The Economic Impacts of Learning Losses

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Foreword

The worldwide school closures in early 2020 led to losses in learning that will not easily be made up for even if schools quickly return to their prior performance levels. These losses will have lasting economic impacts both on the affected students and on each nation unless they are effectively remediated.

While the precise learning losses are not yet known, existing research suggests that the students in grades 1-12 affected by the closures might expect some 3 percent lower income over their entire lifetimes. For nations, the lower long-term growth related to such losses might yield an average of 1.5 percent lower annual GDP for the remainder of the century. These economic losses would grow if schools are unable to re-start quickly.

The economic losses will be more deeply felt by disadvantaged students. All indications are that students whose families are less able to support out-of-school learning will face larger learning losses than their more advantaged peers, which in turn will translate into deeper losses of lifetime earnings.

The present value of the economic losses to nations reach huge proportions. Just returning schools to where they were in 2019 will not avoid such losses. Only making them better can. While a variety of approaches might be attempted, existing research indicates that close attention to the modified re-opening of schools offers strategies that could ameliorate the losses. Specifically, with the expected increase in video-based instruction, matching the skills of the teaching force to the new range of tasks and activities could quickly move schools to heightened performance. Additionally, because the prior disruptions are likely to increase the variations in learning levels within individual classrooms, pivoting to more individualised instruction could leave all students better off as schools resume.

As schools move to re-establish their programmes even as the pandemic continues, it is natural to focus considerable attention on the mechanics and logistics of safe re-opening. But the long-term economic impacts also require serious attention, because the losses already suffered demand more than the best of currently considered re-opening approaches.

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Introduction

A central component of the economic development policies of most countries has been investment in the human capital of society. Individuals with more skills are more productive and more adaptable to technological changes in their economies. Nations with more skilled populations grow faster. In many countries, the reactions to the pandemic have, however, threatened the long-run future of the current cohort of students, and the harm to them from recent events can ripple through the world's economies in ways that will be felt far into the future.

As the potential health threats from the COVID-19 virus began to be understood at the beginning of 2020, schools in virtually all nations closed and sent their students home. Since then, public attention has rightfully focused on the immediate health and safety concerns surrounding schools, and nations are experimenting with alternate ways to proceed with their re-opening. Longer-run issues, however, have not received the same attention.

The broader policy discussion has also focused on short-run issues. Policies introduced to fight the spread of the virus consisted of various degrees of business shutdowns and restrictions on movement and commerce. Economic analysis has so far focused on the near-term impact of business closures on unemployment and on ways to provide safety nets for individuals directly harmed, but in doing so often leaves out consideration of longer-run issues.

Indeed, the urgency of dealing with the immediate and obvious issues of the pandemic has pushed aside any serious consideration of the longer-run costs of the virus-induced school closures. There is no doubt that the school closures in the first half of 2020 have resulted in significant learning losses to the affected cohort of students – and some of the re-opening strategies being implemented will only further exacerbate these already incurred learning losses. These losses will follow students into the labour market, and both students and their nations are likely to feel the adverse economic outcomes.

Nobody can predict perfectly how school closures will affect the future development of the affected children, but past research has investigated how school attendance and learning outcomes affect labour-market chances and economic development. This paper summarises the literature on the relationship between skills and years of schooling on the one hand, and individual and aggregate income on the other. In addition, it reviews previous studies of various examples of school closures and their long-term effects on the affected pupils.

This analysis suggests plausible ranges for the economic impact of existing and on-going learning losses based on existing economic research. The typical current student might expect something on the order of 3% lower career earnings if schools immediately returned to 2019 performance levels. Disadvantaged students will almost certainly see larger impacts. And, with the forecast of further disruptions in normal school operations, the costs only grow. For nations, the impact could optimistically be 1.5% lower GDP throughout the remainder of the century and proportionately even lower if education systems are slow to return to prior levels of performance.

These losses will be permanent unless the schools return to better performance levels than those in 2019.

In this unprecedented period, there is of course great uncertainty about how to develop better schools, but two moves are suggested by existing research. First, large differences in effectiveness of teachers have been ubiquitous across schools. These differences are likely to be compounded as changes in the approach to schooling such as split shifts in schools and more video and dispersed instruction are introduced. Schools could improve if attention was given to using the teachers more effectively within and across media. Second, because the magnitude of learning losses will differ across students, teachers will face larger differences in preparations as the students return to their classes. More attention to individualising the instruction could elevate the learning for all students and could act to ameliorate the losses from prior closures by offering learning opportunities matched to each student.

Lost learning during times of closed schools

For many children and adolescents, no lessons were held in schools for at least some portion of the first half of 2020. Figure 1 provides estimates of days of schooling lost to closure from an OECD/Harvard survey conducted in mid-May 2020, a time when the school term was not yet scheduled to end in most of these countries. While the details of closures require further investigation, these early estimates show substantial losses in most countries. Additional losses since that survey, as well as expected losses into the future, can be expected to be much larger in most countries.

Little is known about the effectiveness of learning at home for the entire student population and what this means for the development of skills. However, there are indications from multiple countries that many children had little effective instruction. For a significant proportion of pupils, learning during school closures was apparently almost non-existent. For example, early tracking data from an online mathematics application used in a number of US school districts prior to COVID-19 suggest that the learning progress of students has suffered a strong decline during the crisis, especially in schools in low-income areas (Chetty et al., 2020[1]).

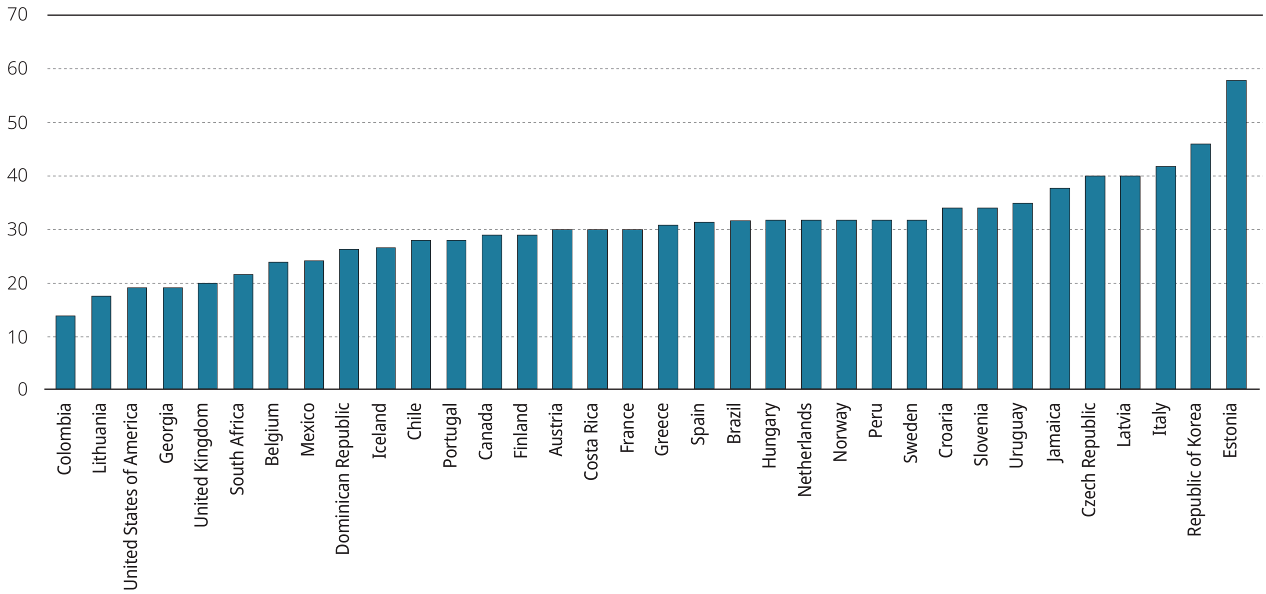
For Germany, a survey of parents of school children shows that the time that children spent on school-related activities per day was halved during the COVID-19 school-closure period, from 7.4 to 3.6 hours (Woessmann et al., 2020[2]). Indeed, 38% of students studied for school for no more than two hours per day, 74% for no more than four hours. By contrast, the time spent with TV, computer games, and mobile phones (passive activities) increased to 5.2 hours per day. For children whose parents were more educated, the decline in school activities was similar to that of other children, although the increase in passive activities was slightly smaller. Low-achieving students in particular replaced learning with passive activities. Only 6% of students had group online lessons on a daily basis, more than half had them less than once a week. Students had individual contact with their teachers even less often. The standard learning tool was task sheets that students received for weekly processing. In sum, learning opportunities were significantly reduced during the school closures, and the reductions were greatest for disadvantaged children.

Beyond the full closures already observed, schools in many countries are also not expected to resume normal school operations during the following school year. With experimentation into partial in-class work, partial video work, asynchronous presentations, and the various new inventions of schools, just counting past school days lost is almost certainly underestimating the total learning loss.

What students learn throughout the year is likely to be significantly less than what was seen in 2019, although there are no good measures of hybrid learning currently available.

Moreover, it is known from many studies (such as the analyses of skill development during the summer holidays described in the Annex A) that learning is a dynamic process that builds on prior learning, so that stagnation leads to growing deficits. Closed schools not only impart less new knowledge (Oreopoulos and Salvanes, 2011[3]), but also mean loss of already acquired skills on which further learning could build (Kuhfeld et al., 2020[4]).

Figure 1 • Days of schooling lost by mid-May 2020



Source: OECD/Harvard University, (2020[5]) Global Education Innovation Initiative at Harvard and OECD Rapid Assessment of COVID-19 Education Response.

Economic effects of lost learning

There are two related streams of long-run economic costs that are central to this discussion. First, affected students whose schooling has been interrupted by the pandemic face long-term losses in income. Second, national economies that go forward with a less skilled labour force face lower economic growth which subtracts from the overall welfare of society.

Much is known about the economic value of schooling and, specifically, of cognitive skills developed through the educational system.[1] Education equips people with the skills that make them more productive at carrying out their work tasks, particularly in modern knowledge-based economies. Education also provides knowledge and skills that enable people to generate and apply new ideas and innovations that enable technological progress and overall economic growth.

The existing research base provides a direct means of estimating the economic costs of learning losses. Even though the levels of learning losses are not known precisely, it is possible to provide estimates of the most likely ranges of economic impact. This analysis focuses primarily on the effects of the lack of development of cognitive skills.

These are not the only costs. In addition, the school closures can be expected to have numerous consequences for the socio-emotional and motivational development of the affected children and adolescents. Development in these areas is restricted by the lack of contact with classmates and the psychological strain on families during an extended stay in sometimes cramped housing conditions. Even though these are not directly addressed in this analysis, these potential deficits in the development of socio-emotional skills are likely to also negatively impact economic potential.[2]

Another important area that is not explicitly covered here is early childhood education. Recent research and the commensurate policy development have pointed to an important role of early childhood education. This critical development window appears particularly important for preparing disadvantaged students for schooling (e.g., (Heckman, 2006[6])). The disruption of this segment of the education system will likely have lasting long-term impacts on affected child cohorts, but it is not currently possible to incorporate this into the estimates.[3]

Skills and earned income

Numerous studies show a strong association between learned skills and the income earned in the labour market. Consistent with the attention on learning loss, the analysis here focuses on the impact of greater cognitive skills as measured by standard tests on a student's future labour-market opportunities (Hanushek and Woessmann, 2008[7]).[4]

As noted, however, there is no direct evidence of the typical loss of achievement. Various researchers have taken different approaches to this estimation.[5] In order to pin down the range of economic losses, it is useful to begin with the simple relationship between school years and normal learning progress. When comparing learning gains on different tests and examinations, these can be expressed in units of standard deviations of the scores in the respective test populations.[6] A rough rule of thumb, found from comparisons of learning on tests designed to track performance over time, is that students on average learn about one third of a standard deviation per school year.[7] Accordingly, for example, the loss of one third of a school year of learning would correspond to about 11% of a standard deviation of lost test results (i.e., 1/3 x 1/3).

In order to understand the economic losses from school closures, this analysis uses the estimated relationship between standard deviations in test scores and individual incomes from a recent international study (Hampf, Wiederhold and Woessmann, 2017[8]).[8] This analysis is based on data from OECD's Survey of Adult Skills (PIAAC), the so-called "Adult PISA" conducted by the OECD between 2011 and 2015, which surveyed the literacy and numeracy skills of a representative sample of the population aged 16 to 65. It then relates labour-market incomes to test scores (and other factors) across the 32 mostly high-income countries that participated in the PIAAC survey.

Countries vary considerably in the economic rewards to higher skills. While workers in Singapore are estimated to receive 50% higher income if they have one standard deviation higher test scores, the typical worker in Greece gains just 14% more income with one standard deviation higher test scores. For the United States, the comparable return to skill is 27%, and for the average across all sampled countries it is 23%.[9] Importantly, these relationships provide estimates of the impact of skill differences across the entire work life.

Table 1 displays the estimates of the percentage loss in lifetime income for students suffering cognitive learning losses typical of different proportions of the school year (relying on one year of school equals one-third standard deviations of learning). The table provides estimates for school closures from one-quarter of a year to a full year, and for the returns to skills found across the sampled countries and for the United States and the extremes of Greece and Singapore. Looking at the losses associated with one-third of a year closure, the pooled estimates indicate that current students will suffer 2.6% loss in income across their entire career. The estimated losses for this one-third year closure exceed 3% in the US and reach 5.6% in Singapore.

These estimates should be thought of as the lower bound of the impact of learning losses. In addition to the income earned, higher skills are also significantly linked to the likelihood of employment in the labour market. For example, in the United States one standard deviation of PIAAC skills is associated with a probability of employment that is about 10 percentage points higher (Hampf, Wiederhold and Woessmann, 2017[8]: Table 2). Furthermore, as discussed above, no consideration is given to potential impacts on socio-emotional skills.

Years of schooling and earned income

An even more extensive literature examines how additional years of schooling – which are far easier to measure than the skills actually acquired – affect income in the labour market. The strong correlation between years of schooling and income is probably one of the most robust findings of all empirical economic research. Numerous studies that focus on identifying the causal effect of additional years of schooling are quite consistent with simple estimation of the relationship.[10] The possible effects of lost school years are consistent with the literature reported above: roughly speaking, each school year is associated with an average of about 10% higher income in many countries.

Table 1 • Lost individual income due to Corona-induced learning loss

Learning loss (school-year equivalents)	Pooled (0.232)	US (0.274)	Lowest [Greece] (0.137)	Highest [Singapore] (0.501)
0.25	1.9%	2.3%	1.1%	4.2%
0.33	2.6%	3.0%	1.5%	5.6%
0.50	3.9%	4.6%	2.3%	8.4%
0.67	5.2%	6.1%	3.0%	11.1%
1.00	7.7%	9.1%	4.6%	16.7%

Note: The values in parentheses in the row headers are the income return per standard deviation of individual test scores.
Source: Author calculations based on Hampf, Wiederhold and Woessmann, (2017[8]), "Skills, Earnings, and Employment: Exploring Causality in the Estimation of Returns to Skills", *Large-scale Assessments in Education*, Vol. 5/1, pp. 1-30.

Estimates based on the OECD Survey of Adult Skills show that income increases by 11.1% per additional year of schooling in the United States and by 7.5% on average across the sampled countries (Hanushek et al., 2015[9]: Table 2). If one again considers a corona-induced loss of one third of a school year, these results would suggest a loss of income for the affected pupils of about 2.5-4% over the entire working life – very similar to the estimates reported above on the basis of the loss of skills. Moreover, additional years of schooling are systematically associated with higher employment and lower unemployment (see, e.g., (Woessmann, 2016[10])).

Skills and economic growth

Better educational achievement is reflected not only in higher individual incomes but also in higher national incomes overall. Basic cognitive skills, as measured in international comparative tests for pupils in math and science, are probably the most important long-term determinant of economic growth and thus of the long-term prosperity of a society (Hanushek and Woessmann, 2008[7], 2012[11], 2015[12], 2016[13]). These results on the relationship between educational performance and economic growth can be used to calculate projections of the economic costs of learning losses.

Table 2 uses existing estimates of how skills of the labour force relate to economic growth to evaluate the potential aggregate losses of school closures. (The details of these projections are found in Annex B.) These estimates come from comparing the GDP expected across the remainder of the 21st Century with the given learning losses versus that without such losses.[11] A learning loss equivalent to one-third of a year of schooling for the current student cohort is estimated according to historical growth relationships to mean 1.5% lower GDP on average for the remainder of the century. The present value of the total cost would amount to 69% of current GDP for the typical country.

These estimates assume that only the cohort currently in school is affected by the closures and that all subsequent cohorts resume to normal schooling. If schools are slow to return to prior levels of performance, the growth losses will be proportionately higher.

Slower growth from the loss of skills in today's students will only be seen in the long term. However, when viewed over the long term, they assume an enormous magnitude. In other words, countries will continue to face reduced economic well-being, even if the schools immediately return to the pre-pandemic levels of performance.

These estimates can be applied to individual countries.[12] For example, for the United States, if the student cohorts in school during the 2020 closures record a corona-induced loss of skills of one tenth of a standard deviation and if all cohorts thereafter return to previous levels, the 1.5% loss in future GDP would be equivalent to a total economic loss of USD 14.2 trillion. By the nature of growth, these losses will not be felt for some time in the future, but the calculations of the present value of these growth losses puts them into current dollar terms.

The overall economic growth effects show that higher skills of one person do not come at the expense of the economic opportunities of others. The overall economic costs of lost learning are not less if they affect all pupils equally. The notion that lost years of schooling are not so bad if they affect everyone are based on the erroneous assumption of a national economic "cake" of fixed size and that education largely serves to determine the share of income going to each individual. But the cake shrinks when everyone reaches a lower level of education; the entire economy suffers, not least because of higher burdens on social security systems and lost tax revenues for social tasks.

Table 2 • Long-run loss in GDP due to Corona-induced learning loss

Learning loss (school-year equivalents)	In % of discounted future GDP	In % of current GDP	GDP decrease in year 2100
0.25	1.1%	52%	1.9%
0.33	1.5%	69%	2.6%
0.50	2.2%	103%	3.8%
0.67	2.9%	136%	5.1%
1.00	4.3%	202%	7.5%

Note: See Annex B for projection methodology.
Source: Author calculations based on OECD, Hanushek and Woessmann (2015[14]), *Universal Basic Skills: What Countries Stand to Gain.*

Distributional issues

Because of the nature of school closures, students returned to their homes for the duration. This entirely unexpected event left most schools unprepared for continued learning. Schools pursued a wide variety of strategies involving use of technology, provision of written materials, and hybrid approaches. But the schooling-at-home approach clearly relies considerably on the instructional skills of parents, while the use of technological solutions to ameliorate the effects of closures depended on broad availability of tablets, computers, and internet access.

The negative impact of this situation was undoubtedly greater for students from disadvantaged households. Low-achieving students will find it particularly hard to acquire new instructional material on their own at home, without the explanations and support of trained teachers. It is not simply a matter of closing the "digital divide" across households. Thus, the prior estimates of the earnings loss, which apply to students of average achievement in the average household, are likely to underestimate the career earnings losses to students from disadvantaged households and for low-achieving students. These considerations also hold into the future to the extent that disruptions in schooling with different re-opening strategies imply continued pressure on learning at home.

Note that this differential impact across students does not necessarily affect the estimates of aggregate losses in GDP through growth, because those estimates relate to the average cognitive skills of the population. The distribution of the rewards from growth would, nonetheless, likely be skewed by the differential learning losses across affected families.

Aggregate losses in GDP across G20 nations

The magnitude of the long run losses associated with the disruption in schooling are truly huge. Most of the public and governmental attention has focused on short run issues of unemployment and business closures. As important as these issues are, they tend to mask the more serious long-run costs. Table 3 provides estimates for each of the G20 countries of the present value of GDP lost over the remainder of the century. These losses are calculated assuming that just the grade 1-12 students who faced the initial disruption of schooling in 2020 are affected and that the education system returns to 2019 levels for all other past and future students. The economic losses from 1/3 year of learning range from an estimated economic downturn of USD 504 billion in South Africa to USD 15.5 trillion in China. If the disruption turns out to be greater, these losses grow proportionately.

The magnitude of these losses requires systematic and sustained actions to improve the educational opportunities of the current and future students.

Table 3 • Present value of lost GDP due to Corona-induced learning loss for G20 nations

	GDP 2019 (billions USD)	Impact of Lost Learning (billions USD)	
		-1/3 year learning	-2/3 year learning
Argentina	990	-683	-1 347
Australia	1 262	-871	-1 716
Brazil	3 092	-2 134	-4 205
Canada	1 843	-1 272	-2 507
China	22 527	-15 543	-30 636
France	3 097	-2 137	-4 212
Germany	4 474	-3 087	-6 084
India	9 229	-6 368	-12 552
Indonesia	3 197	-2 206	-4 347
Italy	2 557	-1 765	-3 478
Japan	5 231	-3 609	-7 114
Republic of Korea	2 206	-1 522	-3 000
Mexico	2 519	-1 738	-3 426
Russian Federation	3 968	-2 738	-5 397
Saudi Arabia	1 609	-1 110	-2 189
South Africa	731	-504	-994
Turkey	2 350	-1 621	-3 196
United Kingdom	3 121	-2 154	-4 245
United States	20 575	-14 197	-27 982

Note: GDP for 2019 is in billions of US dollars in 2017 purchasing power parity (PPP) terms from the World Bank. Present value of lost GDP is based on estimated difference in GDP for 80 years with lower achieving labour force expected from educational losses of one-third or two-thirds years compared to future GDP without learning loss. Future losses are discounted at 3 percent. See Annex B for estimation of impacts from lower growth.
Source: Authors calculations; *World Development Indicators database*: (World Bank, n.d.[15])
https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.KD?name_desc=true (accessed August 21, 2020).

Making up for learning losses

Both the re-opening strategies of countries and the opportunities for school improvement vary widely around the world. Because of the indicated substantial costs of learning losses, the most immediate – and most obvious – responses to the COVID-19 situation are to return to schools wherever epidemiologically feasible and – where it is not – to implement daily online instruction rather than leaving children on their own.

The one essential backdrop is, however, that the current cohort of students will be less prepared for further schooling and ultimately for the labour force than they would have been without the pandemic. Thus, for these students the old status quo will not serve them well. If these students are to be remediated, it would require improving the schools, not returning schools to where they were in 2019.[13] The large cross-country variation in the productivity of schools suggests such improvement is possible.

A second element of the new environment is that less information is available. Again, while highly variable, with closures many countries effectively suspended student assessments and normal school accountability. With the varied conditions for re-opening, and with concerns about the impacts of past disruptions, in some countries there is considerable sentiment for suspending testing and accountability during the following year(s). Such actions could have serious repercussions. Schools will have only imperfect information about the learning losses suffered, particularly for disadvantaged students and others hardest hit by the past closures. Furthermore, such a suspension of testing would threaten important uses of assessments – uses that have previously been shown to have positive effects on student learning (Bergbauer, Hanushek and Woessmann, 2019[16]).

The special nature of the COVID-19 pandemic does elevate two possible approaches to improving the schools and to dealing with the deficits of the current students.

Research from both the developed world and the developing world has consistently pointed to large differences among teachers in their effectiveness in the classroom (Hanushek and Rivkin, 2012[17]; Burgess, 2019[18]; Harbison and Hanushek, 1992[19]; Hanushek, Piopiunik and Wiederhold, 2019[20]). It seems very likely that this carries over to new modes of instruction. In particular, while it has yet to be analysed rigorously, some teachers are undoubtedly better than others at providing video-based instruction, while others are more effective at providing in-person instruction. Policies that recognise differences in effectiveness and that use more effective teachers in a better manner would improve overall school performance. For example, the more effective teachers for video-based instruction might be given expanded groups of students (with suitable offsets for the expanded workload of doing this).

A second change from normal operations of schools relates to the larger variations in student preparation that are likely to appear in the majority of classrooms. As indicated, the closure period, if not the initial re-opening period, impose larger education burdens on some students than others – leading to more variation in the performance levels of students in each class. While teachers have long recognised the variation in their incoming students, the substantial suspension of standard teaching will make this larger. A natural response (which could be institutionalised) is to move toward more individualised instruction. Some countries have already moved closer to a mastery learning concept. Students would work on specific learning modules until they could demonstrate that they have completely mastered them. At that time, they would move forward, regardless of what other students in their classes were doing. Students in the same classroom could have differentiated learning goals, ranging from the understanding of basic concepts to the mastery of deep academic challenges in each area. Such individualised instruction could be greatly helped by digital learning technologies that adapt learning goals to the individuals' current achievement levels.

These two examples – while drawing on special features of the current COVID-19 school situation – largely reflect ideas that have been discussed over a considerable period. The current reactions to the pandemic do, however, open the possibility of moving in directions that improve school quality and thus offer hope of eliminating the learning gap faced by today's students.

Conclusions

As a result of the schools being closed due to the COVID-19 pandemic, classes were almost universally disrupted for months in the first half of 2020. As pupils gradually return to school, the high costs of not learning should be taken into account. The future impact of past and future learning losses need to be considered when it comes to the design of mixed in-person and home learning and when classes are potentially cancelled again locally or regionally due to newly occurring infections.

Roughly speaking, research in the economics of education shows that each additional year of schooling increases life income by an average of 7.5-10%. In other words, a loss of one third of a school year's worth of learning would reduce the subsequent earned income of the pupils concerned by about 3%. Beyond crudely measured school attainment, the loss in cognitive skills resulting from school closures and the untested ways of re-opening is the larger issue. The different ways of estimating the economic costs of the pandemic for current students provide consistent estimates of today's learning challenges.

The costs of school closure and the associated learning losses go beyond the lower incomes that this cohort of students can expect. A less skilled work force also implies lower rates of national economic growth. A loss of one-third of a year in effective learning for just the students affected by the closures of early 2020 will, by historical data, lower a country's GDP by an average of 1.5% over the remainder of the century. If the re-opened schools (which also involve new students) are not up to the same standard as before the pandemic, the impacts on future economic well-being will be proportionately larger.

In addition to the economic effects of the cognitive skill losses emphasised here, there are other potentially important costs due to losses in social-emotional development of children, although neither the magnitude nor the economic impact of these are currently known.

There is considerable anecdotal evidence that children from disadvantaged backgrounds and pupils with learning difficulties have a particularly difficult time coping with the home-learning phase. Due to the very different pressures, school closures threaten to become a major burden on the equality of educational opportunities and lead to increased inequality in society.

Immediate concrete measures need to be taken to provide effective learning for all age groups, albeit in an adapted format – from improving distance learning to developing constructive ways to re-open schools to all children and adolescents. Because school attendance will likely remain disrupted for some time to come, the serious costs of not learning must be considered and comprehensive measures must be taken to ensure that learning takes place everywhere again. Indeed, as described, it is possible and important to build upon the new organisation of schools to ensure that the schools are actually superior to the pre-COVID schools.

Unless schools get better, the current students will be significantly harmed. Moreover, the harm will disproportionately fall on disadvantaged students. Substantial learning differences across countries, closely related to institutional structures of their school systems, indicate that improvements are possible (Hanushek and Woessmann, 2011[12]; Woessmann, 2016[11]). Therefore, permanent learning losses are not inevitable if countries improve the learning gains of their students in the future.

Annex A.
Direct evidence on the effects of closed schools

The studies cited previously deal mainly with the economic effects of skills and years of schooling in general. In the case of school closures lasting several months, as in the current case of the COVID-19 pandemic, the question arises whether the learning that has been missed cannot be made up for. Do the learning losses due to school closures really have long-term effects? Analyses of three examples of long school interruptions – strike-induced school closures, the German "short school years" of the 1960s, and long summer holidays – show that this is indeed the case.

Long-term effects of strike-related school closures

Fortunately, in the past there have not been many cases of long-term, nationwide school closures. But there are a number of cases where teacher strikes have led to school closures lasting weeks or even months. In several cases, their effects have been studied in scientific detail.

In 1990, for example, teachers in the Walloon part of Belgium went on strike for several months, closing almost all the schools repeatedly for up to six weeks at a time over several months. Belot and Webbink (2010[23]) compare the development of the affected pupils with those in the Flemish part of Belgium, which was not affected by the strike-related school closures. Results suggest that the school closures have led to an increase in grade repetition and, in the long run, to lower educational attainment, including lower completion of degrees at higher education levels.

For the Canadian province of Ontario, Baker (2013[24]) shows that teacher strikes have led to significantly lower skill gains of the affected students. Jaume and Willén (2019[25]) looks at particularly long-term effects of strike-related school closures for Argentina: they find that pupils who were affected by teacher strikes in primary school later suffer salary losses of 2-3% on the labour market. They are also more often exposed to unemployment and work in occupations with lower skill requirements. Closed schools can therefore indeed have very long-term negative consequences for the children and adolescents concerned.

The experience of the German "Short School Years"

The experiences of the German short school years in the 1960s show that even a previously planned reduction in schooling time leaves traces if it lasts long. In the post-war period, the school year began in spring in most of Germany's federal states. In order to standardise the date of the start of the school year to the fall nationwide, two short school years were held in 1966/1967 in many states: the first lasted from April to November 1966, the second from December 1966 to July 1967. In the current literature, the effects of these short school years are analysed together with those of the extension of compulsory schooling from eight to nine years implemented in many states during the same period.

Based on the German PIAAC data, it can be seen that the students affected by the two short school years have indeed received a total of three quarters of a year less instruction (Hampf, 2019[26]: Table 3). This loss can also be seen in the long-term skills of the pupils concerned: even in the age group from early 50s to late 60s, the maths skills are still about a quarter of a standard deviation lower because of the two years of short schooling (Hampf, 2019[26]: Table 4).

In the long term, the short school years have not only reduced student skills but also their income in the labour market. The data set "Qualifications and Career Progression" shows that the students affected by the short school years achieved an average of about 5% lower earned income during their working lives (Cygan-Rehm, 2018[27]: Table 4).[14] In this case, too, it is therefore true that the loss of schooling has clearly had negative long-term effects.

Loss of skills during long summer holidays

Finally, further insights into the negative effects of closed schools come from studies of skill development during summer in countries such as the United States and Canada that have long summer holidays of two to three months. To this end, an entire literature has collected information on knowledge levels of students at both the beginning and end of the summer holidays.

The results show the great importance of closed schools for the skill development of children and adolescents, which is usually referred to as summer learning loss or summer setback. They also reveal strong differences in summer learning loss between children from different socio-economic backgrounds and between pupils with learning difficulties and pupils with strong learning abilities.

On average, over the summer months students suffer skill losses in the order of about 10% of a standard deviation.[15] Closed schools therefore mean not only stagnation, but a sharp decline (Kuhfeld et al., 2020[4]). This loss of skills is particularly pronounced in maths, though in reading students from disadvantaged backgrounds also suffer a pronounced loss of skills. In contrast, the reading skills of pupils from socio-economically better-off backgrounds actually increase slightly over the summer holidays. These differences in skill loss during the summer holidays are responsible for a considerable proportion of the marked socio-economic differences in performance that arise during school life.

Summary of closure experiences

Overall, the experience of various cases of continued school closures – whether due to strikes, short school years, or long summer holidays – shows that the lack of schooling has a negative impact on the long-term opportunities of the children and adolescents concerned. The experience of the long summer holidays in particular also suggests that school closures have widened the gap in skill development. As a result, there is a great danger that school closures will further increase future inequality in society.

Annex B. Projection of costs from lower economic growth

The projections of the impacts of learning losses on growth rely on a simple description of how skills enter the labour market and have an effect on the economy.[16] A range of estimates covering plausible amounts of learning losses is considered. These projections parallel projections for gains in the economies of different countries (OECD, Hanushek and Woessmann, 2015[14]), except here the consideration is how an economy is affected by a less skilful workforce.

Learning losses are portrayed as lower cognitive skills for the cohort of students enrolled in grades 1-12 in January 2020. The learning losses are presented in "school-year equivalents" using the rule of thumb that three years of schooling is equivalent to one standard deviation of test scores. The projections cover the range of learning losses from one-quarter to a full year.

The labour force itself will become less skilled than that in 2019 as increasing numbers of new, poorer trained people enter the labour market and replace the more skilled who retire. The estimates assume that no students before or after those affected by the 2020 closures have lowered skills – i.e., that students outside of the immediate closure group have a constant achievement level equal to that of the 2019 workers. The affected twelve years of students are assumed to enter the labour force one year at a time starting in 2021. A worker is assumed to remain in the labour force for forty years, implying that the labour force quality falls over the first dozen years and will not fully return to the 2019 quality level until 52 years have passed (12 years of entry of less skilled students and 40 years until all of the less-skilled workers retire).

The annual growth of the economy is assumed to be 1.98% higher per standard deviation in educational achievement for the labour force; see (Hanushek and Woessmann, 2015a[12]). This assumes that future growth follows the pattern of growth of nations between 1960-2000. Each year into the future, annual growth is based on the average skill of workers (which initially changes as new, less skilled workers enter and later changes when they retire). The estimate of the loss in GDP with a less skilled workforce compared to GDP with the existing workforce is calculated from 2020 until 2100. The growth of the economy with the current level of skills is projected to be 1.5%, or the rough average of OECD growth over the past two decades. The projection is carried out for 80 years to correspond to the life expectancy of somebody born in 2020.

Future losses in GDP are discounted to the present with a 3% discount rate. The resulting present value of shortfalls in GDP is thus directly comparable to the current levels of GDP. It is also possible to compare the gains to the discounted value of projected future GDP without a pandemic to arrive at the average decrease in total GDP over the 80 years.

Notes

1. For a brief overview of the theoretical foundations of the economic effects of better education and references to the relevant literature on economics of education since the seminal contributions of (Schultz, 1961[28]; Becker, 1964[29]; Mincer, 1974[52]), see, for example, (Woessmann, 2016[10]). (Bradley, and Green, 2020[57]) provide an up-to-date overview of research in the economics of education.

2. For evidence of the economic impact of non-cognitive skills, see for example (Heckman, Stixrud and Urzua, 2006[30]; Lindqvist and Vestman, 2011[31]). In addition to the monetary consequences of education considered here, numerous non-monetary consequences of education have also been documented (Lochner, 2011[62]; Oreopoulos and Salvanes, 2011[3]).

3. Some bounds on overall effects are presented in (Hanushek, 2014[61])

4. Generally, one of two approaches is chosen to address the cognitive skills-income relationship. On the one hand, some studies measure the skills of students towards the end of high school and then observe these students again after their transition to the labour market. This way, it is possible to estimate the association between the skills measured at school age and later income, which is usually measured in the early years of employment. Examples of this first group of studies are (Murnane, Willett and Levy, 1995[42]; Neal and Johnson, 1996[58]; Mulligan, 1999[33]; Murnane et al., 2000[32]; Altonji and Pierret, 2001[50]; Chetty et al., 2011[34]; Lindqvist and Vestman, 2011[31]). On the other hand, there are studies that survey the cognitive skills of adults in order to be able to directly investigate the connection of these skills with current income in the labour market for all age groups. Examples of the second group of studies are (Leuven, Oosterbeek and Ophem, 2004[35]; Hanushek and Zhang, 2009[36]; Hanushek and Woessmann, 2012[11]; Hanushek et al., 2015[8]; Hanushek, Wiederhold and Woessmann, 2017[37]). For overview articles see, for example, (Bowles, Gintis and Osborne, 2001[38]; Hanushek and Woessmann, 2011[21], 2008[7]; Hampf, Wiederhold and Woessmann, 2017[8]). Overall, studies of the two approaches come to very similar conclusions. However, research has shown that the income effects are substantially underestimated if only persons in the early years after entering the labor market – approximately up to the age of 35 – are considered (Hanushek et al., 2015[9])

5. The approaches include simulation of achievement models (e.g., (Azevedo et al., 2020[39]; Dorn et al., 2020[40])), extending observations of learning loss over the summer breaks (e.g., (Kuhfeld et al., 2020[4])) and potentially applying information about prior breaks in schooling because of strikes, institutional changes, and the like. These last approaches are summarised in the Annex A.

6. A one standard deviation difference in scores would correspond to the difference between the test score of somebody at the test mean (the 50th percentile) and somebody at the 84th percentile. One half standard deviation corresponds to the difference in scores of somebody at the 50th percentile and somebody at the 69th percentile of the test distribution.

7. Note, however, that this correspondence has not been extensively researched and is likely to vary by grade level, position in the test distribution, and other factors.

8. Hampf, Wiederhold and Woessmann (2017[8]) extend and refine the prior estimates in Hanushek et al. (2015[9]). The updated study focuses on causal interpretations of the underlying statistical models and on the importance of measurement errors in test scores.

9. These estimates refer to the relationship that is corrected for measurement errors; estimates dealing with issues of reverse causality are much larger, while those considering omitted variables are slightly smaller (Hampf, Wiederhold and Woessmann, 2017[8]).

10. The literature on the returns to years of schooling is so extensive that numerous survey articles have already dealt with it; see for example (Card, 1999[59]; Card, 2001[41]; Harmon, Oosterbeek and Walker, 2003[42]; Heckman, Lochner and Todd, 2006[60]; Psacharopoulos and Patrinos, 2018[43]; Gunderson and Oreopoulos, 2020[57]).

11. Estimated losses are the present value of income over the century with a discount rate of 3%. For the general methodology, see (OECD, Hanushek and Woessmann, 2015[14]) and the specifics in Appendix B.

12. These estimates and much of the discussion of overall costs apply most directly to the more developed countries where school attendance is close to universal. Developing countries, particularly with more fragile school systems, will likely face additional challenges.

13. A similar point is made in https://unesdoc.unesco.org/ark:/48223/pf0000374029.

14. The more recent findings show that the lack of evidence for long-term effects of the short school years in an earlier study by Pischke (2007[44]) may be due more to methodological issues.

15. For overview articles, see, for example, (Cooper et al., 1996[45]; Alexander, Pitcock and Boulay, 2016[54]). Important contributions to this literature are, for example (Heyns, 1978[55]; Downey, von Hippel and Broh, 2004[46]; Alexander, Entwisle and Olson, 2007[47]). A recent contribution is, for example, (McEachin and Atteberry, 2017[48]).

16. The details of the projection methodology, in somewhat different circumstances, can be found in (OECD, 2010[53]; Hanushek and Woessmann, 2011[49]; Hanushek and Woessmann, 2015[12]).

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