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Article

Instruction time and educational outcomes

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Instruction time and educational outcomes

The quality of instruction and the activities it replaces determine the success of increased instruction time

Keywords: instruction time, heterogeneous returns, implementation challenges, education reforms

ELEVATOR PITCH

Increasing instruction time might seem a simple way to improve students' outcomes. However, there is substantial variation in its effects reported in the literature. When focusing on school day extensions, some studies find no effects, while others find that an additional hour of daily instruction significantly improves test scores. A similar pattern arises when examining the effect of additional days of class. These mixed findings likely reflect differences in the quality of instruction or in the activities that are being replaced by additional instruction. Hence these elements need to be considered when designing policies that increase instruction time.

KEY FINDINGS

Pros

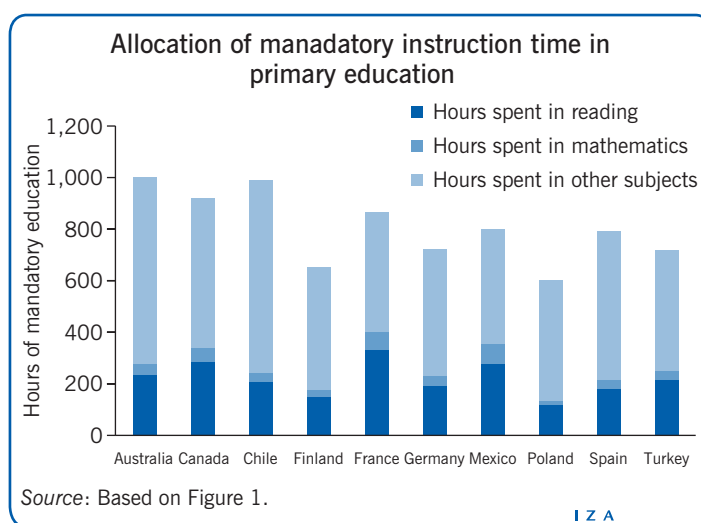
- ⊕ Increasing instruction time can significantly improve students' performance.
- ⊕ Using additional time to reinforce content seems to help reduce inequality on test scores.
- ⊕ Reducing absences is an effective way of increasing instruction time and improving students' performance.
- ⊕ Returns to instruction time are greater in schools that offer a better learning environment, and in those that have greater autonomy.
- ⊕ Instruction time extensions can reduce teenage pregnancy and youth crime.

Cons

- ⊖ Increasing instruction time does not necessarily generate large gains in students' performance.
- ⊖ It can be expensive to increase instruction time.
- ⊖ Implementing instruction time changes can be difficult and some schools might struggle to adapt.
- ⊖ Using additional time to cover new content seems to be more beneficial for high-performing students, increasing both within and between school inequality.
- ⊖ Extending instruction time too much could be detrimental.

AUTHOR'S MAIN MESSAGE

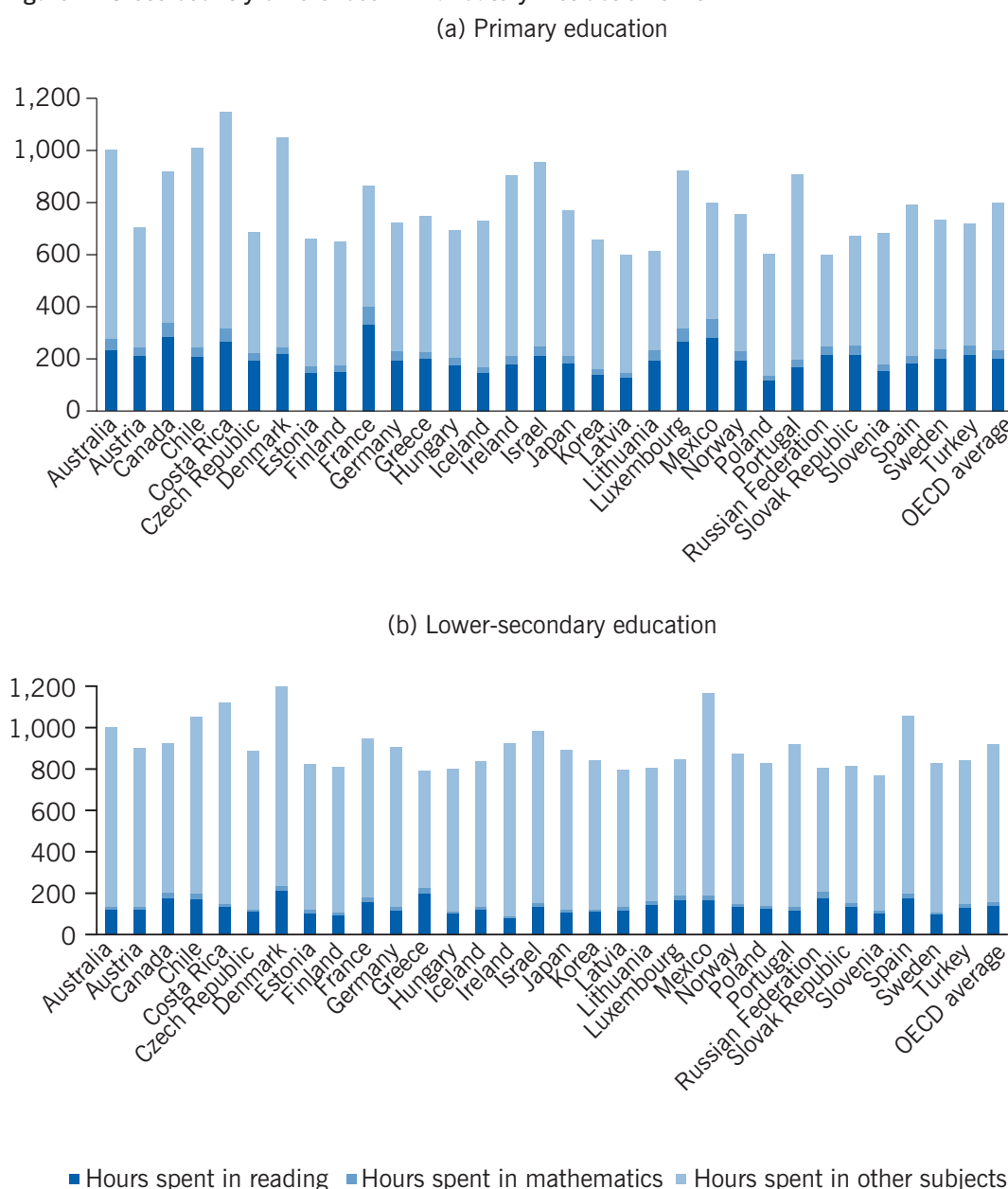
Instruction time extensions are not trivial. To make them effective, policymakers should consider how other elements of the school system—such as school infrastructure, school resources, and teachers—will be affected. These elements, as well as the type of activities that will be replaced by the additional instruction should be considered when designing such policies. In addition, deciding whether to use the additional time to reinforce or introduce new topics is important as it impacts which students will benefit the most.



MOTIVATION

There are important differences in the amount of time that students from different countries spend at school. While primary school students receive around 650 hours of instruction per year in Finland, in Australia they receive around 1,000; similarly, large differences are observed in secondary education (Figure 1). There are also important cross-country differences in the instruction time allocated to different subjects. In Portugal, for instance, primary school students spend the same amount of time in language as in mathematics. In France, however, they spend 80% more time in language than in mathematics.

Figure 1. Cross-country differences in mandatory instruction time



Source: Author's own compilation based on data from OECD. Education at a Glance 2019. Online at: https://www.oecd-ilibrary.org/education/education-at-a-glance-2019_f8d7880d-en

Understanding to what extent differences in students' academic performance across countries are due to differences in instruction time is not trivial. Luckily, the growing interest in understanding how to make schools more effective, and the increasing availability of detailed student registers have allowed researchers to accumulate vast evidence on the causal effect of instruction time on students' educational outcomes.

This evidence is likely to be of interest for policymakers, as many countries are considering or have already allocated substantial funds to increasing the amount of time that students spend at school. This article aims to contribute to this debate by reviewing the literature on the causal effect of instruction time, highlighting some important challenges for the implementation of instruction time extensions.

DISCUSSION OF PROS AND CONS

Instruction time can be modified by increasing the length of the school day, by extending the school term, or by redistributing the time allocated to different subjects. Each of these alternatives imposes different implementation challenges and they do not necessarily affect students' learning in the same way. It is thus worth examining the relevant literature on the effect of instruction time on students' achievement to highlight the main challenges that school systems face when implementing reforms that change the amount of time students spend at school or in specific subjects.

Extension of the school day

The first way to increase instruction time involves increasing the amount of time students spend at school each day. To provide additional instruction time, schools must either increase teachers' working hours or hire new teachers. This can be costly, especially if there is a limited supply of teachers. In addition, depending on the magnitude of the reform, schools might need to invest in new infrastructure. This, for instance, has been the case in several Latin American countries that recently switched from a two-shifts scheme—in which some grades were taught in the morning and some in the afternoon—to a one-shift scheme that allowed students to have classes both in the morning and in the afternoon. The effects of this type of reform critically depend on schools' ability to overcome the abovementioned challenges. Furthermore, since extending the school day mechanically reduces the time students spend outside of school, the benefits of such reforms depend not only on the quality of learning opportunities available at school, but also on their relative quality with respect to students' learning opportunities at home.

The full-school-day (FSD) reform implemented in Chile is perhaps the most studied of the large Latin American reforms. A 2021 study evaluates the effect of the reform by focusing on incumbent students—that is, students enrolled in a school before the adoption of the FSD reform—and by exploiting variation in the predicted exposure to the reform that students would have experienced in the case of remaining in the same school between the first and fourth grades [1]. This study finds that a year of exposure to the FSD program improved fourth grade students' performance in Spanish by 0.024 standard deviations and in mathematics by 0.008 standard deviations. Other studies report similar positive effects of the reform for students in second and in tenth grades.

Reforms extending the school day have also been implemented in other regions, though the size of such extensions has usually been smaller than in the Latin American context. Two relevant studies examine reforms that increased weekly instruction time in Germany [2] and Israel [3]. The German reform increased weekly instruction time by around two hours, while the Israeli reform affected weekly instruction time through changes introduced in the funding rules of public schools. Both studies find positive effects of weekly instruction time on students' achievement. The German study finds that the reform improved students' performance in mathematics, science, and reading by a little bit more than 0.05 standard deviations [2], while the Israeli study finds that an additional hour of weekly instruction on mathematics, science, and English improved students' performance by 0.03 to 0.05 standard deviations [3]. Another study evaluates the expansion of mathematics and reading instruction time in lower-secondary schools in southern Italy and documents positive effects on mathematics test scores [4]. According to its results, expanding instruction time by 25% increases mathematics test scores by 0.12 standard deviations. A study from the US context shows that extending the school day and providing additional literacy instruction time in low-performing schools in Florida have positive effects on reading test scores [5]. The authors document an improvement of 0.05 standard deviations on reading test scores after one year in the program.

Although most of these studies point toward positive effects, there are some that find no significant effects of school day extensions on students' achievement. In addition, the size of the effects documented by studies that do find positive effects varies substantially across settings. Part of this variation might reflect differences in the learning opportunities that students have available at school and at home in different countries, but they also suggest that the implementation of these reforms and the ability of schools to adjust to longer schedules are important in shaping their returns.

Extension of the school term

A second way to increase instruction time involves extending the length of the school year. As in the case of the reforms discussed above, extending the school year requires additional teaching hours. With this approach, however, the availability of teachers is less of an issue. If the teachers currently working in the school system are willing to provide the extra days of work needed, then no additional teachers are needed. The same is true in terms of infrastructure. There might be some extra wear and tear for the additional use of school buildings, but no new infrastructure is required.

In contrast with the evidence on the effects of extending the school day, there is little evidence on the effects of reforms that extend the school year. The best evidence available primarily comes from studies that exploit either regional variation on school year length or quasi-experimental variation on effective days of class within a year. While such studies do not provide many insights about how to overcome the implementation challenges of reforms extending the school term, they do inform about the potential benefits of these policies.

A set of recent studies investigate the effect of the number of school days prior to standardized tests on students' performance. These studies exploit either unplanned school closures due to adverse weather conditions [6], [7] or changes in term and/or test

dates [8], [5]. A 2014 study finds that days of class lost due to bad weather had no impact on students' test scores in Massachusetts [6]. However, another study finds contrasting results, showing that school closures induced by snow significantly reduced the number of students performing satisfactorily on reading and mathematics standardized exams in Maryland [7]. A study from 2013 exploits variation on exams and school year starting dates in Mexico, and shows that additional days of instruction prior to examination slightly improve students' mathematics performance [8]. The authors allow for non-linear returns and find that the maximum effect of an additional ten days of class ranges from 0.04 standard deviations for fourth grade students to 0.07 standard deviations for fifth grade students. A similar approach using data from North Carolina has been taken by another set of researchers, but they find smaller effects [5]. According to their results, having ten extra days of class before state-level exams improves students' performance in mathematics by 0.017 standard deviations and in reading by 0.008 standard deviations.

Some of these studies highlight the importance of effective instruction days in a year by looking at students' absences. The Massachusetts study discussed earlier finds that each absence induced by bad weather decreases mathematics test scores by 0.05 standard deviations [6]. The North Carolina study also finds that absences negatively affect students' performance, although their estimates are slightly smaller [5]. Their results indicate that a ten-day reduction in absences would improve students' performance in mathematics by 0.055 standard deviations and in reading by 0.029 standard deviations. Absences seem to have a larger effect on students' performance than days of class lost due to schools' closures. This asymmetry can be rationalized with a teaching model in which coordination of students is important [6]. Teachers might be better at dealing with disruptions that affect all their students simultaneously—for example, school closures—than with disruptions that affect different students at different times—for example, absences.

A few studies have also investigated the effects of reforms that modified the length of the school year. Two such studies examine the effects of exceptionally short or long school years due to country-level reforms of school calendars that left the curriculum unchanged [9], [10]. The first study investigates the short 1966–1967 West German school year and documents an increase in repetition rates in primary school of 1 percentage point, as well as a reduction of 1 and 3 percentage points in enrollment in the academic and in the intermediate secondary school track, respectively. Interestingly, the study finds no significant effects on earnings or employment. The second study examines the long 1978–1979 Indonesian school year and reports a reduction in repetition rates and improved educational attainment, with positive knock-on effects also on wages and on the probability of working in the formal sector.

In line with the evidence discussed previously, studies investigating the effects of additional instruction days on students' achievement point toward positive effects. The asymmetry found with respect to the effects of school closures and absences suggests that reducing absences could be an effective way of increasing effective instruction time and improving students' outcomes.

Redistribution of time across subjects

Finally, the third way in which instruction time can be modified is by redistributing the time allocated to different subjects. Depending on the size of the changes, such reforms

could increase the demand for certain types of teachers and at the same time reduce the demand for other types of teachers. Therefore, redistributing the number of hours dedicated to different subjects might generate some political challenges. In this type of reform, the alternative use of time is very clear; their net benefits depend on the gains students experience in subjects that receive extra time, and on the losses they experience in subjects that suffer the time reduction. An advantage of redistributing instruction time is that if the school term is already long or if students are already staying long hours at school, this does not make students spend even more time at school, which in some cases could be detrimental.

There is very little evidence on the optimal allocation of instruction time or on the effects of redistributing instruction time across subjects. The most informative results for this type of change come from studies that exploit within-school or within-pupil variation in subject-specific class hours. By exploiting such sources of variation, these studies keep both the length of the school day and the school term constant and identify the effect of instruction time by comparing students' performance across subjects. An important assumption in these studies is that returns to instruction time are the same for all subjects.

One of the first studies to follow this approach examines the effect of instruction time on students' achievement using cross-country PISA data and finds that a one-hour increase of weekly subject-specific instruction time raises scores in that subject by 0.06 standard deviations [11]. Similar effects have been documented by more recent studies following the same approach.

Who benefits the most?

The discussion above focuses primarily on average effects. However, increasing instruction time does not necessarily affect all students equally. As mentioned earlier, the returns to additional instruction time depend on both the learning opportunities that students have at school and at home. Thus, the quality of school inputs, the use of additional time, and students' backgrounds likely play important roles in determining the returns from policies that extend instruction time (Figure 2).

Consistent with the idea that low socio-economic status (SES) individuals have worse learning opportunities at home, a number of studies find that increasing instruction time is more beneficial for relatively disadvantaged students [1], with yet another study finding that the difference is driven by high-achieving disadvantaged pupils [4].

Despite having worse learning opportunities at home, it is not obvious that extending instruction time will always bring greater benefit to more disadvantaged students. The ability to take advantage of the learning opportunities available at the school might also play a role. A 2013 study on Mexico, for instance, finds that improvements were lower in poorer schools [8]. In a different study based in Florida, the authors do not find a consistent pattern in heterogeneity by socio-economic characteristics, but they do show that the effects of increased instruction time are lower for students at the bottom of the ability distribution [12]. In line with this result, a 2017 study finds stronger effects among high-performing students [2]. Other studies simply do not find evidence of differential effects by students' SES (e.g. [3]).

This set of results suggests that there are other dimensions beyond students' characteristics that shape the returns to instruction time. A study from 2018, for instance, highlights that productivity of instruction time positively depends on the quality of the classroom environment, as captured by student disruptions and student-teacher interactions [13].

Figure 2. Heterogeneity in returns to instruction time

<i>Study</i>	<i>Country</i>	<i>Variation</i>	<i>Heterogeneity by student's SES</i>	<i>Heterogeneity by school characteristics</i>
Lavy (2019) [3]	Israel	Additional resources resulting on increased daily instruction areas	No statistically significant differences by SES	
Battistin and Meroni (2016)	Italy	Additional weekly instruction hours on reading and mathematics	Larger effects among high-achieving disadvantaged students	
Meroni and Abbiati (2016) [4]	Italy	Additional weekly instruction hours on reading and mathematics	Larger effects among high-achieving disadvantaged students	
Lavy (2015) [11]	Countries taking PISA	Differences in instruction time across subjects		
Cattaneo et al. (2017)	Switzerland	Differences in instruction time across subjects	Larger effects on more demanding school tracks	Larger when there are good accountability systems in place, and in settings in which schools have greater autonomy
Bellei (2009)	Chile	Extension of school day	Larger effects on disadvantaged schools	
Berthelon et al. (2016)	Chile	Extension of school day	Larger effects on disadvantaged schools	
Barrios-Fernández and Bovini (2021) [1]	Chile	Extension of school day	Larger effects among students whose parents did not attend university, had fewer than 50 books at home, and had no computer or internet at home	Larger effects in schools enjoying of greater autonomy (no-fee charter schools)

Figure 2. Heterogeneity in returns to instruction time, cont.

Study	Country	Variation	Heterogeneity by student's SES	Heterogeneity by school characteristics
Domínguez and Ruffini (2023)	Chile	Extension of school day	Larger earnings and employment gains among students from low-income backgrounds	
Hincapie (2016)	Colombia	Extension of school day	Larger effects on disadvantaged schools and on rural schools	
Huebener et al. (2017) [2]	Germany	Extension of school day	Larger effects among high performing students	
Cerdán-Infantes (2007)	Uruguay	Extension of school day	Larger effects on disadvantaged schools	
Figlio et al. (2018) [12]	USA (Florida)	Extension of school day	Smaller effects for students at the bottom of the ability distribution No clear pattern by students' SES	
Aguero and Beleche (2013) [8]	Mexico	Instruction days before exam	Smaller effects on disadvantaged schools	
Carlsson et al. (2015)	Sweden	Instruction days before exam	No statistically significant differences by SES	
Fitzpatrick et al. (2011)	USA	Instruction days before exam	No statistically significant differences by SES	
Sims (2008)	USA (Wisconsin)	Instruction days before exam	Larger effects in rural schools and in districts with larger minority shares	Larger effects in districts with higher levels of school expenditure
Aucejo and Romano (2016) [5]	USA (North Carolina)	Students' absences	Absenteeism is more detrimental for low performing students	

Source: Barrios-Fernández, A., and G. Bovini. "It's time to learn: School institutions and returns to instruction time." *Economics of Education Review* 80 (2021): 1 [1]; Huebener, M., S. Kuger, and J. Marcus. "Increased instruction hours and the widening gap in student performance." *Labour Economics* (2017) [2]; Lavy, V. "Expanding school resources and increasing time on task: Effects on students' academic and noncognitive outcomes." *Journal of the European Economic Association* 18:1 (2019): 232–265 [3]; Meroni, E. C., and G. Abbiati. "How do students react to longer instruction time? Evidence from Italy." *Education Economics* 24:6 (2016): 592–611 [4]; Aucejo, E. M., and T. F. Romano. "Assessing the effect of school days and absences on test score performance." *Economics of Education Review* 55 (2016): 70–87 [5]; Agüero, J. M., and T. Beleche. "Test-mex: Estimating the effects of school year length on student performance in Mexico." *Journal of Development Economics* 103 (2013): 353–361 [8]; Lavy, V. "Do differences in schools' instruction time explain international achievement gaps? Evidence from developed and developing countries." *The Economic Journal* 125:588 (2015): F397–F424 [11]; Figlio, D., K. L. Holden, and U. Ozek. "Who benefits from longer school days? Regression discontinuity evidence from Florida's additional hours of literacy instruction." *Education Economics* (2018) [12]. Publication details for the unnumbered reference citations can be found in this article's "Additional references" online at: <https://wol.iza.org/articles/instruction-time-and-educational-outcomes/long>

The above-mentioned 2017 study highlights the importance of what schools do with the extra time [2]. The authors argue that using the additional time to reinforce content already in the curriculum is likely to benefit students who struggle more at school. In contrast, using the additional time to cover new topics is likely to benefit more high-performing students. There are other characteristics of the school system that also seem to matter. A cross-country study finds that returns to instruction time are larger in countries that have set accountability systems in place, and in schools that enjoy more autonomy [11]. More recent results also highlight the role of school autonomy [1]. The authors show that in the context of a large reform that increased weekly instruction time by around 30% in Chile, the benefits were greater for students attending no-fee charter schools. They posit that the greater levels of autonomy enjoyed by no-fee charter schools allowed them to better adapt to the longer schedules by making it easier for them to hire new teachers.

The results discussed in this section highlight the relevance of students' and schools' characteristics in shaping the returns of instruction time. This suggests that the design of policies that extend instruction time should consider these characteristics and their interactions to be effective.

Costs of extending instruction time and comparison to alternative policies

As discussed previously, the costs of expanding instruction time depend on the approach chosen and the resources available in the school system before implementation. For instance, the full school day reforms carried out in South America and in other developing countries required substantial investment in new infrastructure. Before the reforms, school systems relied on a double shift scheme with some grades taught in the morning and other grades in the afternoon. Offering the full day to students made it necessary to build new classrooms, but also new recreational spaces and other facilities. These infrastructure investments are not required when expanding the length of the school term or when redistributing the time allocated to different subjects.

Information about the costs of instruction time extensions comes from studies investigating extensions of the school day. The FSD reform implemented in Chile provides perhaps the most useful information about operational costs. In Chile, all publicly subsidized schools are funded through a voucher system. The FSD reform increased the duration of the school day by roughly 30% and the voucher amount by around 32%. The new infrastructure required to implement the FSD reform was funded through other channels, so the increase in the voucher is a good reflection of the increase in operational costs experienced by the system. In 2021, the difference in the monthly voucher that primary schools with and without the FSD reform in place received for each student was around US\$25.70. The same difference was around US\$29.50 for high schools. The main driver of the increased costs is the additional hours of teaching, thus the actual cost of reforms increasing instruction time will greatly depend on teachers' salaries. The proportional increase in the Chilean example is likely to be informative for estimating the additional resources that an extension of the school day or of the school calendar would require, as both types of reform need extra teaching hours.

To assess whether the gains induced by instruction time extensions on academic performance are large, it is useful to benchmark them against the effects of other school inputs. For instance, it has been shown that a 1.0 standard deviation improvement in teachers' effectiveness raises end-of-grade test scores by approximately 0.1 standard deviations. There is also vast evidence on the effects of class size on student achievement. Results from the STAR (Student-Teacher Achievement Ratio) experiment implemented in the US show that students allocated to small classes (i.e. 15 students per class) obtain test scores 0.22 standard deviations higher than students allocated to large classes (22 students per class). In the context of the STAR experiment, reducing class sizes by one-third would require an increase of 33% in the total annual expenditure per student.

As discussed previously, there is important variation in the effects of instruction time found in the literature. The largest effects estimated for school day extensions suggest that an additional hour of daily instruction improves academic performance by between 0.03 and 0.05 standard deviations. This effect is between one-third and one-half of the effect of improving teacher quality by 1.0 standard deviations, and is approximately one-seventh of the class size reduction in an early study mentioned above. The largest effects estimated for school calendar extensions indicate that an additional ten days of class increase academic performance by between 0.04 and 0.07 standard deviations. This effect represents between 40% and 70% of the effect of a 1.0σ improvement on teacher value added, and represents between 18% and 32% of a seven-student class size reduction.

LIMITATIONS AND GAPS

Returns to instruction time are unlikely to be linear. This means that the benefits of an additional instruction hour or day can be very different depending on the base level. Most of the sources of variation exploited to identify the effects of instruction time make it challenging to study non-linearities. Therefore, most of the evidence discussed in this article abstracts from this issue, though the Mexico-based study cited previously is an exception [8]. Its authors investigate how additional days of instruction prior to examination affect students' performance in Mexico and show that they improve students' scores, but that they exhibit diminishing marginal returns. However, more research is required to fully understand these non-linearities and how they interact with characteristics of the students and of the school systems.

SUMMARY AND POLICY ADVICE

With the aim of improving students' educational achievement, many countries are considering or have already allocated substantial funds to increasing the amount of time students spend at school. Time, however, is an inherently limited resource, and extending instruction time mechanically reduces the amount of time students can dedicate to other activities. Therefore, the effect of such policies on students' achievement not only depends on the absolute quality of the additional time at school, but also on its relative quality with respect to the learning opportunities available outside of school.

Thus, the benefits of reforms that increase instruction time can vary substantially across settings, as they depend on the characteristics of the students, the school systems, and on

how the changes are implemented. The literature highlights implementation challenges for three alternative ways of modifying instruction time—(i) increasing daily instruction time, (ii) extending the school term, and (iii) redistributing instruction time across subjects—and discusses evidence on the effects of instruction time on students' achievement. The evidence accumulated over recent decades mostly points toward positive effects, but masks important variation. While some studies find no significant or modestly positive effects, others find that additional instruction time significantly improves students' performance. These differences suggest that the design and implementation of reforms that extend instruction time is not trivial. Policymakers should carefully consider the characteristics of both students and schools that will be affected by the reform and be aware that the returns to instruction time also depend on the quality of other school inputs.

Finally, it is worth considering that increasing instruction time might also affect relevant outcomes beyond education. There is evidence that increasing the time students spend at school reduces teenage pregnancy and crime participation and improves female labor market participation. These effects need to be factored in when evaluating these policies.

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Competing interests

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

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Further reading

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