

Education's Impact on Economic Growth and Productivity

July 2016

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Human capital is an important input into the economy. Increases in education levels since the 19th century have been estimated to account for between one-fifth and one-third of economic growth in the U.S. (Dean 1984, Barro and Lee 2015). On an individual level, the high returns to education reflect its impact on labor productivity, with an additional year of schooling providing an average 10 percent increase in wages (Psacharopoulos and Patrinos 2004). Education has also been identified as a driver of improved demographic and health outcomes, contributing to decreases in infant mortality and fertility over the second half of the 20th and early 21st centuries (Gakidou et al. 2010, Barro and Lee 2015).

Yet despite massive increases in schooling around the world, where now more than 9 in 10 children are enrolled in primary school, productivity and growth have been slowing. Many argue that the 20th century model of schooling is no longer effective at fostering the skills young people need to thrive in a rapidly changing labor market and to make the most of the new digital technology in the workplace. Skill gaps have emerged as an important constraint to economies' capacity to absorb and benefit from fast-changing new technologies. Additionally, polarization of high- and low-skill jobs may be contributing to increasing income inequality. The success with which education and skills catch up with technological progress will be a key determinant of the impact of technological change on productivity and distributional outcomes.

These forces and the needs of the future economy demand that the education sector focus on improving the quality and relevance of education and better fostering skills. Most regions in the world will reach a saturation point in terms of the number of years of schooling that workers complete, but there is still much improvement to be gained in the skills acquired within those years. Moreover, as technology continues to change, on-the-job training to update and adapt skills and lifelong learning will become increasingly important.

Schooling versus skills

In a recent paper, Jorgenson, Ho and Samuels examine growth and productivity in the U.S. from 1947 to 2014 and find that education levels have contributed significantly over time, but predict that in the future schooling attainment levels will plateau. While entrants to the labor market will continue to have high levels of education, the increase in levels of education completed is expected to slow. As this trend materializes across the globe, we reach an important turning point where education's contribution to economic growth may slow.

Yet there is much evidence that measuring skills and education by the number of years workers spend in school is flawed. The quality of education and the level of skills gained while in school vary widely across the globe.

For example, skill gaps have recently been identified as a cause of differing levels of economic growth between regions with similar levels of schooling. In *The Knowledge Capital of Nations*, Hanushek and Woessman (2015) aim to solve the Latin American "puzzle" of high levels of schooling that did not lead to high levels of growth. When comparing Latin America and East Asia, they find that while their

quantity of schooling was similar through the second half of the 20th century, the quality of schooling could better explain differences in productivity. Using international assessments on math and science, the authors conclude that the higher skill levels of East Asian students than those in Latin America can explain the much slower levels of growth in the latter region.

Similarly, Barro and Lee (2015) have developed measures of human capital that account for both the quantity and the quality of schooling, combining average years of schooling and performance on international student and adult skills assessments. Their results also find that high-quality schooling has a significant impact on growth across countries.

Including skills when measuring human capital has important implications for the impact of education on productivity. Rather than school progression and attainment alone, learning outcomes and skills are increasingly used to measure the success of education systems, and disparities in skills across countries have called attention to low-quality schooling in many countries. Figures from developed and developing countries alike paint a worrisome picture. As many as 130 million primary school students lack basic reading and writing skills, largely concentrated in developing countries (UNESCO 2012). A survey of 24 OECD countries found that more than 20 percent of all adults have low proficiency in literacy or numeracy despite the fact that nearly three-quarters of them have completed secondary school or higher (Grotlüschen et al. 2016).¹

In addition to addressing failures of systems to foster high levels of skills, it is important that education and the labor market match up on the types of skills and qualifications necessary for boosting productivity. The OECD estimates that approximately 30 percent of cross-country variation in aggregate labor productivity can be explained by the level of skill used by workers in their jobs, meaning both stronger proficiency and maximizing the use of those skills in the workplace are important for productivity (OECD 2013). Additionally, skill mismatches are a worrying trend for labor productivity—one-third of workers in OECD countries are over- or under-qualified for their positions. Recent studies using the assessments of adult skills in OECD countries find that both mismatch in qualifications and in actual skills lead to lower productivity across the economy due to inefficient allocation of talent across firms (McGowan and Andrews 2015).

Together, these findings emphasize that skills, and not just schooling, are an important factor in productivity. It is no longer sufficient to focus on increasing the number of years workers spend in school, but instead policies aiming to improve human capital and productivity must focus on quality and the relevance of skills learned.

Skills and Technology

The skills that are needed to best complement technology in the workplace are particularly relevant for the economy today and into the future. While advances in technology would predict increases in productivity, allowing workers and firms to produce more with less time and resources, productivity growth in fact has been declining recently. The skills that can be automated by technology versus skills

¹ Low proficiency is classified as scoring at or below Level 1 on the PIAAC assessment of adult skills. For literacy, this means not being able to comprehend and identify straightforward information in a multi-paragraph text. For numeracy, low proficiency means not being able to work with numbers beyond counting, sorting and basic arithmetic. 12.3 percent of all adults had low literacy and numeracy proficiency, 3.2 percent had just low literacy, and 6.7 percent had low numeracy skills.

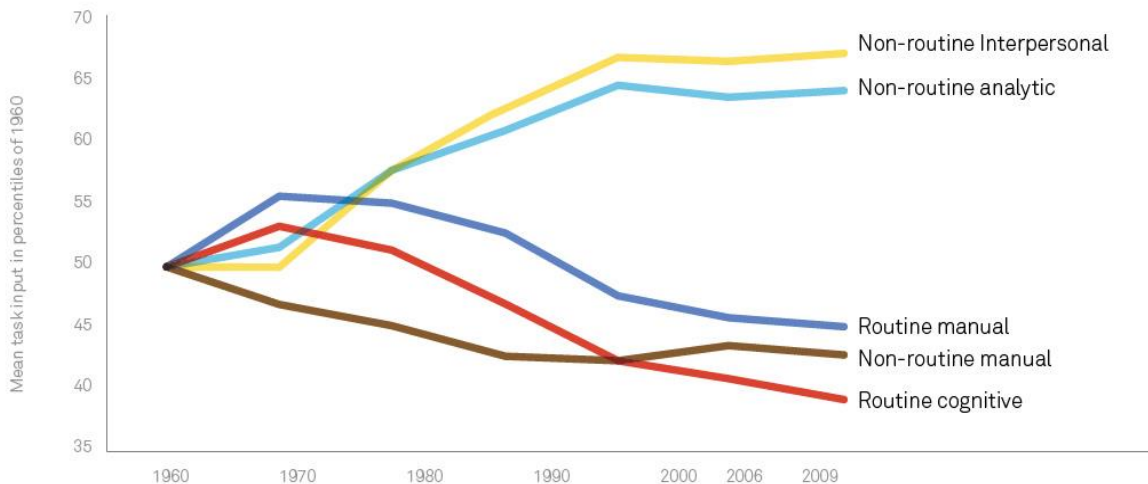
that can complement technology and make workers more productive are one key area of interest among many educationalists and economists alike.

For example, Brynjolfsson and McAfee in *The Second Machine Age* lay out evidence on which skills are uniquely human and will improve productivity and innovation by working with technology, versus the increasing list of skills that can be automated. Research on labor market trends since the mid-20th century in high- and low-income countries alike shows that jobs which rely on skills classified as routine are on the decline due to automation. This includes both manual tasks such as working on a factory assembly line as well as cognitive tasks like accounting (Autor et al. 2001, Autor and Price 2013, Aedo et al. 2013). In the U.S., for example, demand has been rising for interpersonal and analytical skills, skills which complement technology but are difficult to automate (Figure 1). As digital technologies continue to advance, a central question is how education systems can equip young people with skills that will allow them to work with technology to increase productivity and growth (Winthrop and McGivney 2016).

Figure 1



Non-routine Tasks on the Rise in the U.S. Labor Market



Source: David H. Autor and Brendan M. Price, "The Changing Task Composition of the US Labor Market: an Update of Autor, Levy and Murnane (2003)". MIT Mimeograph, Massachusetts Institute of Technology, 2013.

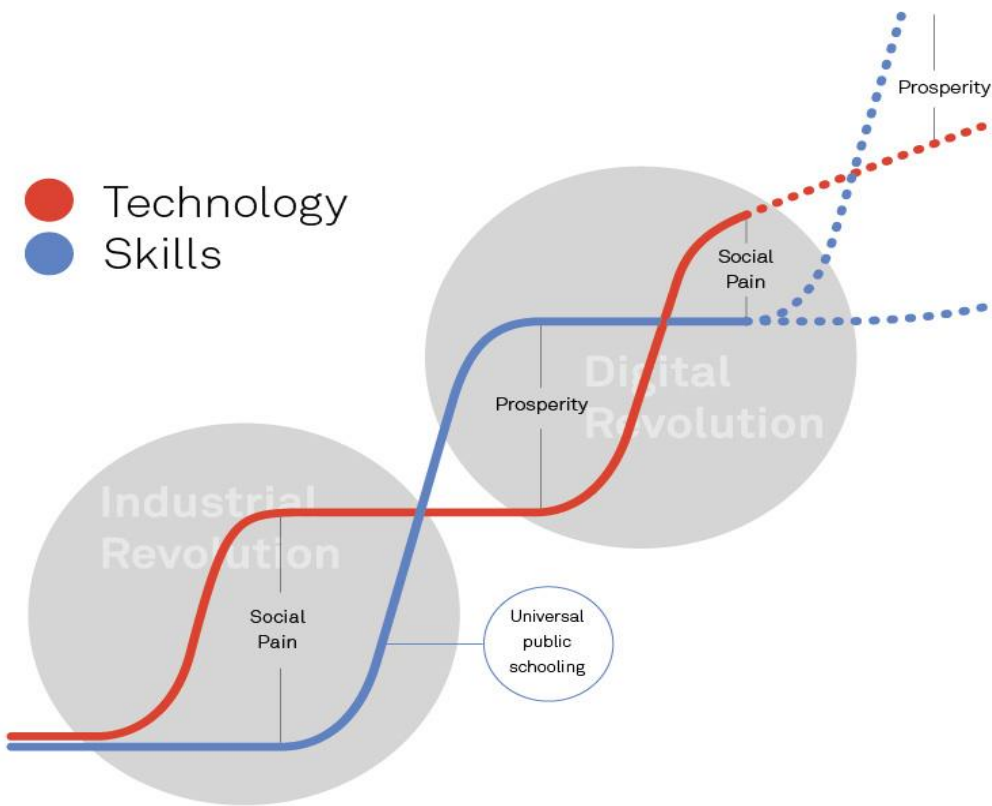
History provides a useful example of the adaptation needed in skills development due to changes in technology and the labor market. Goldin and Katz reviewed the U.S.'s 20th century response to changes in the labor market in *The Race Between Education and Technology* and found that shifts in labor market needs due to industrialization led to a massive increase in secondary school education all over the

country. The literacy and numeracy skills gained by students in high school were crucial to improve their productivity in both “white-collar” office jobs and “blue-collar” manual work. However, there was a lag, with education and skills development taking time to catch up (Figure 2). This lag holds true for skills development in today’s economy as well. Ultimately, Goldin and Katz argue that the lag that exists between technological improvements and the development of matching skills can cause considerable societal pain.

Figure 2



The Race Between Technology and Skills



Source: Andreas Schleicher, "Skills: Global Trends, Challenges, and Opportunities" Presentation, Ljubljana, April 7, 2016. Inspired by Goldin and Katz, "The Race Between Education and Technology."

Changes in technology today are predicted to make the labor market and the jobs of the future fundamentally different from the world of work today (World Economic Forum 2016). In order to improve productivity, young people will need the right mix of skills to take advantage of the new technologies. Strong essential skills like literacy, numeracy and academic knowledge are crucial, but workers will also need to be flexible and adaptive, able to think critically to filter and analyze large amounts of information, and will need strong interpersonal skills to collaborate and effectively communicate with diverse groups of people.

Recent work has shown this breadth of skills to be extremely important for labor market success. The work of Nobel laureate James Heckman has shown that many skills developed through high-quality early childhood development initiatives have a strong impact on later life outcomes. Recently, his work has also compared adults who completed secondary school with those who instead dropped out of school and passed a high school equivalency test. He found that school graduates have better employment outcomes when compared to drop outs with similar cognitive skills. He attributes the gap to those “character” skills that graduates either possess or obtain while in school that enables them to persevere and finish school.

In the education and learning sciences literature, these sets of skills – for example, the ability to set goals, to fail and try again, and to adapt strategies to achieve desired outcomes – are increasingly being recognized as important underlying skills that enable not only academic success but also workplace success. Additionally, 17 percent of employers surveyed around the world report difficulty in hiring due to a lack of candidates with these skills, or so-called “workplace competencies” like communication and collaboration skills (Manpower Group 2015). High-tech companies such as Google value skills like learning agility and problem-solving over technical skills and expertise in content areas, and their hiring practices reflect this shift away from formal qualifications (Friedman 2014).

Skills and Inequality

Around the world, gaps in schooling have been narrowing for generations, with more and more young people and adults attending and completing formal education than ever. Examining their extensive dataset on educational attainment of adults from the 19th century to today, Barro and Lee (2015) find that faster rates of human capital accumulation in developing countries relative to advanced countries helped to reduce the worldwide per-capita income gap. They note that while for some time the world was divided into those with and without education, by 2040 most countries will achieve similar levels of schooling. Other research finds that global gaps will persist much longer (Winthrop and McGivney 2014), but undoubtedly schooling levels are rising in all regions.

However, despite increased access to schooling, deficiencies and lags in the quality and relevance of education and skills needed to be successful in the future world of work are limiting the impact of the new technologies on productivity and economic growth. They are also contributing to a rise in income inequality. As Figure 1 shows, technology and automation have polarized the labor market by types of skills demanded. Not only is the demand for interpersonal and analytical skills on the rise, but there has also been growth in low-skill services jobs. In the U.S., for example, many middle-skill workers who previously were employed in routine work have been forced into low-skill, low-wage employment, while employment and wages for high-skill professional and managerial positions have grown for those at the top of the skill distribution (Autor and Dorn 2013). Labor market polarization and unemployment due to skills mismatch can lead to high levels of inequality, and according to the 2016 *Global Risks Report*, unemployment and underemployment are the top risk for 31 countries (World Economic Forum 2016).

Skills for the Future

While for decades economists have looked to education as a source of growth and increasing productivity, further research is needed on how to make the sector more productive in terms of the relevant skills acquired. Technology and jobs are changing rapidly, and the skills needed to be successful may be fundamentally different from those of the 20th century or the industrial revolution. Further

research is needed on how an individual's skills interact with technology to make them more productive. Further research is also needed into how education systems can foster these skills at scale. While the spread of access to schooling has been one of the most successful "going-to-scale" stories, quality has varied widely and many children and youth are not learning even basic skills.

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