

The Learning Challenge in the 21st Century

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Abstract

Truth matters, and the norms associated with a democratic society, such as the common good, responsibility, ethics, and civic engagement, are under attack with the emergence of the post-truth society. There are concerns worldwide that public education is failing us on pushing back on disinformation. And, in most countries, education systems are not providing workers with the skills necessary to compete in today's job markets. The growing mismatch between demand and supply of skills holds back economic growth and undermines opportunity. At same time, the financial returns to schooling are high in most countries. Schooling

remains a good economic and social investment, and there are record numbers of children in school today. The skills that matter in the coming technological revolution are likely the same as what is needed in a media environment of disinformation. More and better education and noncognitive skills will not only prepare students for the future world of work, they will also prepare them to navigate the increasingly complex post-truth society. They will also allow young people to gain trust. In other words, better education is democratizing, to the extent that it promotes truth, values, and civic engagement.

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Introduction

Truth matters, and the norms associated with a democratic society, such as the common good, responsibility, ethics and civic engagement are under attack with the emergence of the post-truth society. There are concerns worldwide that public education is failing us on pushing back on disinformation. Schools are not seen as developing skills that permit students to adequately differentiate truth from non-truths.

The education system also faces some unprecedented challenges. The quality of education in most of the world is low, and only slowly improving. Also, future workers are concerned with automation's threat – or perceived threat – to jobs. In most countries, education systems are not providing workers with the skills necessary to compete in today's job markets. The growing mismatch between demand and supply of skills holds back economic growth and undermines opportunity. At same time, the financial returns to schooling are high in most countries, and growing skill premiums are evident in much of the world. Schooling remains a good economic and social investment and there are record numbers of children in school today.

The skills that matter in the coming technological revolution are likely the same as what is needed in a media environment of disinformation. More and better education, and non-cognitive skills, will not only prepare students for the future world of work; they will also prepare them to navigate the increasingly complex post-truth society. They will be able to detect fake news – or deliberate disinformation spread through news or online media. It will also allow young people to gain trust. In other words, better education is democratizing, to the extent that it promotes truth, values and civic engagement.

The Challenge

The 20th century, and especially the last half, was an education revolution. There are more people in school today than ever before. We will soon reach convergence on years of schooling in the coming decades. Yet, in nearly all countries, to varying degrees, educational progress has lagged for groups that are disadvantaged due to low income, gender, disability or ethnic and/or linguistic affiliation. In 1950, the average level of schooling was 6 years in advanced countries; it is more than 10 years today. It was less than 2 years in Africa in 1950; it is more than 5 years today. East Asia went from 2 to 7 years between 1950 and 2010: this is a more than 200 percent increase. Globally, in 1900 the average level of education was less than 2 years of schooling; it was still only 2 years by 1950; but it increased to more than 7 years by 2000 and it is projected to reach 10 years by 2050. This is a more than five-fold increase in a century and a half (Barro and Lee 2013).

There are many benefits to investing in education. They include social benefits. They also include economic or financial benefits. One very concrete and comparable, as well as measurable, benefit is the wage impact. That is, as one completes more years of schooling or earns a degree or certificate, her earnings increase relative to what they would have been without that investment. And since we forego earnings in order to study, one can say we are investing in ourselves. As we know, an investment can result in a financial rate of return (just like investing in anything else, such as the stock market, bonds, housing and so on). In fact, it is estimated that every year of schooling raises earnings by 10 percent a year over a lifetime (Psacharopoulos and Patrinos 2018).

A university degree has a rate of return of 15 percent. These are truly high returns and they have remained high over time. They are high during periods of economic growth as wages rise. They are high during periods of financial distress when foregone earnings are lower.

Despite the revolution in access to school, there is still an enrollment problem. According to UNESCO (<http://uis.unesco.org/en/topic/out-school-children-and-youth>), there were more than 258 million children and youth out of school for the school year ending in 2018. The total includes 59 million children of primary school age, 62 million of lower secondary school age and 138 million of upper secondary age.

Even more importantly, there are another 260 million children in school but who cannot read (UNESCO). This is particularly worrying. Also, according to UNESCO, 1 in 4 young people in developing countries are unable to read. The World Bank recently released its Learning Poverty estimates (<https://www.worldbank.org/en/topic/education/brief/learning-poverty>). Learning poverty means being unable to read and understand a simple text by age 10. It is estimated that more than half of the world's 10-year-olds are in learning poverty. The World Bank has also estimated the gaps in learning outcomes between countries and regions of the world as part of its Human Capital Project. The harmonized learning outcomes show the gap between highest performers in the world (in East Asia, Europe and North America) and the lowest performers (mostly low-income countries) to be 2 to 3 standard deviations (Patrinos and Angrist 2018). While these are technical terms, they mean that almost the entirety of low-income countries' education outcomes are eliminated once the quality of learning is considered. In other words, there is not much learning taking place in low-income developing countries (Angrist et al 2019). The situation is only slightly better in middle-income countries.

We are also seeing a shift in the demand for skills. The types of skills being demanded are changing. There is more demand now for analytic and non-routine skills, and less demand for manual skills. In other words, the skills demanded are more complex. This puts a premium on learning (Autor, Levy and Murnane 2003; Autor and Price 2013). It is also found that the labor market is increasingly rewarding social skills; that is, jobs requiring high levels of social interaction. Employment and wage growth were particularly strong for jobs requiring high levels in both math skill and social skills. This is because in a world where machines will undertake more of the routine skills, there will be a premium for social skills that reduce coordination costs and allow workers to work together more efficiently (Deming 2017). Higher social skills lead to higher wages because they reduce the cost of trading tasks with other workers, allowing one to specialize in their most productive tasks and trade output with others. Thus, there is a premium to team-based work and team work, all made easier with social skills.

This is a reversal from what occurred during most of the twentieth century. As countries built their education systems and the population received more schooling, the economic benefits were realized. These included national economic growth and private returns to schooling. The increases in schooling levels also promoted equity as wage gaps declined. This occurred when the increase of educated workers was higher than the demand for them. This had the effect of boosting income for most people and lowering inequality. An influential summary of the state of the art concluded that "higher average levels of schooling exert an equalizing effect on income distribution" (Winegarden 1979; see also Psacharopoulos 1977; Psacharopoulos and Marin 1976). The Nobel

prize winning economist Jan Tinbergen (1974) argued that skill-biased technological progress – with its consequences for income inequality – necessitates an important role for education in mediating the demand for higher-order skills.

However, since about 1980, it is argued that educational supply is no longer meeting educational demand. Since much of the disconnect is because of skill-biased technological change, this has been referred to as the race between education and technology (Tinbergen 1974; Goldin and Katz 2010). Education no longer seems to have mediating effects. If there is no change in the supply of education – its quality, that is – then the net effect could be a rise in inequality. Those with lower levels of education and especially lower quality of schooling will be at a distinct disadvantage.

The Automation Challenge

In 2017, the Japanese insurance company, Fukuoka Mutual Life Insurance, replaced 34 human insurance claim workers with IBM Watson Explorer (McCurry 2017). The Artificial Intelligence (AI) will scan hospital records and other documents to determine insurance payouts, factoring injuries, patient medical histories, and procedures administered. Automation of these research and data gathering tasks will help the remaining human workers process the final payout faster. Fukuoka Mutual will spend \$1.7 million to install the AI system, and \$128,000 per year for maintenance. The company saves roughly \$1.1 million per year on employee salaries by using the IBM software, meaning it hopes to see a return on the investment in less than two years. Watson AI is expected to improve productivity by 30 percent.

Though an isolated case, it is not expected to be the last. What is also interesting is that it is highly educated, white collar workers who are being targeted. The immediate cost savings are also reason to believe we will see more of this in the years to come.

As already mentioned, technological change heralds a renewed race between the supply and demand for schooling, or between education and technology. The ability of workers to compete is handicapped by the poor performance of education systems in most developing countries (Barro and Lee 2015). The returns to schooling are high in most developing countries, and growing skill premiums are evident in much of the world (Montenegro and Patrinos 2014). In high-performing economies, such as those in East Asia, we may have reached the limits of the industrial model and what once worked for developed countries may not work for developing countries. Automation implies deskilling in many aspects and a need for new skills for many (Bentaouet Kattan, Macdonald and Patrinos 2018).

The coming automation – robots, machines and artificial intelligence (AI) – will become increasingly capable. More and more jobs will become targets. Therefore, the risk or perceived risk that your job is likely to be automated will increase.

That is not to say that all AI is negative. There are proponents who say that increased automation and AI will solve many of our problems. The collective intelligence of humanity will increase, and we will live longer, healthier and more satisfying lives (Kurzweil 2005). In a 1930 essay, the economist John Maynard Keynes argued that automation will lead us to a life of leisure because of increases in productivity and a 15-hour work week.

The technological singularity (also, simply, the singularity) is the hypothesis that the invention of artificial superintelligence will abruptly trigger runaway technological growth, resulting in unfathomable changes to human civilization. According to this hypothesis, an upgradable intelligent agent (such as a computer running software-based artificial general intelligence) would enter a "runaway reaction" of self-improvement cycles, with each new and more intelligent generation appearing more and more rapidly, causing an intelligence explosion and resulting in a powerful superintelligence that would, qualitatively, far surpass all human intelligence. Vernor Vinge (1993), who coined the term *technological singularity*, argued that this would signal the end of the human era. More recently, Stephen Hawking (2016) warned about AI.

Whatever the likely long-term effects, there is still the concern about jobs. While the threat may be perceived or overblown, it is nevertheless true that automation implies deskilling in many aspects and a need for new skills for many, especially for workers in developing countries. The ability of both current and future workers to compete is handicapped by the poor performance of education systems in most developing countries (Bentaouet Kattan, Macdonald and Patrinos 2018; Acemoglu and Restrepo 2018). Whether automation means the elimination of jobs or – according to more optimistic economists – the creation of new jobs, recent technological developments imply large disruption to the labor market (Frey and Osborne 2017).

It is estimated that a large number of occupations in East Asia are prone to automation, having a 50 percent or higher probability of being automated (Bentaouet Kattan, Macdonald and Patrinos 2018). With this estimate of the probability of being in an “automation-safe occupation,” we can also see other characteristics of being “safe.” There are occupations that are more likely to be impacted upon by automation, namely those based on repetitive and routine tasks. Other tasks are complemented by automation, meaning that the worker becomes more productive.

Who is less likely to be negatively affected by automation? It turns out that education has an important role to play. Those with more education are less likely to be in jobs that are easy to automate. Skills also matter. Those with higher scores on cognitive achievement tests are also more likely to be immune to jobs that might be automated. In fact, the higher the cognitive score, the safer the worker is.

There is a high value-added in this regard with post-secondary education. That is, those workers with higher-order cognitive skills and in possession of a post-secondary education have the lowest probability of being in an automation-prone occupation.

One implication for education systems is to put everyone through university. However, this would be extremely costly. A more affordable option would be to improve the cognitive skills of those with basic and secondary education. But that could be expensive, too, and it would also require fundamental changes to the education system and further investment into what works to improve learning outcomes.

One thing we need less of is vocational studies. It turns out that school-based, pre-employment, publicly-provided vocational education deemphasizes cognitive skills. Those are precisely the

skills that are needed to improve one's chances of obtaining a good job that is less likely prone to automation. Those in vocational secondary have substantially lower cognitive skills according to an analysis using PISA data (Bentaouet Kattan, Macdonald and Patrinos 2018).

Also of importance are so-called non-cognitive skills, or socioemotional skills, which include the “Big 5” personality traits of extraversion, conscientiousness, openness to experience, emotional stability and agreeableness (Heckman 2011). There is evidence that non-cognitive skills – particularly openness to experience – are positively associated with being in a non-automation-prone occupation (Bentaouet Kattan, Macdonald and Patrinos 2018). Also, vocational education programs tend to emphasize technical skills over cognitive *and* non-cognitive skills, placing such graduates at a further disadvantage. Frey and Osborne (2017) and Brynjolfsson and McAfee (2014) find that non-cognitive skills such as creativity, social-intelligence and advanced perception will be humans' comparative advantage over machines given current technological trends.

Implications for Education Systems

Education systems are faced with the double challenge of improving the quality of education to make it relevant to the labor market given the automation challenge and giving students the ability to navigate the post-truth society. As daunting as that challenge might be, it turns out that the solution to both problems is more and better education. The challenge, however, is that this is expensive and difficult. At the same time, governments have to increase educational attainment, improve cognitive skills, and teach non-cognitive skills. These are expensive and difficult tasks, and the evidence base on how to improve non-cognitive skills is limited.

The labor market returns to schooling are high and this alone justifies expanding access to education. For compulsory schooling, the guidance is clear. It is government's responsibility to finance schooling. At the higher education and post-compulsory levels, the onus is not on government to fully provide and finance it, but certainly to put in place the conditions for increasing access to quality opportunities. This is an area where financial innovations make sense. There are options for governments, such as using the evidence from labor market returns to education to implement financial innovations – and use future earnings to finance higher education (Bentaouet Kattan, Macdonald, Patrinos 2018). High returns suggest that it makes sense to expand higher education – but in an equitable and sustainable manner.

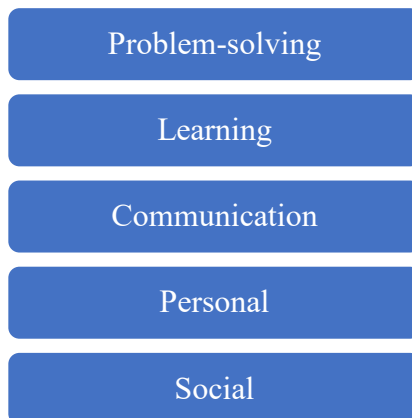
In terms of increasing cognitive skills, the task is difficult, and developing countries lag far behind. Yet, we know how to do it. Education systems that do well prepare children early on, reform continuously, and use information for improvement. There is a need to focus on basic skills, early development, and to measure and improve early reading. High-performing East Asian countries offer some useful lessons (World Bank 2018). These include: (1) aligning institutions to ensure basic conditions for learning by ensuring that the basic conditions for learning are in place in all schools; (2) concentrating effective, equity-minded public spending on basic education, including the channeling of public resources to schools and districts that are falling behind; (3) ensure children are ready to learn in school; (4) selecting and supporting teachers throughout their careers to allow them to focus on the classroom, starting with raising the selectiveness of who becomes a teacher; and (5) assessing students to diagnose issues and inform instruction.

However, since automation implies deskilling and a need for new skills, many current workers would need opportunities to learn. It is important to give opportunities to workers to invest in relevant skills for the labor market that make them benefit from, and remain immune to, automation.

While there is some emerging evidence on how to improve social skills (see Sanchez Puerta, Valerio and Bernal 2016, for example), for creativity, the psychology literature shows little consensus on how to define or teach it (Beghetto and Kaufman 2014). There are few empirical studies on how to improve it (Grigorenko et al. 2008). However, new methods of measuring creativity in terms of divergent thinking have been developed (Plucker and Makel 2010), opening the way for more empirical work. Nevertheless, countries need to figure out how to invest in relevant skills (see Figure 1). These include problem-solving skills to think critically and analyze; learning to learn skills in order to acquire new knowledge throughout a lifetime; communication skills including reading and writing; personal skills for self-management, making sound judgments and managing risks – extremely relevant in the post-truth age where people need to be able to tell fact from fiction; and social skills for collaboration, teamwork, management, leadership, and conflict resolution (Patrinos 2016).

Figure 1: The Skills that Matter

Source: Patrinos 2016



More and better education, and non-cognitive skills will not only prepare students for the future world of work. They will also prepare them to navigate the increasingly complex post-truth society. They will be able to detect fake news – deliberate disinformation spread through news or online media. It will also allow young people to gain trust. The ability to make sense of information from multiple sources is a challenge. It is particularly difficult to distinguish between useful information and mis-truths from online sources. A study found that many young people are not able to evaluate information that flows through social media channels (Wineburg et al 2016). The ability to identify reliable information is a global competence that the OECD has developed a framework for. It requires people to triangulate information by seeking confirmation from multiple sources and be able to evaluate the validity of news and information. PISA 2018 results show that

students in East Asia are better at distinguishing a fact from an opinion than other high performing countries. This is from the reading test in PISA 2018 that includes an assessment of the ability to tell whether a source is credible (Schleicher 2019). In PISA terms, the ability to differentiate between fact and opinion is considered to be at level 5 or above on PISA's six levels of reading proficiency. On average across all countries, 7 percent of 15-year-olds achieve a level five, and just 1.3 percent get up to level six. For Singapore, the percentage of top performers is triple that of the OECD average; that is, 26 percent of students achieved a level five or above, with 7.3 percent reaching level six (Civinini 2019). In other words, better education is democratizing, to the extent that it promotes truth, values and civic engagement. At the same time, globalization and automation mean it is now more important than ever that schools focus on developing students' creativity (Beard 2018).

Literacy and numeracy are important, fundamental building blocks. But computers are going to be far better than humans at processing these forms of explicit knowledge. This means that it is important to also build the skills that AI cannot emulate. Such non-cognitive, socioemotional skills are also the types of skills that will serve young people well as they deal with disinformation and build trust in society. Empathy, agreeableness and openness will serve them very well. Since machines will be better at routine, codifiable tasks according to a set of rules; then people need to become better at open-ended tasks that require flexibility, creativity and judgement. These include skills to promote social interaction.

Education 4.0?

We have all heard of Industry 4.0 or the Fourth Industrial Revolution, popularized by the World Economic Forum. Industry 1.0 refers to the first industrial revolution. Industry 2.0 is the second industrial revolution (1870 – 1914). The third industrial revolution occurred in the late 20th century, also known as the digital revolution. Industry 4.0 is the next stage, comprising the link between cyber and human systems.

It is useful to contrast that to what is happening in education. If Education 1.0 is the traditional schoolhouse, with a teacher and students, then we might think of 2.0 as the education system with collaboration, more use of technology, and the teacher as facilitator. Education 3.0 might be the world of connected learning, personalized instruction, and open access. Then Education 4.0 is a system of lifelong learning driven by autonomy and purpose; that is, just in time learning, ubiquitous, and available to all (Vander Ark 2017).

While there is already evidence that lifelong learning raises productivity and earnings (Desjardins 2016; Dorsett, Lui and Weale 2010), it will become more critical to our lives, community, and society in the future, post-truth society. It contributes towards making people well-rounded and to be able to leverage knowledge (Drucker 1992).

Therefore, economic necessity and the need to disentangle truth from non-truth has become a necessity, making lifelong learning imperative (World Bank 2003). In today's labor market, people need to learn how to learn; to re-learn; unlearn; and learn again (Patrinos 2020). There are also significant health benefits. Research suggests the importance of implementing lifelong learning and early cognitive training to prevent a mental decline in older adults, and early interventions in

the adult age can serve as a preventive tool to promote brain rewiring and neuroplasticity so that learning would improve. It could also impact the decline of Alzheimer's, isolation, and depression in older adults (Hertzog, Kramer, Wilson and Lindenberger 2008). Further, there is evidence that different types of dementia cause different types of damage to the brain and at different rates for different people (Ray and Davidson 2014), and lifetime intellectual enrichment appears to delay the onset of cognitive impairment and dementia (Vemuri et al 2014). For example, a study looking at people genetically predisposed to Alzheimer's Disease (Vemuri et al. 2014) showed that lifelong intellectual activities help to delay the onset of this type of dementia.

Going forward, we will be able to use AI to produce individualized learning. It might be too expensive to do that now, but in the future costs could be much lower, thus making it possible to use it on a wide scale.

In the meantime, promoting more and better education – to produce critical thinkers – will be expensive. For basic education, we need to become more efficient. For post-secondary education, we need to use innovative financing, especially to promote lifelong learning. This means new sources of financing, including income-contingent loan programs and individualized learning accounts (Findeisen and Sachs 2016; Chapman 2006; Palacios 2003; Oosterbeek and Patrinos 2009). Essentially, income-contingency means using future earnings to pay for today's education. One only starts paying back once they reach a certain income level. This is a system introduced in Australia in 1986 which has spread to many more countries today. It could also be used for lifelong learning. Financing university, post-secondary and lifelong learning is key for equity, sustainability, quality and efficiency.

Summing up, the priorities for countries to invest in their people in order to make them compete in the 21st century world of work and be able to navigate the post-truth society, are:

1. *Focus on basic skills first* – this means a sound foundation of solid reading skills. This is what top performers did/do very well, including European leaders such as Estonia and Finland and East Asian stars such as Japan, the Republic of Korea and Singapore.
2. Raise the productivity of schooling – this means raising the value-added of teaching/learning. High performers and the most improved countries (in terms of internationally comparable student achievement scores) do this very well. For example, in Vietnam, primary school children learn about twice as much as comparable students in other developing, middle-income countries such as Peru (Singh 2019).
3. Teach relevant skills – namely, problem solving, learning to learn, communications, personal management, and social skills (see Figure 1 above; Patrinos 2016).
4. Avoid early specialization – since the jobs of the future are unknown and people will change jobs more frequently, it is difficult to predict what precise job skills one will need. Education systems that select students early into vocational streams are not likely to be able to prepare people for the world of work of the future. Early selection into vocational studies is associated with lower academic scores, lower lifetime earnings, and more likely to put people at

risk of automation. This is primarily because such programs deemphasize the cognitive skills that one needs for the world of work – and most likely needed for navigating the post-truth reality.

5. Finance higher education – including using evidence from labor market returns to education to implement financial innovations such as using future earnings to finance higher education (Patrinos 2016). These programs would allow more students to receive a higher education and make it more financially sustainable for the country. It also means creating a “new” source of education finance – namely, future earnings paid back based on income contingency – which promotes sustainability, effectiveness, equity and fairness. It would also allow for higher levels of education, which means more protection from automation and better ability to navigate the post-truth society.

What should future research focus on?

We still need to learn more about *how to* raise the productivity of schooling. While it is recognized that high-performing systems manage to teach their students more in a given period of time, it is still not clear how this is done, other than having good teachers, well managed classrooms, and prepared students. All of these are investments. But we need more evidence on which elements exactly work to improve the quality of education. There are good techniques for imparting reading skills quickly in the early primary years, but less is known about how to accelerate learning in the secondary school years. This is especially a challenge for disadvantaged populations.

It is imperative that we impart relevant skills. The investment in relevant skills includes: problem-solving skills to think critically and analyze; learning -to-learn skills in order to acquire new knowledge throughout a lifetime; communication skills including reading and writing; personal skills for self-management, making sound judgments and managing risks; and social skills for collaboration, teamwork, management, leadership and conflict resolution. The question, however, is how to do it and how to do it cost-effectively. As well as how to incorporate these skills into the existing school curriculum.

While the digital age gives us new problems such as the post-truth phenomenon, it also imparts new opportunities. To improve learning outcomes and combat fake news, we need to use technology effectively. The questions are: How to promote the good use of technology for improving learning? How to use technology to enhance learning outcomes and teach youth how to think critically? And how to complement the teaching - learning experience.

Finally, since we need to expand education, including higher education, then we need to improve the current methods of financing education. Beyond the compulsory level, it is worthwhile to explore new and innovative finance programs such as income contingent loan payments or income share agreements. These might also be used for lifelong learning. These programs work best in advanced economies with robust taxation systems (for repayment).

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