countries, computational thinking is being integrated into compulsory education, and in the United States, the “Computer Science for All” initiative is introducing coding beginning at the primary level (European Commission, 2016a). In the Republic of Korea, for example, classroom robots have been implemented aggressively. While a decade ago they were used as teaching assistants, more recently, they have become a means to teach robotics and to support the teaching of programming, a compulsory subject in middle and high schools (Georges, 2017). Teaching coding and computational thinking beyond digital literacy used to be the exclusive domain of tertiary education, but is now present in both primary and secondary schools. In many countries, coding is now considered a foundational skill along with reading, writing and arithmetic. Teachers need to be trained and supported to teach these skills, including through the integration of computational thinking and coding into initial and continuing training programmes (European Commission, 2016b).

A variety of required skills for success in a rapidly changing digital society have been identified by experts and organizations. Partnership for 21st Century Learning identified three skill groups for success in the twenty-first century, known as twenty-first century skills: learning and innovation skills; information, media and technology skills; and life and career skills.¹ The International Initiative for Impact Evaluation (3ie) advanced the term “transferable skills”, which encapsulates soft skills, twenty-first century skills and life skills, including character skills, personality traits and non-cognitive skills (Brown, 2015). Tony Wagner (n.d.) proposed “Seven Survival Skills” for the modern workplace: critical thinking and problem solving; collaboration across networks and leading by influence; agility and adaptability; initiative and entrepreneurship; effective oral and written communication; accessing and analysing information; and curiosity and imagination. Wagner asserts that these skills are necessary to prepare students to be adaptable and resilient in taking on diverse roles in fields that are continuously evolving with ICT advancement.² Formal education has an obligation to support students to develop these skills, which are increasingly being integrated into curricula internationally (Care, Kim and Vista, 2017).

Computational thinking and coding provide an example of the current trend to integrate new technologies into education systems. The larger message is that education systems should be forward-looking and that teaching should be aligned with the future needs of society. While education is often considered an end in and of itself, there is little evidence to suggest that it will lead to economic returns unless it responds to changing labour market demands.

Beyond educating to provide job-specific skills, emphasis has also been placed on teaching how to learn, unlearn and relearn, as captured by the following quote: “Tomorrow’s illiterate will not be the man who can’t read; he will be the man who has not learned how to learn” (Toffler, 1970, p. 414). According to the psychologist Herbert Gerjuoy, “[t]he new education must teach the individual how to classify and reclassify information, how to evaluate its veracity, how to change categories when necessary, how to move from the

¹ For more information, see [Framework for 21st century learning](#).

² For more information, see [Tony Wagner’s Seven Survival Skills](#).

concrete to the abstract and back, how to look at problems from a new direction – how to teach himself” (Toffler, 1970, p. 414). In this context, developing lifelong learning competencies and capacities to adapt, learn, un-learn and re-learn will be key to designing learning goals and pathways (World Bank, 2018).

2.2. Regions without structural opportunities

Learning to respond to fast-changing environments is just as essential for those living without structural opportunities. Given the pace of change societies are experiencing, the World Bank (2018) identified adaptability – “the ability to respond to unexpected circumstances, and to un-learn and re-learn quickly” – as a key trait for success (p. 7). The development of adaptability requires a “combination of general cognitive, socio-emotional, and even job-specific skills” (p. 40). Technology is being used to aid in the teaching of socio-emotional skills, including in adulthood through online courses. The University of California, San Diego, for example, developed an interactive course on “Learning How to Learn”, which is offered via the online learning platform Coursera.

Though socio-emotional skills are rarely incorporated into school curricula, especially in developing countries, a recent study calls this absence into question. The study measured the impact of a government programme that teaches socio-emotional skills to schoolchildren in Peru. The research suggests that such skills are crucial for the quality of life of all citizens, as higher socio-emotional skills are linked with elevated long-term income potential, better health, more community engagement and increased happiness (IPA, n.d.).

To teach socio-emotional skills to a larger audience, improvements need to be made to curricula design, particularly in low-income countries and rural areas. Furthermore, since cognitive and socio-emotional skills are tied to labour market returns, there is a concern that failure to educate marginalized groups will lead to greater inequalities (World Bank, 2018).

3. How teachers teach

3.1. Student-centred learning

Célestin Freinet and Jean Piaget both emphasize the importance of aligning learners' interests with new pedagogies (Voulgre, 2015), and of placing learners' interests at the centre of learning activities. Piaget firmly expressed that doing so will draw out "voluntary effort" (Piaget, 1988, p. 96), and Freinet highlighted that it is one of the main techniques to learn in the most sustainable way (Freinet, 1992, p. 256).

Student-centred learning based on learners' interests is not a recent trend, but is gaining greater traction, particularly through educational technologies that provide students with tailored learning experiences at an individual pace. As a result of technological advancements, the role of teachers as knowledge transmitters may shift to that of one accompanying learners through the learning process, including by helping them to reach their own understanding of subject matter.

3.2. Constructivism, instructionism and technology use

Today's students, often referred to as Generation Z (those born after 1996), are digital natives that want to be actively engaged in the learning process (Barnes & Noble College, 2015). New teaching methods aligned with student-centred learning are making their way into the classroom, including the flipped classroom, project-based learning, playful learning and learning by making. Based on a constructivist learning approach, these methodologies commonly emphasize the role of teachers as facilitators.

This approach is in contrast with the instructionist learning approach, which places more emphasis on teaching than learning, as it considers learning to be receptive. Both of these learning approaches stress students' voluntary leading role in learning activities. According to Seymour Papert, co-creator of the Logo programming language, instructionism uses computers to do the instruction, which contributed to the idea of computer-aided instruction. Constructivists, on the other hand, see technology as a tool that enables learners to use and build on their knowledge, for example, to facilitate personalized projects.¹

Overall, instructionism sees technology as a means to enhance a teacher's ability to teach, while constructivism sees technology as a means for assisting learners to reach their personalized learning goals. Both of these learning approaches are in use, as technology is both enhancing the way teachers teach and enabling self-guided learning.

3.3. Pedagogy and learning

3.3.1. *New understandings of how we learn*

According to the Education Commission (2018), "the purpose of education and the skills that young people will need are changing, as is our understanding of how children's brains develop and how they best learn" (p. 71). Advancements in educational sciences, such as neuroscience and learning analytics, are helping both to better understand how we learn

¹ For more information, see [Constructionism vs. Instructionism – Part 1: Teaching vs. Learning](#).

and to tailor teaching to specific learners' needs. Neuroscience, for example, can identify characteristics associated with learning difficulties, such as dyscalculia or dyslexia, which can facilitate the development of learning interventions. Neuroscience research suggests that learning new concepts is a powerful motivator for further learning: "one of most powerful triggers that motivates people to learn is the illumination that comes with the grasp of new concepts" (OECD, 2008, p. 2). A pedagogy that focuses on activities that enable the learning of new concepts can create positive associations with learning from an early age.

The use of artificial intelligence (AI) and data analytics is becoming more prevalent in the management and monitoring of personalized learning (United Nations, 2018). A significant amount of information produced by education systems, including student attendance, performance and socio-economic background, and school population composition and instruction time, can be analysed through learning analytics to support student, teacher and school performance (Rabella, 2016).

Learning analytics is an emerging area that explores the measurement, collection, analysis and reporting of data, which is associated with students' learning and their environment (Park and Jo, 2015). Learning analytics software can work in real time to track and provide visualization and analysis of students' learning outcomes, which can help teachers monitor students' responses to curricula and teaching methods. This is useful for identifying when interventions are needed or supporting the improvement of teaching to enhance learning outcomes. The visualization of student performance can help students and parents make informed decisions (Rabella, 2016).

3.3.2. Using information and communication technologies

With the wide-ranging effects resulting from the fusion of intelligent information and communication technologies, such as AI, Big Data, robotics, Internet of Things, 3D printing and quantum computing, changes in the use of space and pedagogy for education are emerging (Kim, 2017). Wireless Internet provides students with access to knowledge from outside the classroom. Virtual reality devices provide immersive environments, while augmented reality enhances and complements real-world exploration. Students are increasingly interacting with teachers on digital textbooks and electronic blackboards through personal devices, as is the case in "Bring Your Own Device" classes.

This context has produced new forms of pedagogy, where the teacher delivers pre-prepared content via digital platforms and provides drill activities in an offline classroom, allowing students to both utilize what they learned online and communicate with peers and teachers. Distance and platform learning could address challenges related to the lack of printed textbooks and teachers in developing countries.

3.3.3. Teaching in different contexts for different groups

The Education Commission (2018) anticipates that the demand for teachers in developing countries will grow dramatically in the years ahead, and predicts that this demand is set to nearly double by 2030. Despite the proven benefit of mother-tongue instruction, more than 500 million primary and secondary schoolchildren, or half of all children in low- and middle-income countries, still do not receive education in their native language. This proportion is particularly elevated in sub-Saharan Africa, at over 90 per cent for all students, contributing to reduced learning outcomes that are more than 50 per cent lower than comparable countries in Asia and Latin America.

In this regard, technology is forecast to provide inclusive alternative education to marginalized and disadvantaged groups through new ways of learning and participating (United Nations, 2018). Dr Sugata Mitra, Professor of Educational Technology at Newcastle University, concretized this idea in his “School in the Cloud” project. With a Self-Organized Learning Environment (SOLE), students from around the world can share information and learn collaboratively through the Internet and online mentoring. A fluid team of e-mediators called “The Granny Cloud”, consisting of a wide range of ages and nationalities, interact with students in SOLEs to stimulate learning and build confidence.²

Another example of the educational benefits of ICT is the software program Native Voice (NatiV), which assists with learning how to read and write in indigenous languages. The use of ICT can help children learn their mother tongue with little supervision, as well as guarantee the preservation of dying minority languages (Mutamiri, Mugari and Brooking, 2015).

Despite the benefits of technology, digital inequality still remains a challenge in many developing countries. According to the International Telecommunication Union (ITU), only about 18 per cent of the population of the least developed countries were using the Internet in 2017 (ITU, 2017). The United Nations Broadband Commission aims to reach 75 per cent coverage worldwide by 2025, 65 per cent in developing countries and 35 per cent in least developed countries (ITU, 2018). It is not possible to access the benefits of technology without stable Internet connectivity and an Internet-capable device. It is essential that access to basic infrastructure be provided. Hence, Sustainable Development Goal (SDG) 4 on quality education is in part reliant upon developments in other SDGs, especially SDGs 5 (gender equality), 7 (affordable and clean energy), 9 (industry, innovation and infrastructure) and 17 (partnerships for the Goals) (United Nations, 2018). Extending access to new technologies could help with one of the greatest education challenges in the developing world: “to reach with quality educational opportunities the four hundred million students who live in poverty” (Smith, 2013, p. 154).

The impacts of the use of technologies in education will vary according to context. Any advantages of digital whiteboards in classrooms, for example, will largely depend on how teachers are able to use this technology to enhance student learning outcomes. For this type of technology to be useful, teachers require training and support over a period of time. Technology should be carefully selected and implemented so that it can: help meet learning goals or extend access to education; and provide sustainable, cost-effective solutions, taking into consideration the costs of implementation and teacher training.

² For more information, see [School in the Cloud](#).

4. The role of the teacher

The role of the teacher is changing in many ways in conjunction with the effects of new technologies. For some, this means taking on more responsibilities than before, while others experience a diversification of teaching into more specialized roles, in part through the use of technology. Educational technology has been developing at a rapid pace and is showing great potential to enhance both pedagogy and student learning experiences. This has led many to question whether teachers might be replaced in the near future.

4.1. Will technology replace teachers?

The debate on whether teachers will be replaced by robots is long-standing. According to an Oxford University study on the future of employment, compared to other professions, the teaching profession is unlikely to be computerized (Frey and Osborne, 2013). Conversely, others have argued that intelligent machines will replace teachers in the next decade (von Radowitz, 2017).

Both arguments have a common thread: that teachers' roles will have to change from the traditional "chalk and talk" model. The first sees teachers as facilitators and the second as assistants. In 2010, the Republic of Korea conducted a four-month pilot which involved the implementation of 29 robots in 21 elementary schools. The pilot aimed to improve English capacity through student interaction with robots. One perceived benefit was that students would feel less nervous practising drill activities with a robot rather than a native teacher due to concerns over being judged or evaluated. It was also expected to reduce the cost of hiring certified native teachers, as well as to facilitate remote support to teachers in provincial cities by telepresence, where a teacher can virtually present through a display mechanism. According to the Daegu City Education Office, if robots are improved and become more affordable, deploying more robots may be considered. At the same time, the Office emphasized that the use of robots was not intended to replace human teachers, but rather to engage children in the learning process and stimulate more interest (Jung, 2010). While it seems unlikely that teachers will be replaced by robots in the near future, it is likely that the roles of teachers will change. One view is that teachers may be asked to assume more specialized roles such as pedagogical engineers or digital pedagogical designers (ILO–UNESCO, 2015). Teachers will likely be increasingly assisted in their work by technology, and will rely more on technology to reach larger audiences.

With regard to the effects of technology on the roles of teachers, Trucano (2016) notes that while "introducing new technologies makes the jobs of teachers more important, more central to the learning process in many ways, it also makes teachers less central or integral (or even needed) to many of the activities currently associated with being a teacher in many parts of the world". This highlights the differentiated change of pace affecting the roles of teachers, redefining their roles in some areas and leaving other regions relatively untouched, which can be attributed, in part, to the uneven distribution of wealth and economic development, as well as the digital divide. This could also be due to the need to adjust teaching to best fit the learning needs of the students being taught.

4.2. Pastoral duties of teachers

Greater emphasis has been placed on pastoral care as one of teachers' non-teaching duties. Related to the evolving health and wellness needs of students, pastoral care generally comprises a range of support and services for students' emotional, psychological and spiritual well-being. It can be delivered by a teacher in a classroom or other educational staff, including school nurses, learning support coordinators, educational psychologists and

behaviour specialists. Given that smartphones and social media are now an integral part of the social landscape, there are concerns that higher levels of online activity will result in exposure to negative online interactions such as trolling (deliberately provocative messages on newsgroups or message boards) and bullying, which could have negative social and academic impacts.

A recent study of online risks among adults and teenagers found that 65 per cent of the respondents in 14 countries had been victims of at least one online risk, including trolling and online harassment. Young people were more likely to experience online violence such as cyberbullying, which can cause suffering both online and offline, leading to health problems including high stress and sleeping disorders (UNESCO, 2017b). In the context of economic decline, job insecurity, increasing inequality and a lack of financial optimism, those belonging to Generation Z in the United Kingdom are seeking mental health assistance more than previous generations due to severe anxiety (Valvano, 2018). The pressures associated with social media have been identified as one of the main factors in aggravating psychological issues. From this perspective, the provision of pastoral care becomes more significant, as it can contribute to positive self-esteem, healthy risk taking and resilience against stress.

4.3. Diversification of educational staff into specialized roles

Teachers are increasingly taking on a range of functions including specialized and non-teaching tasks, some of which could be handled by others with relevant training or experience. This is resulting in a diversification of educational staff into differentiated roles. The Education Commission (2018) recommends “diversify[ing] the composition of the education workforce to leverage teachers, reduce the time teachers spend on non-teaching activities, and improve and personalize learning” (p. 75).

Instead of teaching standardized curricula to classrooms of 30 students, teachers are becoming much more differentiated. Some teachers will teach online, others will oversee large numbers of students in computer labs, or will tutor students one-on-one. Some might also deal mainly with parents, while others will be in charge of educational software development. Other roles include designing digital pedagogy, curating educational content and collecting students’ learning behaviour data. The traditional uniformity of teaching is increasingly characterized by a more segmented division of labour (Moe, 2012).

5. Career of a teacher

While many teachers choose teaching as a career for life, there is a high degree of turnover, partly due to deteriorating working conditions. Education is increasingly being viewed as a market good and is increasingly being managed like a business, leading to cost-saving reforms. A major challenge to staffing classrooms with highly talented and qualified teaching staff is “making teaching an attractive profession with career opportunities” (Natale et al., 2013, p. 3). Understanding the factors that influence teacher retention and attrition could help to increase the supply of qualified and talented teachers. This section examines issues shaping the current careers of teachers and the possible impacts of new technologies on teacher training, recruitment, deployment, assessment and working conditions.

Teacher migration and demographic shifts represent major challenges for the education sector, with implications for teachers in terms of labour supply and working conditions.

5.1. Current scenarios

5.1.1. Teacher migration

Teacher migration is one solution for balancing the supply and demand for qualified teachers in several countries, including Ethiopia and the United States. In the United States, shortages of science, technology, engineering and mathematics (STEM) teachers have led many school districts to hire teachers from other countries, including India, Jamaica and the Philippines (Craft, 2018; Niiler, 2011). Ethiopia has been recruiting maths and science teachers from India, and hundreds of university instructors from Nigeria (UNESCO–IICBA, 2010, p. 2). According to Penson and Yonemura (2012), South–South migration has also gained in importance, with many teachers being forced to migrate due to conflicts and environmental stresses, among other factors.

Additional motivations for migration include opportunities for financial benefit and professional development. Hiring teachers from other countries may provide a solution to local teacher shortages and/or the means to staff hard-to-fill positions, and may also offer cultural benefits. Hiring such teachers may serve as a cost-saving measure, particularly through the use of fixed-term contracts.

The practice of recruiting teachers from foreign countries has received scrutiny from both parents and teachers. First, it increases non-union hires, and second, it is seen as a means to avoid addressing the root causes of teacher shortages, specifically poor wages and working conditions. Teacher migration can also lead to a lack of qualified teachers in developing countries, as they are drawn to developed countries that offer better incentives (Craft, 2018).

Efforts are being focused on this issue of teacher “brain drain”. The Commonwealth of Nations adopted the Commonwealth Teacher Recruitment Protocol (CTRP) in 2004 due to concerns, mainly from small States, of losing teachers to recruitment from other countries. The Protocol was developed to minimize the negative effects of teacher migration while harnessing its positive impacts, and is widely recognized as an example of good practice both within and outside the Commonwealth (Penson and Yonemura, 2012).

The OECD (2017a) encourages education systems to hire a diversity of leaders and teachers to more closely reflect the diversity of student populations.

5.1.2. Demographic changes

Current demographic trends could have important implications for teachers. On the one hand, the overall student-aged population is declining due to low birth rates in most developed countries (United Nations, 2018). On the other hand, there is a population explosion in developing countries. This creates different types of challenges for education systems. For example, in the Republic of Korea, when faced with a decreasing student-aged population, the Government decided to revamp their national tertiary education system to attract students from other countries. In 2017, South Korean universities experienced record-high growth in international student numbers, with Chinese students accounting for the largest proportion (Kennedy, 2018).

Given that the demand for education in low-income countries could nearly double by 2030, the Education Commission (2018) stresses the importance of innovation for meeting this future demand. Based on current projections, the Commission estimates that less than one in ten young people in low-income countries will be on track to gain minimum secondary school-level skills. The United Nations (2018) states that in Africa, “the challenge will be to deliver relevant quality education to even greater numbers of children of school age”, whose numbers will continue to increase beyond 2030 (p. 2). This presents a challenge for recruiting and training sufficient numbers of quality teachers.

5.2. Current challenges and possible future scenarios

Innovative solutions are needed to address concerns over future trends facing education systems and teachers. This section focuses on how technology could be utilized to both improve and extend the provision of education, and explores possible future scenarios for a diversified teaching workforce.

There is a strong push to increase the use of technology inside and outside classrooms. According to a recent meta-analysis of school-based learning interventions in low- and middle-income countries, using computers or computer-assisted learning was among the interventions that had the greatest impact on educational outcomes (World Bank, 2018). Outside classrooms, education management information systems, platform and blended learning could help increase access to education, reduce in-class instruction time per pupil and improve quality.

One possible method for balancing the divergent demographic shifts is through digital migration – extending remote teaching services to regions with a demand for qualified teachers. Digital migration could also create and strengthen networks and opportunities for knowledge sharing between countries. This type of remote arrangement already exists, albeit on a small scale, enabled by the use of ICTs. One example of such an arrangement is the “School in the Cloud”, and another is VIPKID, which connects 200,000 students in China with 30,000 teachers in the United States and Canada “for real-time, one-to-one English learning classes” (World Bank, 2018, p. 97).

The diversification of teaching staff through a division of tasks between teaching and non-teaching roles, as well as through a more hierarchical structure that affords greater upward mobility, could foster a more productive and incentivized education workforce. The United Nations (2018) envisions a more productive division of labour through the redistribution of teachers’ non-teaching tasks to clerical staff trained in the use of administrative software. Many of the time-consuming, repetitive tasks could be handled by computers, providing teachers with more time to focus on other tasks, “particularly with respect to the psycho-social dimensions of learning” (p. 4). It has been predicted that there will be a diversification of teaching staff in the United States to cater to the increasing number of students attending hybrid schools with instruction both in class and online. This

would involve a mix of both teaching and non-teaching staff fulfilling specialized functions, such as teaching online, overseeing large numbers of students in computer labs, tutoring one-on-one, or communicating with parents (Moe, 2012).

Providing more opportunities for upward mobility for teachers may become common practice, as this could encourage teachers to perform better and help to attract, motivate and retain educational staff. The flat career path of teachers results in attrition, with limited opportunities for advancement primarily involving administrative roles outside the classroom. To address this, developing sustainable career pathways that appeal to new graduates is recommended (Natale et al., 2013).

One drawback of a more diversified hierarchical structure for educational staff is reduced collective bargaining power for teachers. Such a differentiated group may not be as easily represented by unions and may not have as unified a voice as those that hold the same or similar functions. This diversification could also add a level of complexity to the training of specialized teaching and non-teaching staff. In this regard, care should be taken to ensure that such transformations do not negatively impact the working conditions of educational staff and, by extension, the learning outcomes of students.

5.3. Teacher training on ICT competency

Despite the need to use technology to make teaching meaningful to today's students, professional development is still lacking across much of the world. According to UNESCO (2016), “[t]eachers’ use of ICT to actually innovate teaching is an exception rather than the norm” (p. v). Recognizing the difficulties in developing teacher ability to teach with ICTs, Gwang-Jo Kim, former Director of UNESCO Asia and Pacific Regional Bureau for Education, noted that “more often than not, teachers’ actual use of ICT in the classroom is reported as incremental, merely reinforcing traditional teacher-centred approaches by using slides and drill-and-practice exercises” (p. v).

Quality teaching depends on teachers’ continued learning “as teaching contexts, pupil behaviour and expectation of teachers change” (Eraut quoted in Dembélé and Miaro-II, 2013, p. 11). Given that digital skills are vital for both teachers and students, training on how to incorporate technology into learning is critical to maintain the relevance of teaching. Pre- and in-service training on the use of ICTs can empower teachers to teach or nurture the acquisition of digital skills (United Nations, 2018).

Technological competency is not only useful for teaching digital skills, but can also facilitate teacher training by providing teaching and learning resources and networking opportunities. The adoption of collaborative open educational resources by Indian schoolteachers, for example, helped to strengthen the ability to teach with technology and to collaborate with colleagues through technology (Kasinathan and Ranganathan, 2017). Technology can also enable teachers to pursue self-guided learning. The Khan Academy, for example, can be used to reinforce concepts not fully familiar to teachers, such as those in maths and science. Pilot studies in England that used software to film and analyse the classroom have reported positive findings for teachers, namely that the software’s video coaching encourages self-reflection and helps teachers to enhance their teaching (Rogers, 2018).

A recent study of schoolteachers in Madrid, Spain, revealed that teachers have low skills for developing learning activities through ICTs, far below identified optimal levels. One reason for this is the difficulty in aligning training with the rapid development of ICTs, along with the uneven implementation of new technologies (Fernández-Cruz and Fernández Díaz, 2016). In this regard, UNESCO created an internationally recognized ICT Competency Framework to guide teacher training in the use of ICTs. In a pilot programme in Kenya and

the United Republic of Tanzania, teacher training that was based on this Framework and provided primarily via e-learning and m-learning platforms, enabled teachers to meaningfully use ICTs in support of their STEM teaching and learning (UNESCO, 2016).

For training to be effective, teachers need to develop ownership over new technologies (United Nations, 2018). According to UNESCO (2016), successful integration of ICT pedagogy is compromised when training is done sporadically; instead, a systematic approach with adequate monitoring and assessment of teacher development is required. In this context, teachers should undergo pre-service and in-service training on ICTs to support aligning teaching with the changing needs of society.

5.4. Non-traditional forms of recruitment and deployment

Teachers need to be prepared to adapt to new forms of schooling and to set up strategies for non-traditional forms of recruitment supported by technology such as social media. In new forms of schooling such as online and blended schools, recruitment and deployment of educational staff will differ from traditional models. Online schooling models leverage limited teaching talent by freeing up teachers' time while students are learning digitally, and by enabling teachers to reach students remotely using technology (Ableidinger and Hassel, 2012). For online schools, teachers can be hired beyond geographic restrictions and can accept non-standard employment arrangements, such as working part time or from home. Teachers at online schools could experience higher student-to-teacher ratios due to the capacity to deliver lectures to very large class sizes, which could reduce demand for teachers. The different teaching and learning environment of online schools raises considerations about the kinds of non-traditional professional development that will be needed to support this context (Pazhouh, Lake and Miller, 2015).

Teachers must adapt to new recruitment processes, which are being diversified through school websites and social media platforms (Facebook, LinkedIn, Twitter, Google+). The advertising of positions is extending beyond traditional channels including through the use of social media and e-newsletters targeting local community groups (Rogers, 2018). Those using social networks can make contacts within school districts and schools, and connect directly with recruiters and hiring managers. To stay competitive and gain information about available positions, teachers might need to be active online and maintain updated profiles on different social media platforms.¹

5.5. Teacher attrition and retention

Working conditions are shown to be positively linked to teacher satisfaction and retention. Favourable working conditions such as up-to-date facilities with advanced technology can facilitate teacher recruitment, motivation and retention. Conversely, unfavourable conditions such as short-term contracts and limited opportunities for upward mobility are linked to teacher dissatisfaction. While many developing countries experience challenges in finding and training qualified teachers, in many developed countries, there exists a surplus of qualified teachers. Nonetheless, recruiting and retaining these teachers remains a challenge due to competition from other more attractive professions. The perception of poor working conditions for teachers is a major deterrent to joining the profession (Asthana and Boycott-Owen, 2018).

¹ For more information, see: A+ Resumes for Teachers: *Social media networking tips to propel your job search forward* (n.d.).

Technology infrastructure in schools can be positively linked to teacher satisfaction and retention by helping teachers to teach better and to expedite administrative tasks, thereby reducing stress (Rogers, 2018). One study in the United States revealed that advanced technology resources in rural schools had a positive effect on teacher retention by fostering a sense of school pride (Cowan, 2010).

For more established teachers, the horizontal career structure can be discouraging. A lack of upward mobility could partly explain why mid-career teachers often experience burnout, stress and dissatisfaction (Natale et al., 2013). In England and Wales, the School Teachers' Review Body (2017) attributes high rates of teacher attrition and a difficulty to hire qualified teachers to low teacher incentives, which are not as competitive with other professions.

The use of non-standard, potentially precarious contracts can negatively impact the hiring and retention of new teachers. Temporary contracts can reduce teacher motivation to invest in career development and to establish themselves in the school community. It could also discourage teachers by reducing access to professional support and prospects for career advancement. In New Zealand, for example, the proportion of new teachers hired on non-permanent contracts reached 71 per cent in 2015. When new teachers are hired under several fixed-term contracts in a row, their chances of leaving the teaching profession increase, given that these conditions create psychosocial and economic risks (PPTA, 2016). This suggests that unstable working conditions are a major factor leading to teacher dissatisfaction.

In order to improve teacher recruitment and retention, steps need to be taken to make the profession more attractive and fulfilling. This would involve identifying both positive and negative aspects of the profession and adjusting the work of teachers accordingly.

5.6. Gender imbalances in the teaching profession

A gender imbalance in the teaching profession is problematic since gender ratios can affect the status of the profession and encourage gender stereotyping. This can contribute to further imbalances and constrain the supply of qualified teachers. Professions where women represent the majority often offer lower pay and hold less prestige as compared to those of men (Rich, 2014).

Globally, the percentage of women in the teaching profession reached 68 per cent in 2014, with greater gender imbalance in pre-primary and primary education (OECD, 2017b). In African countries, the reverse is the case, as women are less represented in the teaching profession than men. This is particularly so in West Africa, where in 2011, women accounted for 20 per cent or less of primary-school educators, including in the Central African Republic, Liberia and Togo (Wong, 2015). A more gender balanced workforce could help raise the status of teachers in many countries and address staffing issues.

5.7. Assessment of teachers

Teacher assessment usually takes either a formative or summative form. Formative assessment is focused on identifying the strengths and weaknesses of teachers and addressing them through training. Summative assessment is more focused on accountability and can be linked to career and salary outcomes. Many teachers find performance appraisals to be beneficial and supportive of their development. Proper monitoring and evaluation of teaching leads to the continuous improvement of teacher effectiveness (OECD, 2009).

Some concerns surround current assessment practices, with one such tension stemming from the tying of assessment to teacher remuneration and advancement. In England, in 2017, teacher unions warned of an “epidemic of stress” due to high instances of long-term sick leave caused by work pressure, anxiety and mental illness. The stress was linked to heavier workloads and the pressure created by a punitive and unproductive assessment system (Asthana and Boycott-Owen, 2018). Such assessment is even more controversial when student performance data is included. For example, in the United States, teachers in the State of Delaware cannot earn a positive rating “unless their students demonstrate satisfactory levels of learning growth” (OECD, 2011, p. 81). When confronted with an evaluation that is consequential to their salary and career, teachers are less inclined to reveal weaknesses, which undermines the improvement function of evaluation tools. The OECD (2009) indicates that systems with a strong emphasis on accountability elevate tensions and “may in some instances lead teachers to feel insecure or fearful” (p. 8).

There is also concern over new technologies that are facilitating the monitoring and assessment of teacher performance. Some software can award aggregate overall scores for assessing and ranking teachers.² On the one hand, the use of user-friendly dashboards to easily visualize data can enable teachers to better monitor and assess their own progress. This could greatly streamline the monitoring and assessment process and allow for more constructive feedback from leadership, which could produce more personalized professional development. On the other hand, there are concerns about the ability of software to objectively evaluate teachers. In this regard, careful consideration based on research and dialogue between teachers and leadership could inform decisions about the best approaches to teacher assessment using technology.

5.8. Psychosocial risks attached to new technologies

New software can assist with much of the tedious and repetitive administrative work of teaching, such as providing feedback and creating reports for parents (United Nations, 2018; Trucano, 2016). There is a shared vision that technology will help teachers focus more time on teaching: “[t]ools that reduce the time teachers spend on administrative tasks also help free them up to teach”. (Education Commission, 2018, p. 66). The Stanford Mobile Inquiry-based Learning Environment platform, for example, reduces some of the burdens of teaching in real time. The United Nations (2018) projects that “[n]ew approaches to the collection, dissemination and analysis of data” will both improve monitoring and assessment and reduce the administrative workloads (p. 4).

Although technology can be beneficial to the work of teachers, for example, by promoting collaboration among colleagues, allowing for the sharing of resources through online communities, or reducing time on administrative tasks, technology can also expose teachers to certain psychosocial risks. Some risk factors include overwork, reduced autonomy and privacy, an “always-on” working environment, work insecurity and work intensification (ILO, 2016 and 2017).

Being connected with parents and/or students on social network services can constitute an invasion of teacher privacy and extend work outside of regular working hours. Teachers often find it difficult to balance work and private life when constantly in contact with parents, students and other teaching staff. They must always be ready not only to address student questions and act as counsellors, but also to handle complaints, inquiries and demands from parents.

² For an example of such software, see *Instructional effectiveness: Your partner in promoting educator expertise and student success*, Galileo K-12 online, Assessment Technology Incorporated.

Teachers on temporary contracts may also experience aggravated psychosocial risk (ILO, 2016). Since teachers in these positions often lack trade union representation, they generally have less capacity to ensure their health and safety in the workplace.

Technology is changing the teaching profession dramatically, with both positive and negative effects. It is empowering both teachers and students to perform their work better and more efficiently, while also exposing teachers to greater levels of assessment and stress than in the past. Teachers are facing demands to integrate new technologies into their teaching, as well as to learn how to teach twenty-first century skills to students with evolving learning demands in a rapidly changing society.

6. Future governance

This section examines aspects of education system governance, including effective monitoring, assessment and distribution of resources and staff, community involvement, new trends in technology use and the privatization of education services. It also looks at possible new forms of governance for adapting to these changes.

6.1. Monitoring and assessment

The effective monitoring and assessment of an education system is crucial for its performance, but is not a well-established practice. According to the World Bank (2018), “[m]easurement enables policymakers to design more effective, context-specific solutions” (p. 35). Despite potential benefits, only one of six governments publish annual education monitoring reports. While monitoring can improve the deployment and tracking of teachers and reduce the mismanagement of resources, only one half of countries publish data about government spending on education (Education Commission, 2018). In India, for example, improvements to the monitoring of teachers was “10 times more cost effective at reducing student–teacher ratios and improving contact time than hiring more teachers” (p. 66). Assessment of student performance at school, regional and national levels can help to facilitate the regulation and improvement of education systems, which allows leaders to “target efforts and resources where they are most needed” (p. 17). The majority of students in the developing world, however, do not undergo systematic testing.

6.1.1. Enhanced monitoring through technology

Technology enables the enhanced monitoring of both performance management and accounting practices in education systems, which may contribute to improving learning outcomes. For effective use, adequate professional development regarding new technologies and methods of monitoring and assessment is needed. The Education Commission (2018) reports that an Android-based application in India’s VISHWAS program facilitated online reporting by inspectors, allowing them to track and report data from their smartphones, such as attendance, learning materials and accounting.

Another area where monitoring could be reinforced is in the use of technology for accounting practices. Reliable education management information systems can track resource spending and facilitate budgeting, effectively minimizing waste and freeing up resources. In Bogotá, Colombia, for example, through sound financial management, the city successfully increased enrolments by 37 per cent without augmenting spending. Ghana also improved resource and teacher allocations by using information technology to map all secondary schools for better tracking (Education Commission, 2018).

Technology can also enable school leadership to reach out to the public to improve monitoring. Civil society involvement enabled by the Internet has been shown to increase accountability and help reduce corruption and waste. Increasing transparency and garnering community involvement can enhance community oversight. In order to root out ghost teachers, local organizations in Honduras worked with parents and volunteers to cross-check the names of teachers recorded as collecting salaries by posting their information online. Their work helped uncover that 26 per cent of teachers listed were not present at their post, and thereby reduced instances of ghost teachers to below 1 per cent (Education Commission, 2018). Even without sophisticated technologies, communities can be powerful watchdogs, as evidenced by the *Educación con Participación de la Comunidad* (EDUCO) project in El Salvador. By relying on community involvement, this project was found to be more effective “than monitoring by other school professionals or self-reporting” (p. 66).

6.1.2. Monitoring non-traditional schools

The governance of new forms of non-traditional schools that do not exist in “brick and mortar” structures requires reflection on effective monitoring and assessment methods. Difficulties include: how to properly oversee online schools when traditional “walkthrough” inspections are not possible; and how to fairly assess schools if students only attend for part of the year. Overall, the key question is that of accountability – how to guarantee that public spending is used appropriately in online schools (Pazhouh, Lake and Miller, 2015).

It is also necessary to have monitoring systems for new forms of education, where rules are not well established. Regarding teacher certification in online schools in the United States, provisions now in place were generally lacking until being implemented in the form of “concessions to labor groups or in response to scandals” (Pazhouh, Lake and Miller, 2015). A more active approach to education policy would anticipate weaknesses and establish safeguards.

6.2. New public–private partnerships

Public–private partnerships can help governments reach their education goals. The Education Commission (2018) recommends reaching out to non-state actors including the private sector to help expand and improve education. The Commission views public–private partnerships as a means to connect all schools by 2030. This type of partnership, enabled by “universal service funds”, has already helped to extend network connections in several countries through licensing agreements with Internet providers, including in Portugal, Senegal, South Africa and Tunisia.

For governments to regulate partnerships effectively, proper monitoring needs to be in place to ensure both transparency and accountability. There is a need for greater transparency and a clearer understanding of what services are being privatized by public schools to increase accountability (Hogan and Thompson, 2017). The trend in privatization with its various forms of partnerships can allow actors to replace “democratic processes with technical or market solutions”, facilitating “the privatisation of decision-making” (Ball, 2007, p. 9). Transparency is key to reducing the chances of decisions being made on business interests without civil society being well informed (Hogan and Thompson, 2017). Private providers focusing primarily on short-term gains in the education sector fundamentally distort the mission of education and introduce “troubling assumptions ... about teachers and teaching” (Hargreaves and Fullan, 2013, p. 36).

This concern for transparency is especially relevant as global for-profit players expand their involvement in education, particularly in the Global South where private companies have government contracts to provide for-profit education. This signifies “a radical restructuring of what constitutes the ‘public’ in public education” (Hogan and Thompson, 2017, p. 16). Focusing on profits rather than on quality of services being provided is a growing concern. It raises questions about the quality of learning taking place, and can lead to poor working conditions and practices, including the hiring of uncertified teachers under precarious contracts with little or no professional development.

6.3. Professionalization or deprofessionalization

Teachers play a central role in preparing young people for the world of work and life in general, and as such their professionalization or deprofessionalization remains a major societal concern. In fact, while some support more professionalized and highly trained staff, others see benefits in tendencies toward deprofessionalization.

Regarding support for the professionalization of teachers, the OECD (2009) states, “[r]aising teaching performance is perhaps the policy direction most likely to lead to substantial gains in student learning” (p. 3). A subsequent OECD (2011) publication attests that “[b]uilding a highly skilled professional educator workforce is central to a country’s ability to improve the outcomes of schooling for its young people” (p. 80). More recently, the World Bank (2018) added that teacher quality is an even more important determinant for primary school student achievement in low- and middle-income countries than in high-income countries. In addition, Hargreaves and Fullan (2013) claim that “professional capital practices” will enable societies to reap “rewards of economic productivity and social cohesion in the next generation” (p. 36).

While professionalization may offer advantages in terms of incentives, status and the professional development of teachers, its benefits for students have been questioned. The overall argument against professional development includes that the limited resources allocated to education could be used more efficiently on, for example, infrastructure, online learning platforms and smaller class sizes (Hoyle and Megarry, 2012). Reducing teaching costs, “education’s greatest expense”, offers a means to improve short-term efficiency (Hargreaves and Fullan, 2013, p. 36).

The market-driven style management of education systems, including efficiency practices, could be another factor leading to the deprofessionalization of teachers. This is attributed to three main forces: evaluation of teachers based on students’ standardized test scores; quick pathways to teaching licences; and predefined and narrow curricula. The first two facilitate easy hiring and firing of teachers, and the third, while helpful to novice teachers, is discouraging to ones with more experience (Mathis and Welner, 2015, p. 3).

Market forces alone are not adequate to define the working conditions and incentives of the teaching profession. To improve standards for teachers, communication between stakeholders offers a promising approach. Social dialogue, supported by well-documented research on how the professionalization of teachers impacts education systems, should be part of a joint mechanism for setting the degree of teacher professionalization.

6.4. Collective organizing and collective bargaining

Teachers’ right to associate, collectively bargain and otherwise exercise meaningful voice vary widely across the world and, in some countries, have deteriorated with the implementation of austerity measures following the 2008 financial crisis. Unionization and collective bargaining offer mechanisms for teachers to address and improve conditions of their work. In Gambia, for example, the teachers’ union reached an agreement with the Government that allowed teachers to receive their salaries directly through a cooperative credit union in order to avoid commuting to urban centres to be paid (Education Commission, 2018).

The diversification and fragmentation of teachers resulting from technology-supported pedagogy may change the way work is organized and performed, making it much more difficult for teachers’ unions to organize and collectively bargain. Technology is changing the governance of education, with Megill (2015) suggesting that education systems “will look less like a 1910 auto factory and more like Uber or Airbnb”. Teachers’ unions need to adapt to this changing context or face the risk of declining union power.

The capacity to adapt to the changing context of education is illustrated by the case at California Virtual Academies (CAVA), one of the largest online public charter schools in the United States. In April 2018, California Virtual Educators United, which represents CAVA instructors across the State, reached their first collective agreement with CAVA. The process faced many challenges, as captured by CAVA teacher and union President:

“Organizing teachers in a workplace where we don’t see our peers and where the bargaining unit stretches across a state as large as California isn’t easy and even less easy establishing a precedent-setting agreement” (CTA, 2018). Despite limited opportunities to engage in face-to-face organizing, the teachers managed to form an organizing team and reach out to approximately 750 colleagues across California via Facebook. This social network contributed to building solidarity, demonstrating how virtual tools can offer potential for educators to organize. This example suggests that new forms of collective organizing and bargaining are possible when innovative strategies are undertaken.

Conclusion

Some of the trends highlighted in this paper with respect to the teaching profession and technology include: new forms of schooling and emerging pedagogies; teacher shortages and migration; diversification of educational staff; increasing use of temporary contracts; low retention of teachers; and new forms of organizing and collective bargaining. Technology has a great deal of potential to transform education and it is becoming increasingly important for teachers to incorporate technology into their work. It is currently unclear as to how much should be invested into technology and the professional development of teachers to use this technology. Questions to be considered by experts when designing future education policy include:

1. What new approaches to education are needed to reduce inequalities resulting from the technological divide?
2. How can social dialogue be implemented to better align education with the needs of all stakeholders?
3. How can technology be used to improve working conditions in the teaching profession to attract and retain qualified personnel?
4. What kinds of resources and forms of professional development do teachers need to better integrate new technologies into their work?
5. How can social partners work collectively to address the psychosocial challenges facing teachers in technologically intensive environments, both inside and outside of classrooms?
6. How can the ILO and the international community support new forms of teacher organizing brought about by transformations in teaching due to new technologies?

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