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**Article**

## What is the economic value of literacy and numeracy?

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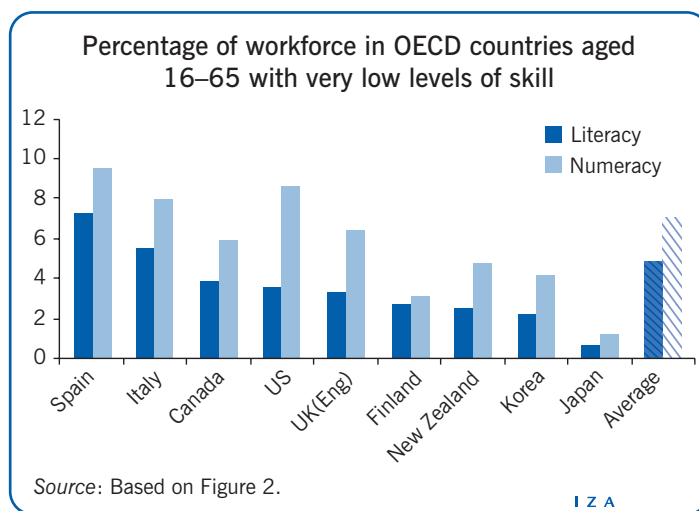
# What is the economic value of literacy and numeracy?

## Basic skills in literacy and numeracy are essential for success in the labor market

Keywords: basic skills, literacy, numeracy, wages, education policy

### ELAVATOR PITCH

Even in OECD countries, where an increasing proportion of the workforce has a university degree, the value of basic skills in literacy and numeracy remains high. Indeed, in some countries the return for such skills, in the form of higher wages, is sufficiently large to suggest that they are in high demand and that there is a relative scarcity. Policymakers need robust evidence in order to devise interventions that genuinely improve basic skills, not just of new school leavers entering the market, but also of the existing workforce. This would lead to significant improvements in the population that achieves a minimum level of literacy and numeracy.



### KEY FINDINGS

#### Pros

- ⊕ In many countries, even relatively low levels of basic skills in numeracy and literacy attract a wage premium.
- ⊕ The wage premium paid to those with better literacy or numeracy varies across countries, reflecting the relative supply of and demand for such skills.
- ⊕ A significant proportion of the workforce does not have sufficiently high levels of skills, so interventions aimed at adults are required.
- ⊕ Children and young people who have parents with higher levels of basic skills also develop higher levels of skills.

#### Cons

- ⊖ A high wage premium paid for basic skills partly reflects a relative scarcity of such skills; if all workers acquired high levels of skills it is not likely they would all earn such a high premium.
- ⊖ In attempting to improve basic skills, undue focus on reading, writing, and mathematics in school can potentially overly narrow the curriculum.
- ⊖ There is limited evidence that improving adults' basic skills in later life can improve their economic position.
- ⊖ More recent studies that examine returns to skills rely heavily on one source of data; if there is a problem with this source then all studies may be systemically flawed to some degree.

### AUTHOR'S MAIN MESSAGE

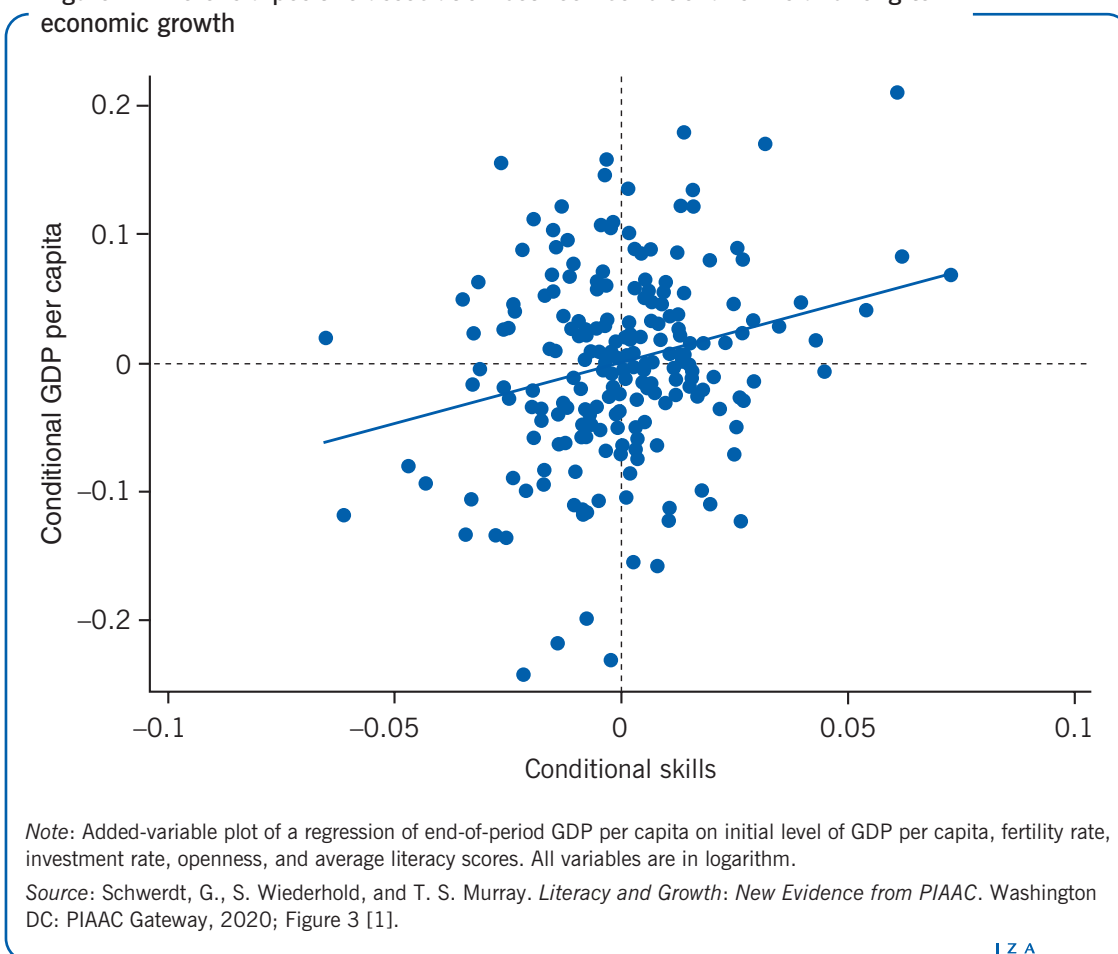
In many countries a significant proportion of the population still fails to gain basic skills in literacy and numeracy at school, which has negative consequences on future earnings and employment. And even if the skills of school leavers are improved, a sizable minority of the workforce would still have poor skills for many years to come. Simply increasing the number of years spent in education, or the qualification level of the workforce, will not automatically improve the basic skills of the workforce. Instead, investment in programs to improve individuals' basic skills should be accompanied by rigorous evaluation, as the content of the curriculum and the standards achieved matter a great deal.

## MOTIVATION

An important motivation for considering the value of basic skills for individuals, in terms of higher pay or better employment prospects, is the fact that countries which have a more skilled workforce also tend to have higher rates of economic growth (Figure 1) [1]. However, it is difficult to prove the precise cause and effect, since wealthier countries that are economically stronger tend to spend more on education and have a more skilled workforce as a consequence. Nevertheless, most of the evidence on the value of “human capital”—the sum total of the creative skills and knowledge embodied in employees—suggests that individuals with more education, and particularly more skills, have higher levels of productivity and higher wages as a result [2].

The demand for higher skill levels appears to have increased over the long term in many countries, which has been partly driven by technological changes that have favored the higher skilled [3], [4]. Conversely there is some evidence of a “hollowing out” of the labor market, with reductions in the number of intermediate-level occupations [5], as well as high levels of over-education and over-skilling among more educated workers. It is, therefore, somewhat ambiguous as to how much basic skills in literacy and numeracy will be valued in the labor market.

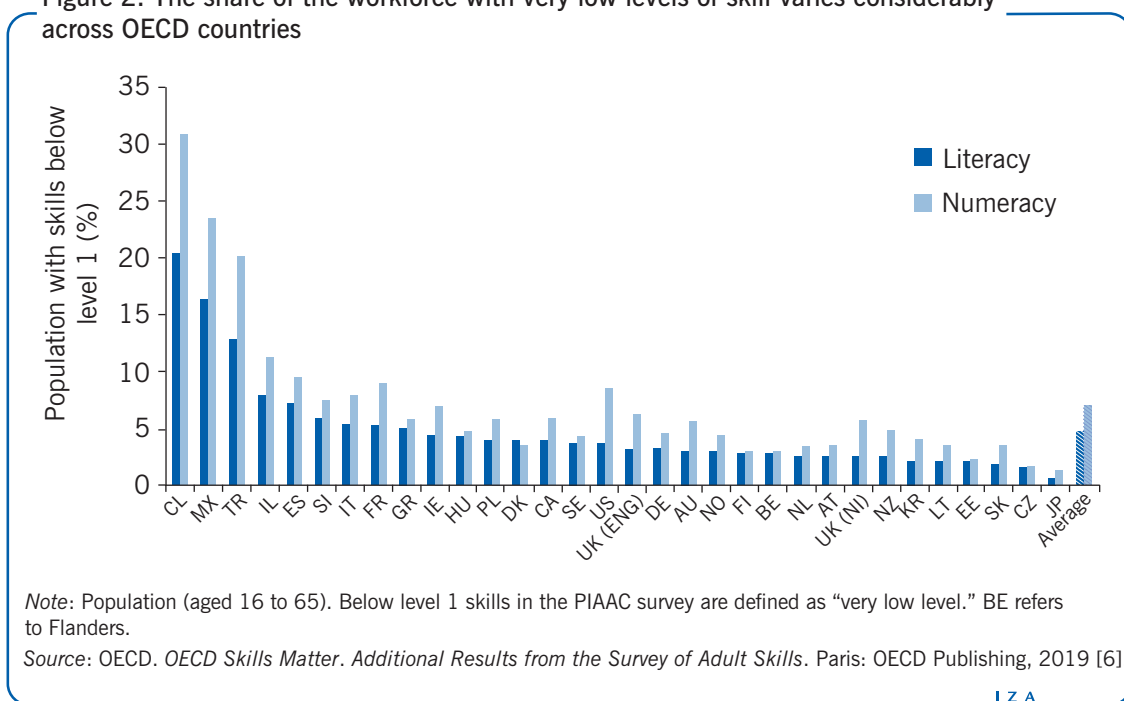
Figure 1. There is a positive association between conditional skills and long-term economic growth



## DISCUSSION OF PROS AND CONS

Many countries around the world have experienced unprecedented increases in the education levels of their populations over recent years, with more than one-third of 25 to 65-year-olds across all OECD countries having received tertiary-level education. In fact, in some countries, such as Canada, Japan, Korea, and New Zealand, more than half of all young people are achieving tertiary education [6]. However, despite this massive investment in education, a significant proportion of the workforce in some countries still has very low levels of literacy and numeracy, with negative consequences for their likely labor market success (Figure 2).

Figure 2. The share of the workforce with very low levels of skill varies considerably across OECD countries



There are numerous measures of literacy and numeracy used in the literature. Recent publications have drawn heavily on data from the OECD Programme for the International Assessment of Adult Competencies (PIAAC), though the main conclusions in this article are drawn from a broader set of studies that use a range of different data sets across a number of different countries. The latest PIAAC data assess skills in literacy, numeracy, and problem solving across 32 OECD countries and six partner countries, though here the focus is on literacy and numeracy. The tests used by PIAAC were designed to be comparable to previous international studies, and specifically the International Adult Literacy Survey. Scores on the PIAAC tests are designed to have maximum scores of 500 (similar to the OECD Program for International Student Assessment (PISA) tests of 15-year-olds). For some analyses these scores are converted into proficiency levels. The levels of both literacy and numeracy are defined in PIAAC as follows:

- Below Level 1 (0–175)
- Level 1 (score 176–225)
- Level 2 (score 226–275)

- Level 3 (score 276–325)
- Level 4 (score 326–375)
- Level 5 (score 376–500)

This article refers to “very low” levels of skill as meaning individuals who scored below level 1 in these tests.

### **The wage premium for basic skills**

For the individual worker, having higher skills is beneficial in that they result in higher wages and greater employment opportunities [7], [8], [9], [10], [11], [12], [13]. For example, it has been recognized for some time that in the US, individuals with higher levels of cognitive skills, including mathematical skills, have higher earnings [12]. Even relatively low levels of basic skills in numeracy and literacy attract a wage premium and have done so in many countries for a number of decades.

It is also evident that the wage premium paid to those with better literacy or numeracy skills varies across countries, partially reflecting the relative supply of and demand for such skills. Recent data from PIAAC provide comparable information across 32 OECD countries on the literacy and numeracy skills of working-age adults and have been used to determine the wage premium associated with having greater levels of skills [7], [8]. These data indicate a strong positive relationship between literacy and numeracy skills and wages within each country. For example, across the countries in the PIAAC data, on average a one standard deviation increase in numeracy skills is associated with a 20% wage premium for workers [7], [8]. In the first round of PIAAC data collected in 2011–2012, the premium was similar at 18% [11]. For context, these wage premia are equivalent to comparing an individual with numeracy skills at the 50th percentile to someone at the 84th percentile. A note of caution, however. The results come from a pooled country regression and provide the economic value of one standard deviation of skill, where the latter is calculated across all included countries [8]. This makes the return estimates more comparable across countries. However, the underlying distribution of skills will vary by country. Within each country the magnitude of the standard deviation of skill will vary, as will its value.

However, the estimates of the wage premium associated with having better basic skills vary substantially across countries. For example, in eight countries the wage premium is below 15% but in nine countries it is above 21%. Chile shows the highest wage premium from having better numeracy skills at nearly 37%. Despite large variations in the returns to skills across countries, it is evident that skills are significantly rewarded by a wage premium in all countries participating in PIAAC [7]. The PIAAC evidence is broadly consistent with the main conclusions drawn from other earlier studies using the International Adult Literacy Survey data collected in 1996, which also show a high premium for basic skills (both literacy and numeracy) and again indicate substantial variation across countries [9], [10], [13].

These large-scale, comparative international studies are very useful for understanding the supply of skills across different countries. They can also now be used to offer a perspective on the returns to skills in developing countries [14]. However, such studies are cross-sectional, which means that, at best, they can show the magnitude of any association between the skills acquired and earnings. In other words, these are correlational studies

that cannot necessarily explain the causal impact of improving an individual's basic skills. Nevertheless, it is striking that in such studies the large premium paid for basic skills remains evident even after allowing for individuals' level of education. This implies that even comparing individuals with similar levels of education, such as high school or university graduates, those with better skills still earn a positive wage premium. This suggests that education and skills are not synonymous and that skills are valued in the labor market over and above any premium paid to those who are more educated.

These findings are consistent with earlier work that uses far richer data to look at the wage premium associated with basic skills [13], [15]. In these studies, the authors draw on several longitudinal data sets collected during childhood, specifically the UK birth cohort data sets, which enable researchers to take into account a person's early cognitive ability (as measured by various cognitive tests taken in primary and early secondary school). The studies find that for a given level of initial childhood ability, those with better basic skills in adulthood have higher wages and higher rates of employment. This provides somewhat indicative evidence of the impact of basic skills on wages, over and above any labor market benefits from early ability. Furthermore, this work suggests that an additional standard deviation in literacy skills attracted a wage premium of around 14% and better numeracy skills a premium of around 11%, for a cohort of 34-year-olds in 2004 (using the British Cohort Study of individuals born in 1970) [15].

These premia are remarkably similar to those estimated in the mid-1990s UK labor market using an earlier birth cohort (the National Child Development Study of individuals born in 1958). This leads to the conclusion that any improvement in the supply of skills was accompanied by increases in demand, which resulted in stable returns to literacy and numeracy (at least in the UK). Further, these estimates are derived from models that take account of individuals' early cognitive ability, as measured at ages five to seven, and take into account that individuals with better skills are more likely to be employed in the first place.

There is no doubt that there are important methodological challenges in determining the extent to which better basic skills directly impact and are causally related to individuals' wages. This is because it is difficult to isolate the effect of these basic literacy and numeracy skills from the effect of an individual's other abilities. For example, an individual with a given level of IQ may have better literacy skills than another individual with the same level of IQ. The question is then, whether the additional literacy skills have value over and above the impact of the individuals' IQ on their earnings. And this is not just an academic issue. Imagine the apparent wage benefit from having better literacy and numeracy skills is actually attributable to the fact that workers who have better literacy and numeracy also have greater levels of other abilities (social skills, IQ, motivation, for example). The argument is then that individuals with greater levels of other ability will be more productive in the workplace and will earn more, irrespective of their literacy or numeracy skills. So it is the other abilities driving the higher wages, not the individuals' basic literacy and numeracy. If this is the case, then interventions focused on improving these basic skills will not necessarily lead to improvements in individuals' wages, or in their employment prospects. Researchers have used various methods to deal with this issue and, on balance, conclude that better literacy and numeracy skills do indeed have a positive (causal) effect on wages and employment, distinct from the effect of an individual's education level and other abilities.

Another methodological challenge is measurement error in surveys designed to assess individuals' skills. Correcting for measurement error in the PIAAC data for example, increases the wage premium by 10% [7]. Studies utilizing PIAAC data may therefore report a lower bound of the true wage premium for skills. PIAAC is a useful data set to assess the wage premia for literacy and numeracy skills as it leads to a level of consistency which ensures that results are more easily comparable across studies. However, if there is a measurement problem with the PIAAC data then all studies that use it may be systemically underestimating or overestimating the value of basic skills.

### **Improving the basic skills of the workforce**

The proportion of workers with very low levels of skill varies enormously across countries, which suggests that different education systems are more or less effective in providing students with the basic skills they need to succeed in the labor market (Figure 2). Countries with particularly high proportions of very low-skilled people (aged 35 and over) include Chile, Mexico, and Turkey—in these three countries this remains true even for younger cohorts (aged 25–34).

At the other extreme, some countries have had much more success in ensuring that only a very small proportion of their younger population has very weak basic skills. Japan, Korea, and Finland are striking in this regard, in that in all three countries less than 5% of their population aged 25–34 have the lowest level of skill [6]. It is generally the case that the wage premium for basic skills is lower in countries where more workers have acquired such skills, as one might expect.

In many countries the expansion of the education system and increased years of schooling have meant that young people have better basic skills than their older peers. This is particularly the case in countries such as Korea, where only 4% of 25 to 34-year-olds have the lowest level of skills, compared to 31% of 55 to 64-year-olds [6]. But in some countries, expanding the education system has not necessarily led to substantial improvements in the basic skills of young people entering the labor market. In the UK, for example, 13% of 25 to 34-year-olds have the lowest level of basic skills, compared to 18% of 55 to 64-year-olds.

However, in some countries even those with relatively low levels of basic skills are relatively highly qualified. Strikingly, in Canada and the US respectively, 52% and 62% of those with the lowest level of basic skills have actually achieved upper secondary education [6]. Caution must be exercised though in interpreting what this means for understanding the quality of these education systems. First, it is known that skills are maintained and further developed in the labor market and so assessing the skills of adults does not necessarily tell much about the quality of their schooling. Second, some individuals surveyed as adults will be migrants and hence have acquired their education elsewhere. Third, socio-economic conditions affect children's cognitive skill development, and material conditions and economic inequality vary across countries irrespective of the quality of education systems. What this evidence does imply, however, is that simply increasing the average number of years spent in education by students and increasing average qualification levels may not automatically provide workers with the skills they need.



## Improving adults' basic skills

Even if school systems improve markedly and school leavers achieve higher levels of literacy and numeracy, a significant proportion of the existing workforce still does not have sufficiently high levels of basic skills. Therefore, interventions aimed at adults will necessarily be required. This is an area where the evidence is much weaker than it is for school leavers. Few good quality studies exist on whether interventions aimed at adults, once they enter the labor market, are able to improve their literacy and numeracy. And even if these interventions actually improve individuals' skills, the question remains whether this will really lead to gains in their wages and employment.

There is an urgent need to go beyond correlational evidence and to obtain experimental evidence on whether interventions that aim to improve adults' basic skills can succeed in producing permanent gains in their skill levels *and* improvements in their employability and earnings. With that evidence, both academics and policymakers will be in a stronger position to argue, from a purely economic stand point, that it would be beneficial to invest far more in improving adults' skills. There are also many non-economic reasons to invest in adults' skills that need to be recognized, including the notion that a minimum level of literacy and numeracy is a civil right and a necessity in order to be a fully participating member of a modern democracy.

However, even without such good evidence that the economic position of adults can be successfully enhanced by improving their basic skills, there are other indirect economic reasons to consider this as a policy strategy. Children and young people who have parents with higher levels of skills also develop higher levels of skills themselves, that is, there appears to be an intergenerational transmission of skills. Policymakers need to consider these longer-term social gains from having better skills. Certainly, research has indicated a strong intergenerational correlation between a parent's level of cognitive skill in childhood and their own children's skill levels. However, much of this correlation is likely to reflect the intergenerational correlation in ability rather than literacy and numeracy. Nevertheless, research concludes that, even after accounting for a parent's ability and education level, parents with higher levels of literacy and numeracy have children who go on to have higher levels of basic skills as well. Whilst this work does not prove a causal relationship, at a minimum the evidence provides support for the notion that identifying parents with poor literacy and numeracy skills can help predict which children are most at risk of having poor skills themselves. At best, it may suggest that investment in adults' skills is likely to pay dividends, if not for the adults themselves then at least for their children.

## Further considerations on improving basic skills

At a national level, the skill level of a country's workforce is certainly correlated with its growth in GDP per person. For example, across a range of OECD countries, a 1% increase in literacy skills—as measured by the Survey of Adult Skills—is associated with a 3% increase in GDP per capita [1]. This suggests that individuals with better basic skills are more productive and hence countries with a more skilled workforce will experience more rapid economic growth. If this is the case then improving the skills of the workforce in a particular country will lead to productivity and earnings gains for individuals and economic gains for the country.



However, as discussed earlier, the high wage premium paid to workers with better skills also reflects a relative scarcity of skill. For an individual worker, the investment in improving their basic skills is likely to lead to higher wages and better employment prospects. But if *all* workers in the economy had higher levels of skill it is not likely that they would *all* earn the current premium for that skill, unless having a more skilled workforce stimulated a firm's demand further.

It is very difficult to predict what would happen to employers' demand for skills if there was a significant improvement in the skill levels of the whole workforce. It is not clear what major improvements in the supply of skilled workers would do in terms of producing wage gains for individuals and productivity gains for the economy as a whole, since the wage premium for individuals might fall if there was sufficient supply of skills to meet demand. Though it is likely that, in fact, both demand for skill and productivity would be higher.

There are also concerns in some countries that a greater emphasis on basic skills might affect education systems. For example, there is growing concern that the policy response to the PISA test results may have had unintended side-effects in some countries. The PISA tests are taken by 15-year-olds and are designed to measure the skills of those approaching the end of secondary school. The resulting scores and national league tables of skills have sparked huge policy interest and in some countries, such as the UK and Germany, quite significant policy responses. Some educationalists have argued that in attempting to improve basic skills, however, undue focus on reading, writing, and mathematics in school can constrict the curriculum and cause schools to become too focused on teaching to narrow tests of literacy and numeracy. Further, some have worried that a greater emphasis on mathematics, in particular during primary and secondary education, is also seen as potentially off-putting to some students. Though in many Asian countries this is not considered a problem.

While these considerations are not necessarily reasons to ignore the benefits of improving individuals' basic skills, they do indicate that the way policymakers go about improving literacy and numeracy is crucially important. In the UK, for example, there has been a considerable policy focus on improving literacy and numeracy in schools, and the policies in place to regulate school quality have encouraged schools to pay more attention to improving students' skills. Some have argued that this has led to a limited focus on test scores, to the detriment of the wider benefit of education, even though there has in fact been some progress in improving skills of recent cohorts. Despite this effort, and given how much longer they stay in education, it is noticeable that younger workers in the UK do not have much better skills than older workers. Hence, there is no doubt that improving basic skills of school leavers remains challenging.

## LIMITATIONS AND GAPS

There are some key limitations to what is known, thus gaps in understanding. Students who leave school with poor basic skills are disproportionately drawn from poor family backgrounds in most countries. It is important to know more about how these most disadvantaged students can be helped to succeed in school and achieve at least a minimum level of skills.

Also, assessing the skills of adults is difficult but vital. Better ways of measuring and appraising the literacy and numeracy skills of the workforce are needed, using longitudinal research designs, in order to monitor the progress that is being made.

In addition, the evidence is not particularly good regarding how basic skills of adults can be improved at scale, and whether improving adults' basic skills in later life can actually improve their labor market success. Rigorous evaluations of basic skills interventions are needed using experimental and quasi-experimental methods.

Finally, this contribution focuses only on the economic benefits of good basic skills for individuals. But the wider social benefits of basic skills, for example, intergenerational benefits, increased political involvement, tolerance, community engagement, are also crucially important. Better evidence is required on this issue too in order to ensure that a more complete argument for policies to improve the skills of young people and adults is adequately considered.

## SUMMARY AND POLICY ADVICE

Evidence suggests that there are economic gains for individuals if they have better basic skills (literacy and numeracy in particular). In many countries, however, a relatively large minority of workers still lack good basic skills. For these countries, policymakers need to ensure that both school leavers and adult workers have higher levels of literacy and numeracy. If this can be achieved—even though the currently high premium paid to those with even modest levels of literacy and numeracy will decline somewhat—it would be expected that, overall, individuals would be more productive, which would have wider economic benefits.

The real challenge is to know *how best* to bring about improvements in workers' basic skill levels. Some progress has been made in some school systems, particularly where there have been major increases in the number of years of schooling acquired (e.g. Japan). In other systems, increasing the numbers of students with higher-level qualifications has not always reduced the proportion of workers with weak basic skills. For example, in the UK, qualification levels have risen but the proportion of the adult workforce with very low numeracy and literacy has not reduced substantially in recent decades. This suggests that simply increasing the number of years spent in education, or the qualification level of the workforce, does not automatically improve the basic skills of the workforce. Both the content of the curriculum and the quality of the education matters a great deal.

Countries such as the US and the UK, where the premium paid for literacy and numeracy skills remains high, should consider further investment in improving the basic skills of both school leavers and adults who are already in the labor market. The high premium paid for skills in these countries reflects shortages in supply relative to employers' demand.

Policymakers need robust evidence upon which they can design interventions that genuinely improve the basic skills of both new school leavers coming into the market and the existing workforce. This would lead to improvements in the proportion of the population that achieve a minimum level of literacy and numeracy. Policymakers must also ensure that any investment in programs to improve individuals' basic skills are accompanied by rigorous evaluation, as without evaluating whether such programs actually work it will be uncertain whether they have produced genuine improvements in individuals' level of skill.

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### **Competing interests**

The IZA World of Labor project is committed to the IZA Code of Conduct. The authors declare to have observed the principles outlined in the code.

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