5 Investments in a solid foundation for learning and well-being

This chapter explores how investments in education – including in financial, human, material and time resources – are related to student performance, well-being and equity in education. It then highlights changes in schools' and students' readiness for digital and remote learning, including the availability and use of digital devices in school. The chapter also studies how schools serve as hubs for students' learning and well-being.

For Australia*, Canada*, Denmark*, Hong Kong (China)*, Ireland*, Jamaica*, Latvia*, the Netherlands*, New Zealand*, Panama*, the United Kingdom* and the United States*, caution is advised when interpreting estimates because one or more PISA sampling standards were not met (see Reader's Guide, Annexes A2 and A4).

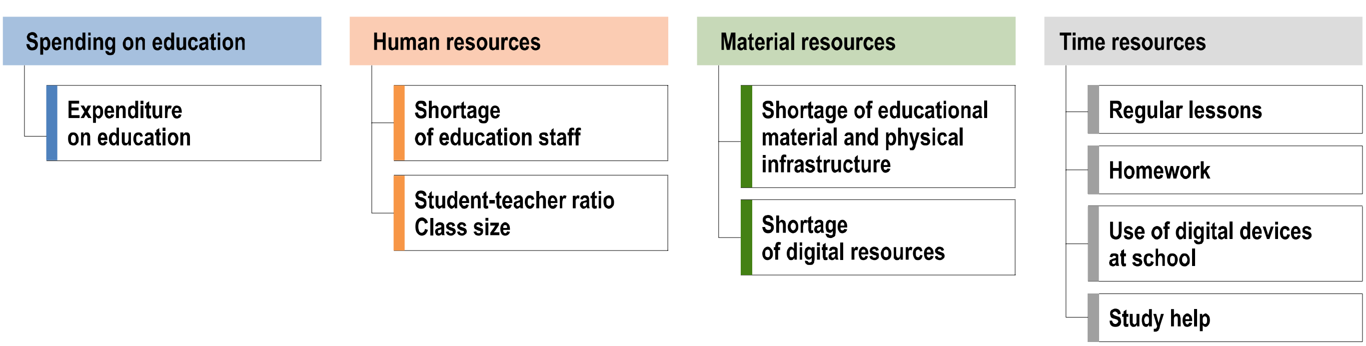
This chapter analyses in detail how the resources invested in education are distributed across schools, and how they were allocated in resilient education systems where learning, equity and well-being were maintained and promoted despite the recent disruptions due to the COVID-19 pandemic. Those resources related to the resilience of education systems are considered as “components of resilience” throughout this chapter.

The chapter starts by describing expenditure on education across education systems, and the relationship between expenditure on education and student performance. It then examines how expenditure trickles down to individual schools by focusing on school staff (“human resources”) and educational material (“material resources”), which includes digital devices (Figure II.5.1). The chapter concludes with an analysis of the amount of time students spend on digital devices for learning and leisure activities in school, and how schools can improve the efficiency of learning time and serve as hubs for social interaction by providing study help.

What the data tell us

- In more than half of all education systems with available data, and on average across OECD countries, more students in 2022 than in 2018 attended a school whose principal reported that instruction is hindered by a shortage of education staff. In 58 countries/economies, the share of students in schools whose principal reported that instruction is hindered by a lack of teaching staff increased between 2018 and 2022.
- In about half of education systems with available data, principals in 2022 were less likely than their counterparts in 2018 to report shortages of educational material. On average across OECD countries and in 41 education systems, socio-economically disadvantaged schools were more likely than advantaged schools to suffer from a lack of or poor-quality digital resources.
- PISA 2022 results show that school phone bans appear to be effective in reducing distractions in class. However, on average across OECD countries, 29% of students in schools where the use of cell phones is banned reported using a smartphone several times a day, illustrating that cell phone bans are not always effectively enforced.
- Schools in high-performing education systems tend to provide a room where students can do their homework, and school staff offer help with students’ homework.
- In those education systems where more students in 2022 than in 2018 attended schools that offer peer-to-peer tutoring, students’ sense of belonging at school strengthened during the period.

Figure II.5.1. Resources covered in PISA 2022



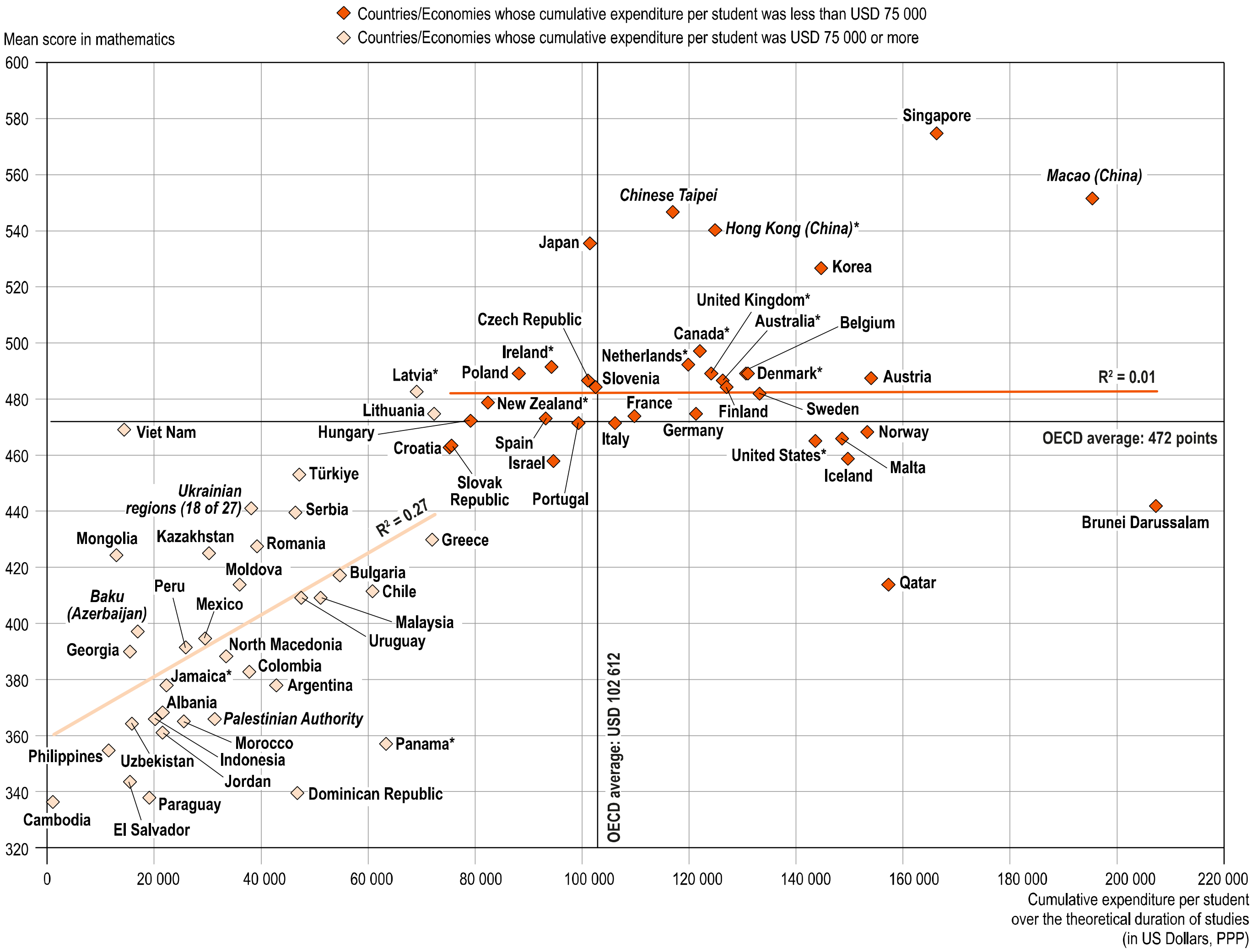
How educational resources are allocated

As shown in earlier PISA results, PISA 2022 reveals that expenditure on education is related to student performance only to a certain extent. Among the countries/economies whose cumulative expenditure per student was under USD 75 000 in 2019 (the level of spending in 35 countries/economies), higher expenditure on education was significantly associated with higher scores in the PISA mathematics test. Across these countries/economies, 27% of the variation in student performance was accounted for by the difference in expenditure on education. However, this was not the case among countries/economies whose cumulative expenditure was greater than USD 75 000 (see Figure II.5.2). For this latter group of countries/economies, the ways in which financial resources are used seems to matter more for student performance than the level of investment in education.

School systems with greater total expenditure on education tend to be those with higher levels of per capita GDP. Spending on education and per capita GDP are highly correlated (r = 0.71 across OECD countries and r = 0.87 across all participating countries/economies in PISA 2022, Tables B3.2.1 and B3.2.2). In 2019, average total expenditure by educational institution per student from the age of 6 to 15 in OECD countries was USD 102 612 (PPP-corrected dollars). High-income countries/economies, as defined by the World Bank classification,[1] cumulatively spent USD 114 001, upper middle-income countries spent USD 32 801 and lower middle-income countries spent USD 18 174, on average (Table B3.2.1).

Financial resources are allocated differently across education systems and are distributed among core educational services (such as salaries paid to teachers, administrators, management and support staff, and maintenance or construction costs of buildings and infrastructure) and ancillary services (student welfare services such as transportation, meals and health services for students). Total cumulative expenditures encompass both public and private spending, across public and private educational institutions (OECD, 2022[1]). Despite the competing demands for resources, expenditure on education has increased over the past few years. Between 2012 and 2019, expenditure per student from primary to tertiary education grew at an average annual rate of 1.7% in real terms across OECD countries (OECD, 2022[1]). After the first year of the COVID-19 pandemic, total expenditure on primary to tertiary educational institutions per full-time equivalent student increased by 0.4% between 2019 and 2020, on average across OECD countries (OECD, 2023[2]).

Figure II.5.2. Mathematics performance and spending on education



Note: Only countries and economies with available data are shown.
Source: OECD, PISA 2022 Database, Tables I.B1.2.1 and I.B3.2.2 (Volume I).

Components of resilience: Providing high-quality and sufficient teaching and non-teaching staff

Across education systems, PISA 2022 results show that high-performing education systems were populated with high-quality teaching and non-teaching staff in sufficient numbers. Systems where more teachers were fully certified by an appropriate authority tended to score higher in mathematics, even after accounting for per capita GDP, across OECD countries (Table II.B1.5.101). Systems where principals reported increased hindrance to instruction due to inadequate or poorly qualified teaching staff between 2018 and 2022 showed a decline in mathematics performance, on average across OECD countries (Table II.B1.5.104). Across all countries/economies, students' senses of belonging at school weakened between 2018 and 2022 in schools whose principals reported an increase in the lack of, or in inadequate or poorly qualified, assisting staff during the period.

In most education systems, principals in 2022 were more likely than their counterparts in 2018 to perceive shortages of education staff

PISA results show that, in more than one in two education systems school principals in 2022 were more likely than their counterparts in 2018 to report that instruction was hindered due to inadequate or poorly qualified teaching staff (Table II.B1.5.4). This was particularly evident in education systems that saw the proportion of full-time teachers shrink over the period (r=-0.32).[2] Yet PISA results also show that between 2018 and 2022, student-teacher ratios and class size decreased slightly across OECD countries and remained stable in most countries/economies (Tables II.B1.5.13 and II.B1.5.16), which confirm the latest data published in Education at a Glance (OECD, 2023[2]). School principals perceived a shortage of education staff not only because of a lack of staff members but also because of a lack of high-quality teachers. Teacher absenteeism, which is not necessarily reflected in the number of teaching staff, was observed in many countries/economies when schools re-opened after the crisis phase of the COVID-19 pandemic ended (OECD, 2022[1]).

PISA 2022 measured the quantity and quality of education staff in schools by asking principals whether providing instruction at their school is hindered by a lack of teaching and assisting staff (such as pedagogical support, administrative staff, or management personnel) or by poor or inadequate qualifications of teaching and assisting staff. It is important to keep in mind that these measures are based on school principals' perceptions; they are not objective measures of staff shortage. Principals in different countries may have different perceptions of what constitutes a shortage of teaching or support staff in their school.

In more than half of all education systems with available data, and on average across OECD countries, more students in 2022 than in 2018 attended schools whose principals reported that instruction is hindered because of a shortage of education staff (Table II.B1.5.4). Between 2018 and 2022, the share of students in schools whose principal reported that instruction is hindered by a lack of teaching staff increased in 58 countries/economies (Figure II.5.3), and by more than 30 percentage points in Australia*, Belgium, Cambodia, Chile, France, Guatemala, Latvia*, the Netherlands*, Poland and Portugal. Only in Indonesia did fewer school principals in 2022 than in 2018 report that instruction is hindered due to a lack of teaching staff. In 41 countries/economies more principals in 2022 than in 2018 reported that poor or inadequate qualifications of teaching staff hinders learning; in Belgium, Cambodia, Hong Kong (China)*, the Netherlands* and Poland this share grew by more than 20 percentage points during the period. Only in Indonesia and the United Arab Emirates did fewer school principals in 2022 than in 2018 report that poor or inadequate qualifications of teaching staff hinders instruction.

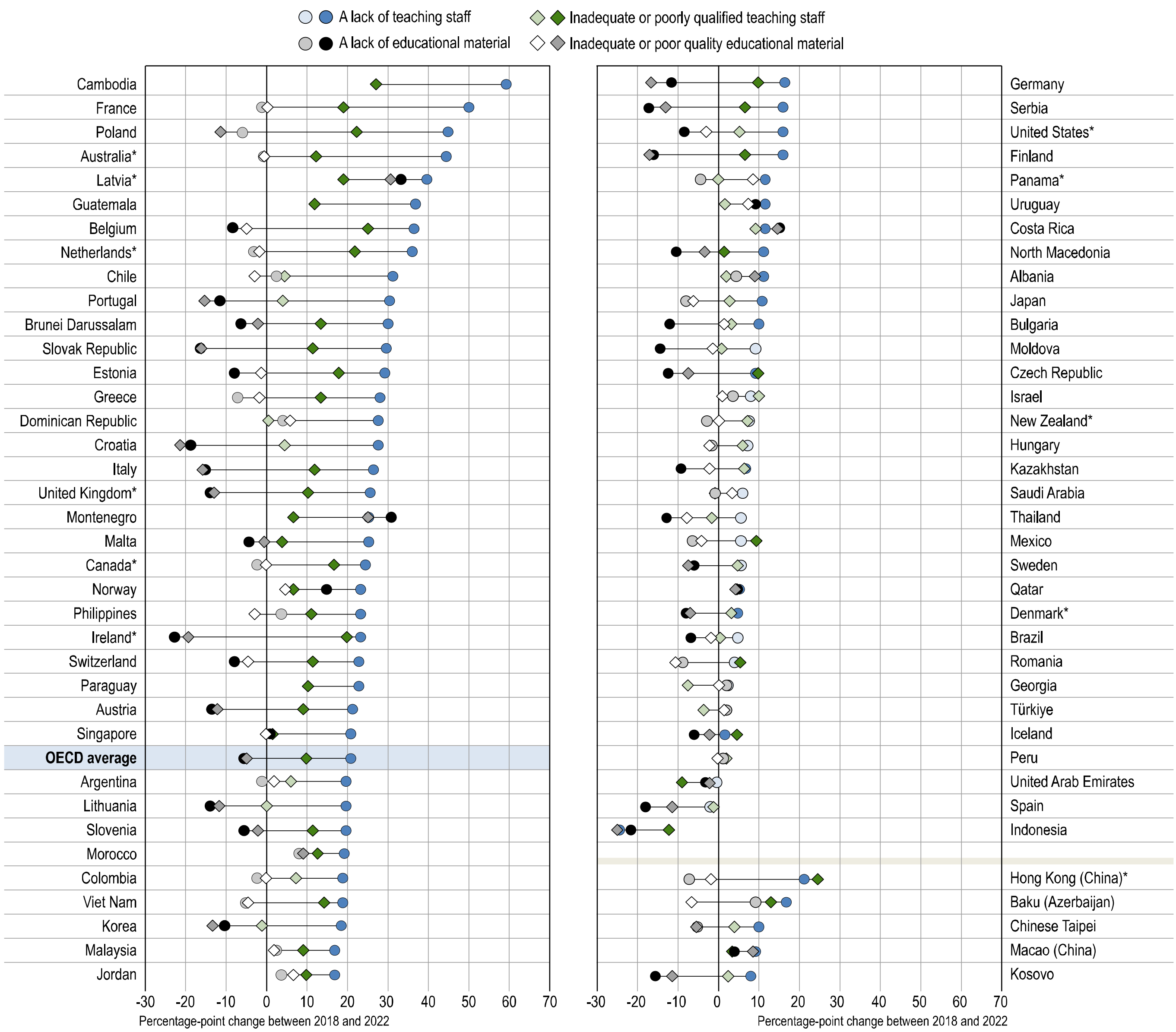
Some education systems suffer more from a lack of teaching staff while others suffer more from a lack of assisting staff, according to school principals. In 21 countries/economies, at least 50% of students were in schools whose principals reported that a lack of teaching staff hinders learning (Table II.B1.5.4). In 13 countries/economies, at least 50% of students attended schools whose principal reported that instruction is hindered by a lack of assisting staff.

Within countries/economies, principals' reports on shortages of education staff vary according to school characteristics (Figure II.5.4). In 30 countries/economies, students attending socio-economically disadvantaged schools were exposed to more shortages of education staff than their peers in advantaged schools. The largest disparities in shortages of education staff related to the socio-economic profile of schools were found in Peru, Jordan, Australia*, Colombia, Brunei Darussalam, Uruguay, Panama* and the United Arab Emirates (in descending order) (Table II.B1.5.2). Only in Malta were shortages of education staff more prevalent in advantaged schools.

In 36 countries/economies, shortages of education staff were more prevalent in public schools than in private schools. The largest disparities in shortages of education staff were observed in Greece, Uruguay, Morocco, Türkiye, Colombia, New Zealand*, the United Arab Emirates and Portugal (in descending order). In France public schools suffered less from shortages of education staff than private schools. On average across OECD countries and in 16 countries/economies, shortages of education staff were more prevalent in rural schools than in urban schools. In four countries/economies, shortages of education staff were more prevalent in urban schools than in rural schools.

Figure II.5.3. Change between 2018 and 2022 in shortage of education staff and material resources

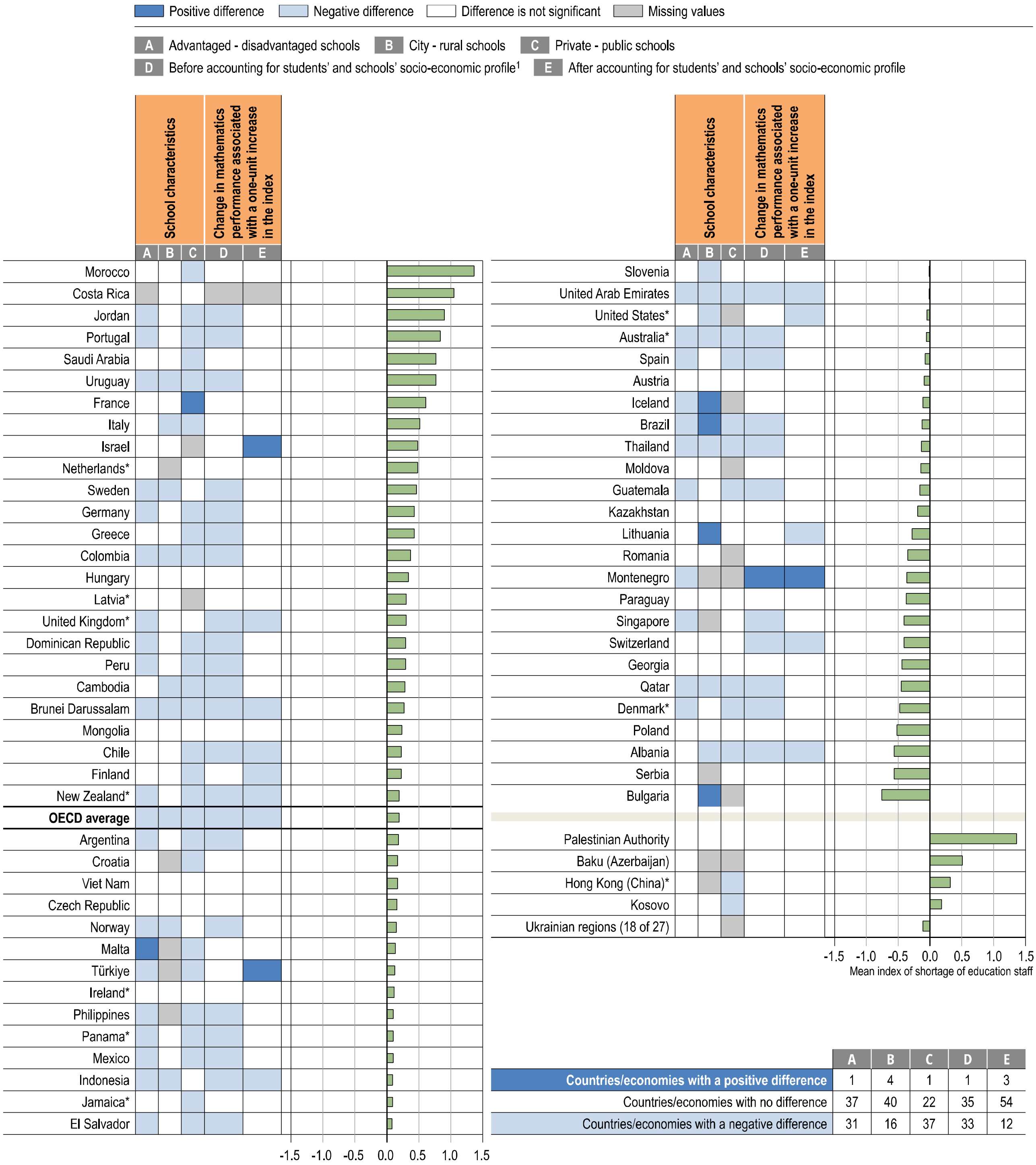
Percentage-point change in students whose principals reported that the school's capacity to provide instruction is hindered to some extent or a lot by the following



Notes: Only countries and economies with available data are shown.
Statistically significant differences between PISA 2018 and PISA 2022 (PISA 2022 - PISA 2018) are shown in a darker tone (see Annex A3).
Countries and economies are ranked in descending order of the change in lack of teaching staff between 2018 and 2022.
Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

Figure II.5.4. Shortage of education staff and school characteristics

Based on principals' reports



	A	B	C	D	E
Countries/economies with a positive difference	1	4	1	1	3
Countries/economies with no difference	37	40	22	35	54
Countries/economies with a negative difference	31	16	37	33	12

1. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).

Note: Higher values in the index indicate greater shortages of education staff.

Countries and economies are ranked in descending order of the index of shortage of education staff.

Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

At the system level, shortages of education staff are negatively related to student performance in mathematics

In 32 countries/economies, students attending schools whose principal reported shortages of education staff scored lower in mathematics than students in schools whose principal reported fewer or no shortages of staff (Figure II.5.4 and Table II.B1.5.5). In 35 countries/economies, no statistically significant differences in mathematics scores were found between students in schools with more shortages of education staff compared with students in schools with few or no shortages. In Montenegro, students attending schools with more shortages scored higher in mathematics than students in schools with fewer or no shortages of staff.

The association between shortage of education staff and mathematics performance was attenuated after accounting for students' and schools' socio-economic profile, and the negative relationship was significant in 10 countries/economies. In 56 countries/economies, no statistically significant differences in mathematics scores were found between students in schools with more shortages and those in schools with fewer or no shortages of education staff, after accounting for students' and schools' socio-economic profile. In three countries/economies, namely Israel, Montenegro and Türkiye, students attending schools with more shortages scored higher in mathematics than students in schools with fewer or no shortages of staff.

When the components of the index of shortage of education staff were examined separately in relation to mathematics performance (Figure II.5.6 and Table II.B1.5.5), all four components were negatively associated with mathematics performance, on average across OECD countries, even after accounting for students' and schools' socio-economic profile. This negative relationship was the strongest when school principals reported inadequate or poorly qualified teaching staff, on average across OECD countries and particularly in the United Arab Emirates, Japan, Macao (China), Iceland, Indonesia, the Czech Republic and Brazil (in descending order of the strength of the relationship). The lack of teaching staff had the second strongest and negative correlation with mathematics performance across OECD countries, and especially in the United Arab Emirates, Japan, Chinese Taipei, the United States*, Viet Nam and Macao (China) (in descending order). In addition, Table II.B1.5.5 shows that a lack of assisting staff is also negatively correlated with mathematics performance across OECD countries, and particularly in the United Arab Emirates, the Slovak Republic, Lithuania, Italy, Singapore, North Macedonia, Cambodia and Indonesia (in descending order). The negative association between poor or inadequate assisting staff and mathematics performance was strongest in the United Arab Emirates, Korea, Albania and the United Kingdom* (in descending order). These results underscore the importance of having a sufficient number of qualified teaching and assisting staff available to support students.[3]

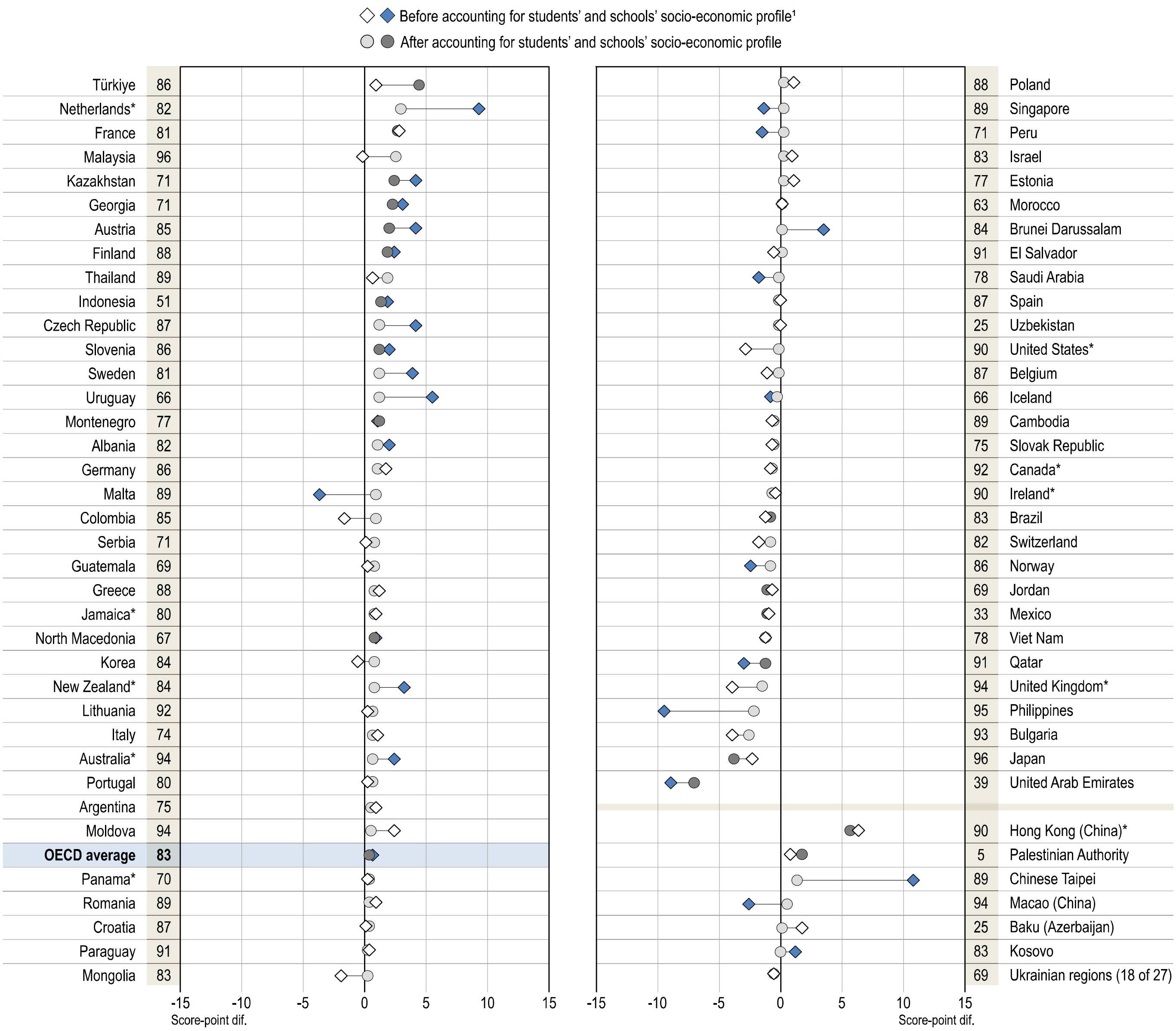
In most PISA-participating countries/economies, most teachers were fully certified, i.e. they are licensed to teach based on standards defined by national or local institutions.[4] On average across OECD countries in 2022, 87% of teachers working in schools with the modal ISCED level for 15-year-old students were fully certified by the appropriate national or local authority. In 13 countries/economies at least 95% of teachers were fully certified and in Macao (China), Australia*, Bulgaria and Ireland* (in descending order), more than 97% of teachers were fully certified (Table II.B1.5.9). On average across OECD countries, the percentage of certified teachers remained stable between 2018 and 2022, but this share decreased in 21 countries/economies, and by more than 10 percentage-points in Baku (Azerbaijan), Kazakhstan, Iceland, Argentina, Viet Nam, the Slovak Republic, Panama*, Brunei Darussalam and Korea (in descending order). In 13 countries/economies, the percentage of certified teachers increased during the period, and by more than 10 percentage points in Colombia, Georgia, Israel, North Macedonia and Montenegro (in descending order).

Schools with more fully certified teachers tended to score higher. After accounting for students' and schools' socio-economic profile, in 12 countries/economies, and on average across OECD countries, students in schools with a larger share of fully certified teachers scored higher in mathematics (Figure II.5.5); in 6 countries and economies they scored lower.

In 8 countries/economies, namely Brunei Darussalam, Uruguay, Slovenia, Chinese Taipei, Iceland, Sweden, the Czech Republic and France (in descending order), the share of fully certified teachers was larger in advantaged than in disadvantaged schools; but in 10 countries/economies, namely Türkiye, Singapore, Philippines, Peru, Colombia, Morocco, Mongolia, Brazil, El Salvador and the United Arab Emirates, the opposite was observed (Table II.B1.5.8).

Figure II.5.5. Certified teachers and mathematics performance

Change in mathematics performance per 10 percentage-point increase in the share of certified teachers at school; based on principals' reports



1. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).

Notes: The percentage of certified teachers in schools attended by 15-year-olds is shown next to the country/economy name.

Statistically significant differences are shown in a darker tone (see Annex A3).

Countries and economies are ranked in descending order of the score-point difference related to a 10 percentage-point increase in the share of certified teachers at school, after accounting for students' and schools' socio-economic profile.

Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

Components of resilience: Reducing student-teacher ratios and class size

Education systems that reported lower student-teacher ratios showed higher mathematics scores even after accounting for per capita GDP (Table II.B1.5.101). The change in class size between 2018 and 2022 was negatively associated with the change in performance between 2018 and 2022. This means that education systems where average class size increased more between 2018 and 2022 tended to show a greater deterioration in mathematics performance over the same period (Table II.B1.5.104). Across all countries/economies, smaller classes and fewer students per teacher were associated with a stronger sense of belonging at school, even after accounting for per capita GDP (Table II.B1.5.101).

In most education systems, student-teacher ratios and class size did not change between 2018 and 2022

PISA 2022 asked school principals to report the number of teachers and students in their schools from which the student-teacher ratio was computed (Table II.B1.5.11). Across OECD countries, there were about 12 students for every teacher. Student-teacher ratios ranged from 27 students per teacher in El Salvador and the Philippines, to fewer than 8 students per teacher in Argentina, Brunei Darussalam, Greece, Italy, Malta and Slovenia.

Between 2018 and 2022, the student-teacher ratio decreased on average across OECD countries (a decrease of 0.2 student per teacher) and in 22 countries/economies. In Cambodia, the Dominican Republic, Brazil, Chile and Kosovo (in descending order) the student-ratio decreased by more than two students per teacher. In 14 countries, the student-teacher ratio increased, and in Peru, the Philippines, Poland and Viet Nam by more than 2 students per teacher. In 36 countries/economies, the student-teacher ratio remained stable between 2018 and 2022. The PISA 2022 results based on school principals' report confirm the latest data published in Education at a Glance (OECD, 2023[2]), yet some caution is advised when interpreting student-teacher ratios, as the ratio may not reflect a possible increase in teacher absenteeism.

On average across OECD countries and in 28 countries/economies, the student-teacher ratio was higher in advantaged than disadvantaged schools (a difference of 1.1 students, on average across OECD countries). The opposite was observed only in Cambodia, the Dominican Republic, Morocco, the Palestinian Authority, Türkiye and the United Arab Emirates where disadvantaged schools had higher student-teacher ratios than advantaged schools. On average across OECD countries and in 28 countries/economies, the student-teacher ratio was higher in public schools than private schools (a difference of 1.3 students, on average across OECD countries). The opposite was observed in 11 countries/economies, namely Argentina, Brunei Darussalam, Chile, Kazakhstan, Korea, Portugal, Slovenia, Spain, Sweden, Chinese Taipei and the United Arab Emirates, where private schools had higher student-teacher ratios than public schools.

PISA 2022 also asked school principals to report the average size of language-of-instruction classes in the national modal grade for 15-year-olds (Table II.B1.5.15). According to school principals, on average across OECD countries there were 26 students per language-of-instruction class. In the Philippines, Cambodia and Viet Nam (in descending order), there were 40 or more students per language-of-instruction class and in Malta, Switzerland and Finland (in ascending order) there were 20 or fewer students per class.

The average size of language-of-instruction class shrank between 2018 and 2022 in 21 countries/economies (by 5 or more students in Argentina, Guatemala, Kazakhstan, Panama*, Saudi Arabia and Türkiye) while it grew in 13 countries/economies (by 2 or 3 students in Albania, Baku [Azerbaijan], Costa Rica, Peru and Poland). On average across OECD countries, there was 0.3 fewer student per language-of-instruction class in 2022 than in 2018 (Table II.B1.5.16). In 40 of 74 countries/economies with available data, class size did not change between 2018 and 2022. Some caution is advised when interpreting class size, as it may not reflect a possible increase in teacher absenteeism.

On average across OECD countries, smaller classes were more frequently observed in socio-economically disadvantaged schools than in advantaged schools (3.3 fewer students per language-of-instruction class), and in public than in private schools (1.5 fewer students per language-of-instruction class) (Table II.B1.5.15).

Components of resilience: Providing adequate and high-quality educational material

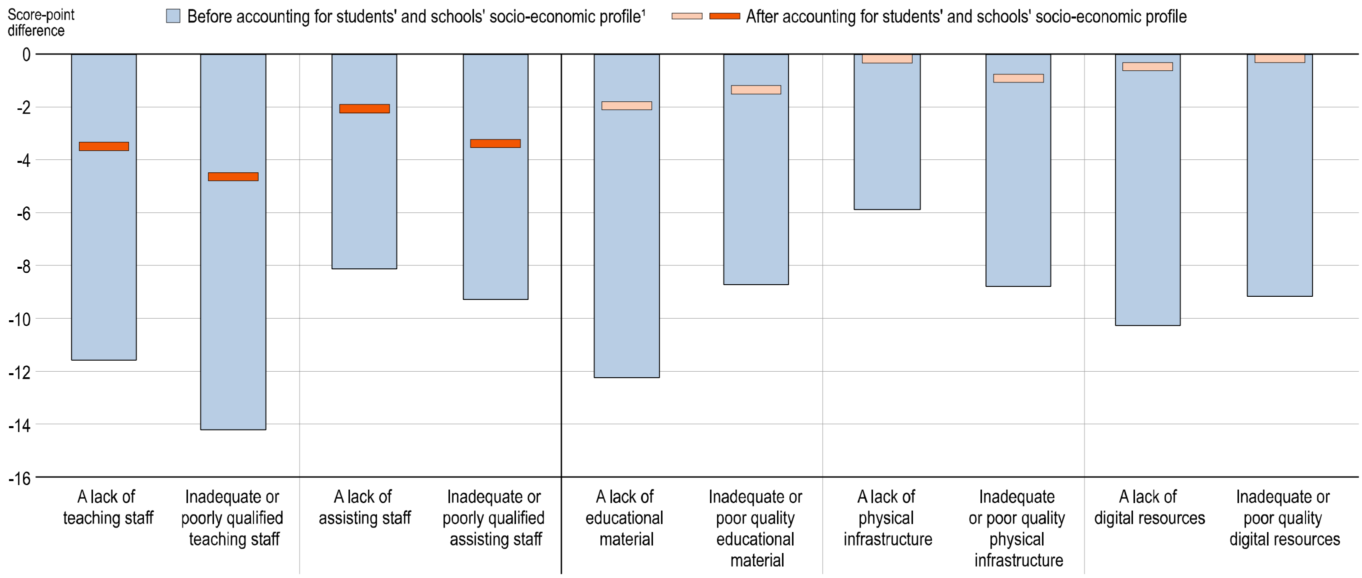
In systems where students scored lower in mathematics, on average, school principals reported that instruction was hindered to a greater extent by a lack of or inadequate/poor-quality educational material and digital resources (Table II.B1.5.100). Across all countries/economies, a negative association was found between a lack of or inadequate/poor-quality digital resources and student performance. PISA 2022 results also show that higher performing systems ensure that every student has access to a digital device (computer or tablet); but the availability of these devices does not, in itself, indicate their capacity to enhance teaching and learning. School policies and practices on the use of digital devices is also important, and having adequate guidelines for their use is key to ensuring a school's preparedness for digital learning.

High-performing schools, which tend to have a more advantaged student body, suffer less from shortages of educational material

In each education system, it is important to ensure that all schools, regardless of their socio-economic profile, enjoy adequate and quality educational material. Students attending schools with fewer shortages of material resources[5] performed better in mathematics, on average across OECD countries and in about 60% of all participating countries/economies, before accounting for students' and schools' socio-economic profile; but this relationship was observed in only 20% of countries/economies after accounting for the socio-economic profiles of students and schools (Table II.B1.5.23). In almost 80% of countries/economies material resources and mathematics scores were unrelated when comparing schools with similar socio-economic intakes. On average across OECD countries, shortages of educational material were more strongly associated with poorer mathematics performance than shortages of physical infrastructure (Figure II.5.6). However, after accounting for students' and schools' socio-economic profile, these associations became statistically insignificant, showing that disadvantaged schools and students suffer the most from a lack of educational material and physical infrastructure.

Figure II.5.6. Shortage of education staff and material resources, and mathematics performance

Change in mathematics performance associated with principals reporting that the school's capacity to provide instruction is hindered to some extent or a lot by the following; OECD average



1. The socio-economic profile is measured by the PISA index of economic, social and cultural status.

Notes: Statistically significant score-point differences are shown in a darker tone. All score-point differences are statistically significant before accounting for students' and schools' socio-economic profile (see Annex A3).

Educational material includes textbooks, ICT equipment, library, laboratory material, etc. Physical infrastructure includes school building, grounds, heating/cooling systems, lighting and acoustic systems, etc.

Digital resources include desktop or laptop computers, Internet access, learning-management systems or school learning platforms, etc.

Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

Half of all participating education systems suffered fewer shortages of educational material in 2022 than in 2018

In about half of education systems with available data, principals in 2022 reported fewer shortages of educational material than their counterparts did in 2018 (Table II.B1.5.21). Fewer students in 2022 than in 2018 attended schools whose principal reported that instruction is hindered by a lack of educational material (e.g. textbooks, IT equipment, library or laboratory material) or physical infrastructure (e.g. building, grounds, heating/cooling, lighting and acoustic systems), or due to inadequate or poor-quality educational material or physical infrastructure, on average across OECD countries (Table II.B1.5.22). Figure II.5.3 contrasts the change between 2018 and 2022 in school principals' perception of the shortage of teaching staff and educational material. It shows that most countries/economies were more affected by perceived increases in the shortage of education staff than in shortages of material resources. On average across OECD countries and in about half of all participating countries/economies, school principals in 2022 were more likely than their counterparts in 2018 to report a shortage of teaching staff and less likely to report a shortage of educational material. The greatest improvements in the concerns of principals about the quantity of educational material during the period were observed in Ireland*, Indonesia, Croatia, Spain, Serbia, the Slovak Republic, Finland, Kosovo and Italy (in descending order); when considering the quality of educational material, the greatest improvements were observed in Indonesia, Croatia, Ireland*, Finland, Germany, the Slovak Republic, Italy and Portugal (in descending order). The most marked improvements in the quantity of physical infrastructure between 2018 and 2022 were found in Indonesia, Korea, Ireland*, Croatia, Hong Kong (China)*, New Zealand* and Colombia (in descending order); Indonesia, Korea, Ireland*, Finland, the Czech Republic, Georgia and Hong Kong (China)* (in descending order) saw the greatest improvements in the quality of the physical infrastructure during that period.

But in Costa Rica, Latvia*, Montenegro and Norway principals were more likely – and by the largest increases -- to report more shortages of educational material. In 25 countries/economies, school principals in 2022 were less likely than their counterparts in 2018 to report that instruction is hindered due to inadequate or poor-quality educational material; but over the same period, principals in Albania, Costa Rica, Latvia*, Macao (China), Montenegro, Morocco and Qatar were more likely to report so. In 23 countries/economies, school principals in 2022 were less likely than their counterparts in 2018 to report that instruction is hindered by a lack of physical infrastructure; by contrast, in Costa Rica, Malta, Qatar and Ukrainian regions (18 of 27) principals in 2022 were more likely than those in 2018 to report so. In 28 countries/economies, school principals in 2022 were less likely than those in 2018 to report that instruction is hindered by inadequate or poor-quality physical infrastructure; but during the same period, principals in in Iceland, Latvia*, Qatar and Singapore were more likely to report so.

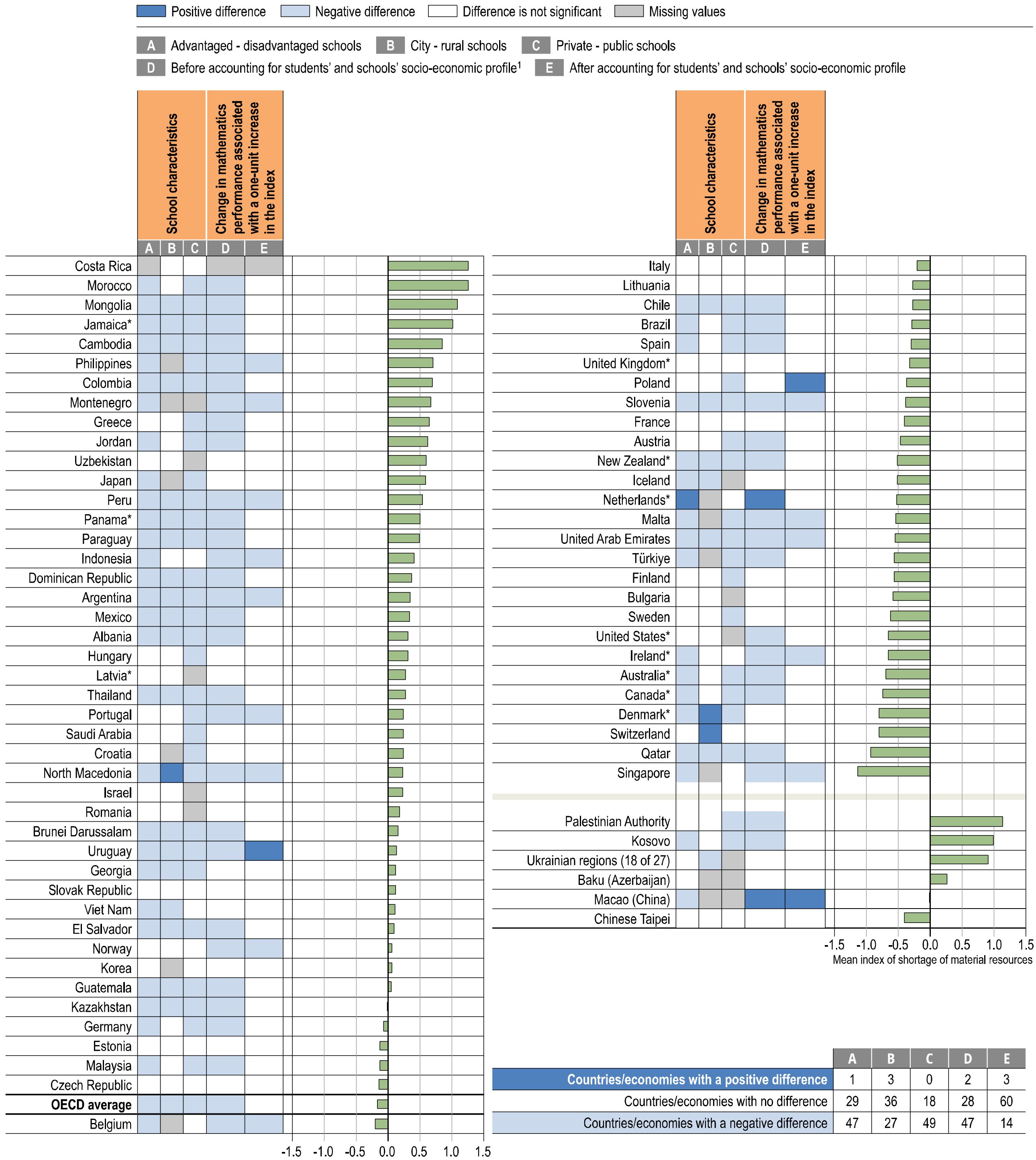
In 2022, school principals in Singapore, Qatar, Switzerland, Denmark* and Canada* (in ascending order) reported fewer shortages of material resources than other participating countries/economies (Figure II.5.7 and Table II.B1.5.17). In Australia*, Canada*, Denmark*, Ireland*, Malta, the Netherlands*, Qatar, Singapore, Sweden, Switzerland, Chinese Taipei and the United States* fewer than one in ten students attended a school whose principal reported that instruction is hindered by either a lack of or inadequate or poor-quality educational material. In Canada*, Denmark*, Finland, Hong Kong (China)*, Qatar, Singapore and Türkiye, fewer than one in six students attended a school whose principal reported that instruction is hindered by either a lack of or inadequate or poor-quality infrastructure.

In PISA 2022, more principals in Costa Rica, Morocco, the Palestinian Authority, Mongolia, Jamaica*, Kosovo, Ukrainian regions (18 of 27), Cambodia and the Philippines (in descending order) reported concerns about shortages of material resources than in other participating countries/economies (Table II.B1.5.17). In Costa Rica, Jamaica*, Kosovo, Mongolia, Montenegro, Morocco and Ukrainian regions (18 of 27) more than two in three students were in schools whose principal reported that the school's capacity to provide instruction is hindered, to some extent or a lot, by a lack of educational material. In Jamaica*, Kosovo, Mongolia, Morocco and Ukrainian regions (18 of 27) more than two in three students were in schools whose principal reported that the school's capacity to provide instruction is hindered by inadequate or poor-quality educational material. In Cambodia, Costa Rica, Jamaica*, Morocco and the Palestinian Authority more than six in ten students were in schools whose principal reported that the school's capacity to provide instruction is hindered by a lack of physical infrastructure. In Cambodia, Costa Rica, Jamaica*, Mongolia, and the Palestinian Authority more than 60% of students were in schools whose principal reported that the school's capacity to provide instruction is hindered by inadequate or poor-quality physical infrastructure.

Education systems where students attended schools with fewer shortages of, or with adequate/high-quality, digital resources performed better in mathematics, on average across OECD countries and in half of all participating countries/economies, before accounting for students' and schools' socio-economic profile; but this relationship is observed in only 20% of countries/economies after accounting for the socio-economic profiles of students and schools (Table II.B1.5.23). In more than 75% of countries/economies digital resources and mathematics scores were unrelated when comparing schools with similar socio-economic intakes.

Figure II.5.7. Shortage of material resources and school characteristics

Based on principals' reports



	A	B	C	D	E
Countries/economies with a positive difference	1	3	0	2	3
Countries/economies with no difference	29	36	18	28	60
Countries/economies with a negative difference	47	27	49	47	14

1. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).

Note: Higher values in the index indicate greater shortages of educational material.

Countries and economies are ranked in descending order of the index of shortage of educational material.

Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

Socio-economically disadvantaged schools were more likely than advantaged schools to experience shortages of material resources, on average across OECD countries and in 46 education systems. Only in the Netherlands* did disadvantaged schools report fewer shortages of educational material than advantaged schools.

Disparities in shortages of material resources were also observed between rural and urban schools (in 27 education systems, rural schools suffered more from shortages) and between public and private schools (in 49 education systems, public schools suffered more from shortages) (Figure II.5.7). Only in Denmark*, North Macedonia and Switzerland did rural schools report fewer shortages of educational material than urban schools; and in no county/economy did public schools report fewer shortages of educational material than private schools.

Components of resilience: Providing access to high-quality digital devices and developing guidelines for their use

A negative association was found between a lack of or inadequate/poor-quality digital resources (e.g. desktop or laptop computers, Internet access, learning management systems or school learning platforms) and student performance (Table II.B1.5.100). Across all countries/economies, 17% of the variation in student performance was accounted for by differences in the extent to which instruction is hindered by a lack of digital resources, according to school principals, after accounting for per capita GDP. Across all countries/economies, 13% of the variation in student performance is explained by differences in the extent to which instruction is hindered by inadequate or poor-quality digital resources, after accounting for per capita GDP. No clear pattern is observed between the availability of digital resources and either equity or well-being.

PISA 2022 results show that higher performing systems ensure that every student has access to a digital device (Table II.B1.5.24). Across all countries/economies, the average computer-to-student ratio was 0.6 (variability of 0.3)[6] and in higher performing systems, the computer-to-student ratio was higher, both before and after accounting for per capita GDP. Across OECD countries, the computer-to-student ratio was 0.8 (variability of 0.3) and this relationship was observed before, but not after, accounting for per capita GDP. Across OECD countries, the average tablet-to-student ratio was 0.4 (variability of 0.2) and higher tablet-to-student ratios were associated with higher performance, both before and after accounting for per capita GDP. Across all countries/economies, the average tablet-to-student ratio was 0.3 (variability of 0.4) but no relationship with mathematics performance was observed.

High-performing schools, which tend to have a more advantaged student body, suffer less from shortages of digital resources

Schools, like most other institutions in society, are adapting to the increasing digitalisation of daily life. In Australia*, Bulgaria, Denmark*, Lithuania, the Netherlands*, New Zealand*, Norway, Singapore, Slovenia, Sweden and the United States* less than 10% of students were in schools whose principal reported that shortages of digital resources hinder instruction to some extent or a lot; in Australia*, Bulgaria, Canada*, Denmark*, the Netherlands*, New Zealand*, Qatar, Singapore, Sweden and the United States* less than 10% of students were in schools whose principal reported inadequate or poor-quality digital resources (Table II.B1.5.17). But in Argentina, Baku (Azerbaijan), Cambodia, Colombia, Costa Rica, Jamaica*, Kosovo, Mongolia, Morocco, the Palestinian Authority, Panama* and Ukrainian regions (18 of 27) more than two in three students were in schools whose principal reported that the school's capacity to provide instruction is hindered by a lack of digital resources.[7] In Argentina, Cambodia, Costa Rica, Jamaica*, Kosovo, Mongolia, Morocco, the Palestinian Authority, Panama* and Ukrainian regions (18 of 27) more than two in three students were in schools whose principal reported that the school's capacity to provide instruction is hindered by inadequate or poor-quality digital resources.

On average across OECD countries and in 40 education systems, socio-economically disadvantaged schools were more likely than advantaged schools to suffer from a lack of or poor-quality digital resources. In no participating country/economy were principals in disadvantaged schools less likely than those in advantaged schools to report that instruction is hindered by a lack of digital resources. Disparities in the shortage of digital resources were also observed between rural and urban schools (in 21 education systems, rural schools suffered more from shortages) and between public and private schools (in 48 education systems, principals in public schools reported more shortages; in no participating country/economy were principals in public schools less likely than those in private schools to report shortages of digital resources) (Table II.B1.5.19). In 40 countries/economies, principals in disadvantaged schools were more likely than those in advantaged schools to report inadequate or poor-quality digital resources (Table II.B1.5.20). In 22 countries/economies, rural schools reported more inadequate or poor-quality digital resources than urban schools; and in 49 countries/economies public schools suffered more than private schools from inadequate or poor-quality digital resources. Only in Canada*, North Macedonia and Chinese Taipei were principals in rural schools less likely than their counterparts in urban schools to report inadequate or poor-quality digital resources; in Belgium, Korea and Slovenia principals in public schools were less likely than those in private schools to report inadequate or poor-quality digital resources.

In OECD countries, nearly every 15-year-old has access to a computer at school

On average across OECD countries in 2022 there was about 0.8 computer (laptop and desktop combined) and 0.4 tablet device and e-book reader available at school for educational purposes for every 15-year-old student (Tables II.B1.5.24 and II.B1.5.27). In Australia*, Austria, El Salvador, New Zealand*, Singapore, the United Kingdom* and the United States* the computer-to-student ratio was higher than one-to-one. In 31 countries/economies, there was fewer than one computer available for every two students; and in 10 countries/economies there was fewer than one computer for every 4 students. In the Dominican Republic, Hong Kong (China)* and Romania the tablet-to-student ratio was higher than one-to-one. In 66 countries/economies, there was fewer than one tablet available for every 2 students, and in 21 countries/economies there was fewer than one tablet for every 10 students.

As in earlier assessments, the computer-to-student ratio increased between 2018 and 2022, though by much less than between 2012 and 2022 (Table II.B1.5.25). The computer-to-student ratio increased in 19 out of 72 countries/economies between 2018 and 2022. The largest increases in the average number of computers per 15-year-old student were observed in Bulgaria, Finland, France, Kazakhstan and Portugal.

In 20 countries/economies, socio-economically disadvantaged schools tended to have more computers per student than advantaged schools (Table II.B1.5.24); in 20 countries/economies, advantaged schools had more computers per student than disadvantaged schools. In 12 countries/economies the tablet-to-student ratio was higher in disadvantaged schools than in advantaged schools (Table II.B1.5.27). The disparity in favour of disadvantaged schools was the largest in Australia*, El Salvador, Japan, Korea, Lithuania, New Zealand* and Poland (in computers-per-student) and in Austria, Korea, Lithuania and Peru (in tablets-per-student). The disparity in favour of advantaged schools was the largest in Guatemala, Panama* and Qatar (in computers-per-student) and in Macao (China) and the United Arab Emirates (in tablets-per-student).

On average across OECD countries and in 28 countries/economies, the ratio of computers to students was higher in private than in public schools; but in 9 countries/economies, namely Argentina, Australia*, Austria, El Salvador, Japan, Singapore, the Slovak Republic, Slovenia and the United Arab Emirates, the computer-to-student ratio was higher in public schools than in private schools. On average across OECD countries, the computer-to-student ratio was higher in rural schools (ratio = 1.0) than in urban schools (ratio = 0.8). In 24 countries/economies, the computer-to-student ratio was higher in rural schools than in urban schools (especially in El Salvador, Hungary, Latvia*, Lithuania, the United Arab Emirates and the United Kingdom*), but the opposite was observed in Albania, Guatemala and Paraguay.

Developing guidelines for using digital devices prepares schools and students for digital learning

The availability and quality of instructional materials, in themselves, do not guarantee better learning; schools and teachers must be able to use these resources effectively to enhance learning and teaching (Burns and Gottschalk, 2019[3]) This is particularly true regarding digital devices in education, as a growing number of countries have invested heavily to equip their schools and students with these tools. This process of digitalisation intensified during the COVID-19 pandemic and the sudden shift towards remote learning when schools were closed (Box II.2.4).

PISA 2022 asked school principals about different aspects of their school's preparedness for digital learning (Table II.B1.5.29).[8] PISA 2022 results show that the availability of computers does not, in itself, indicate a school's preparedness for digital learning; having adequate guidelines for their use is also important (Figure II.5.8). The number of computers available per student at school was positively related to schools' preparedness for digital learning, on average across OECD countries and in 20 countries/economies, even after accounting for students' and schools' socio-economic profile; it was negatively related in 5 countries/economies. On average across OECD countries and in 34 countries/economies, having formal guidelines for using digital devices for teaching and learning in specific subjects was positively related to the index of preparedness for digital learning, after accounting for the number of computers per student.

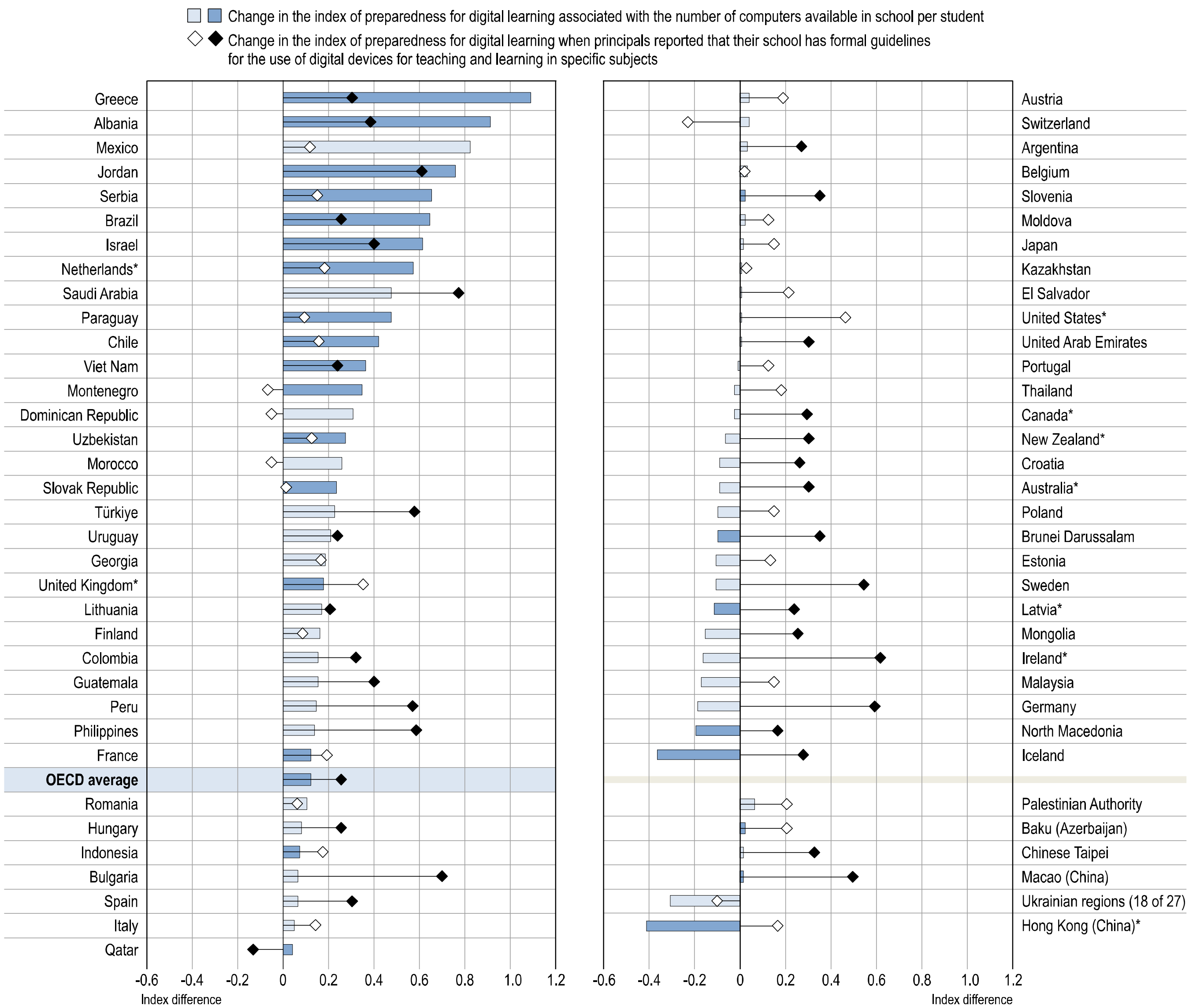
On average across OECD countries, the largest improvements in schools' preparedness for digital learning observed between 2018 and 2022 concern the availability of an effective online learning-support platform (in 2022, 78% of principals agreed or strongly agreed that this is available – a 26 percentage-point increase over 2018); teachers having the necessary technical and pedagogical skills to integrate digital devices into their instruction (88% of principals in 2022 so reported, a 24 percentage-point increase over 2018); and the availability of effective professional resources for teachers to learn how to use digital devices (76% of principals in 2022 so reported, a 13 percentage-point increase over 2018) (Table II.B1.5.32). The largest increases (of more than 50 percentage points) in providing an effective online learning-support platform were observed in Brunei Darussalam, Bulgaria, France, Germany, North Macedonia, Romania and Viet Nam. The largest increases (of more than 40 percentage points) in teachers having the necessary technical and pedagogical skills to integrate digital devices into their instruction were observed in Finland, Ireland*, Japan and Morocco. The largest increases (of more than 30 percentage points) in the availability of effective professional resources for teachers to learn how to use digital devices were observed in Ireland*, North Macedonia, Portugal and Viet Nam.

In 2022 about 59% of students, on average across OECD countries, attended schools where teachers have sufficient time to prepare lessons integrating digital devices; 59% of students were in schools with sufficient qualified technical assistance staff; and 55% of students attended schools where teachers are offered incentives to integrate digital devices into their teaching. There was no significant change, between 2018 and 2022, in teachers having sufficient time to prepare lessons integrating digital devices, according to principals' reports (Table II.B1.5.32). Principals also reported only a three percentage-point increase during the same period in the prevalence of offering incentives to teachers to integrate digital devices into their teaching.

In Cambodia, Indonesia, Kazakhstan, Macao (China), the Philippines, Qatar, Saudi Arabia, Sweden, Thailand, the United Arab Emirates, Uzbekistan and Viet Nam, more than 90% of students attended schools where teachers have sufficient time to prepare lessons integrating digital devices (Table II.B1.5.32). In Argentina, Belgium, Costa Rica, Germany, Greece, Hungary, Japan, Latvia*, Paraguay, Portugal, Spain and Uruguay the opposite was observed: more than 50% of students attended schools where teachers did not have sufficient time to prepare lessons integrating digital devices, according to principals. In Bulgaria, Croatia, Iceland, Kazakhstan, Lithuania, Poland, Slovenia, Thailand, Türkiye, Ukrainian regions (18 of 27) and Uzbekistan, more than 90% of students attended schools where teachers are offered incentives to integrate digital devices in their teaching. The opposite was observed in Costa Rica, Jamaica*, Romania, Spain and Uruguay, where more than 80% of students were in schools where teachers are not offered incentives to integrate digital devices in their teaching. More than 80% of students in Bulgaria, Cambodia, Indonesia, Kazakhstan, the Netherlands*, North Macedonia, Qatar, Sweden, Thailand, the United Arab Emirates, Uzbekistan and Viet Nam attended schools with a sufficient number of qualified technical-assistance staff. By contrast, in Brazil, Greece, Ireland*, Japan, Latvia*, Morocco, Paraguay and Portugal more than 60% of students attended a school whose principal reported insufficient numbers of qualified technical-assistance staff.

Figure II.5.8. Relationship between preparedness for digital learning, availability of computers and school guidelines

Formal guidelines for the use of digital devices for teaching and learning in specific subjects; based on students' and principals' reports



Notes: Only countries and economies with available data are shown.
Results based on linear regression analysis, after accounting for students' and schools' socio-economic profile. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).
Statistically significant differences are shown in a darker tone (see Annex A3).
Countries and economies are ranked in descending order of the change in the index of preparedness for digital learning associated with the number of computers available in school per student.
Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

In 23 countries/economies, socio-economically advantaged schools were better prepared for digital learning than were disadvantaged schools (Table II.B1.5.30). The largest disparities were observed in Albania, Brunei Darussalam, Colombia, the Dominican Republic, El Salvador, Guatemala, Macao (China), Mexico, Peru and Spain. In 18 countries/economies, principals in urban schools were more likely than their counterparts in rural schools to report that their school is prepared for digital learning, with the largest disparities found in Chile, Guatemala, Mexico, New Zealand*, Qatar and Chinese Taipei. In 25 countries/economies, private schools showed greater preparedness for digital learning than public schools, with the largest disparities observed in Albania, Colombia, Costa Rica, Greece, Mexico, Peru and Serbia.

Most schools have established rules about using digital devices on their premises

Using digital devices successfully to enhance teaching and learning may also depend on school policies and practices. PISA 2022 asked school principals whether they had formal guidelines (e.g. written statements, programmes or policies) or specific practices (e.g. regularly scheduled meetings) that focus on how to use digital devices effectively in the classroom.

On average across OECD countries, the most common school practices were teachers establishing rules for when students may use digital devices during lessons (95% of students attended such schools), the school having a written statement about the general use of digital devices on school premises (83% of students) and teachers establishing rules in collaboration with students about using digital resources at school or in class (73% of students) (Table II.B1.5.35).

By contrast, on average across OECD countries, the least common practices were: not allowing the use of cell phones on school premises (34% of students attended such schools), having a specific policy about using social networks in teaching and learning (51% of students) and having a specific programme to promote collaboration on the use of digital devices among teachers (55% of students).

In 13 countries/economies, namely Albania, Brunei Darussalam, Greece, Hong Kong (China)*, Jordan, Kosovo, Malta, Morocco, the Palestinian Authority, Qatar, Saudi Arabia, Spain and the United Arab Emirates, more than two in three students attended schools where the use of cell phones is not allowed. In Canada*, Finland, Lithuania, the Netherlands* and Uruguay less than 10% of students attended schools where the use of cell phones is not allowed. As shown in Box II.5.1, when the use of cell phones on school premises is banned, students are less likely to report becoming distracted by using digital devices in mathematics lessons.

On average across OECD countries and in 13 countries/economies, namely Baku (Azerbaijan), Brazil, Cambodia, Colombia, El Salvador, Guatemala, Kosovo, Malta, Mongolia, Montenegro, Morocco, Panama* and Paraguay, school guidelines and practices to enhance teaching and learning using digital devices were more likely to be found in socio-economically advantaged schools than in disadvantaged schools (Table II.B1.5.36). But in Brunei Darussalam, North Macedonia and Slovenia disadvantaged schools were more likely than advantaged schools to have guidelines and practices for using digital devices.

On average across OECD countries and in 14 countries/economies, disadvantaged schools were more likely than advantaged schools to forbid the use of cell phones. By contrast, in eight countries/economies (Albania, Jamaica*, Macao [China], Montenegro, New Zealand*, North Macedonia, Peru and Qatar) advantaged schools were more likely than disadvantaged schools to forbid the use of cell phones on their premises.

On average across OECD countries and in 27 countries/economies, private schools were more likely than public schools to restrict the use of cell phones. The disparity was the largest in Georgia, Jamaica*, Lithuania, the Philippines, Serbia and Sweden. In six countries/economies, public schools were more likely than private schools not to allow the use of cell phones; the largest disparities were observed in Brunei Darussalam and the United Arab Emirates.

Box II.5.1. Digital devices and distraction

How students use digital resources, and the types of digital devices they rely on, shape the extent to which students might become distracted when using digital technologies. Evidence from PISA 2022 shows that 30% of students reported becoming distracted by using digital devices in mathematics lessons (Figure II.3.4); and students who use digital devices in mathematics class more frequently reported that they are likely to become distracted, after accounting for students' and schools' socio-economic profile and students' mathematics performance (Figure II.5.9). Indeed, students can easily be tempted to multitask, shift their attention to other information or tools available on the devices, or use the Internet browser for non-academic activities when using these devices (Amez and Baert, 2020[4]; Beland and Murphy, 2016[5]; UNESCO, 2023[6]). Students might not be able to navigate through digital environments smoothly and thus can easily lose concentration. Evidence from PISA 2018 showed that, on average across OECD countries, 68% of students displayed limited or no digital navigation skills (OECD, 2021[7]).

Further analyses examining the type of digital technologies students use at school show that students who used smartphones at school more frequently reported that they were likely to become distracted while using digital devices in mathematics lessons (Table II.B1.5.44). Relying on students' cell phones at school increases the risk that students use their phones in class for non-educational activities or get distracted by notifications. By contrast, the use of educational software at school has a more moderately negative association with students' concentration (Table II.B1.5.42), suggesting that the use of digital resources with pedagogical intent makes a difference, although it does not completely eliminate distractions.

Indeed, students appear to be less distracted when they switch off notifications from social networks and apps on their digital devices during class, when they do not have their digital devices open in class to take notes or search for information, and when they do not feel pressured to be on line and answer messages while in class (Table II.B1.5.44). Policies that target students' skills and behaviours when interacting with digital environments are critical in limiting distractions, particularly since students can also become distracted by using other types of digital devices besides cell phones. These findings are consistent with previous evidence from PISA 2018 showing that student-led uses of digital devices in class were negatively associated with student performance in reading, science and mathematics, whereas teacher-led or combined student-teacher uses of digital technologies tend to be more effective (OECD, 2022[8]).

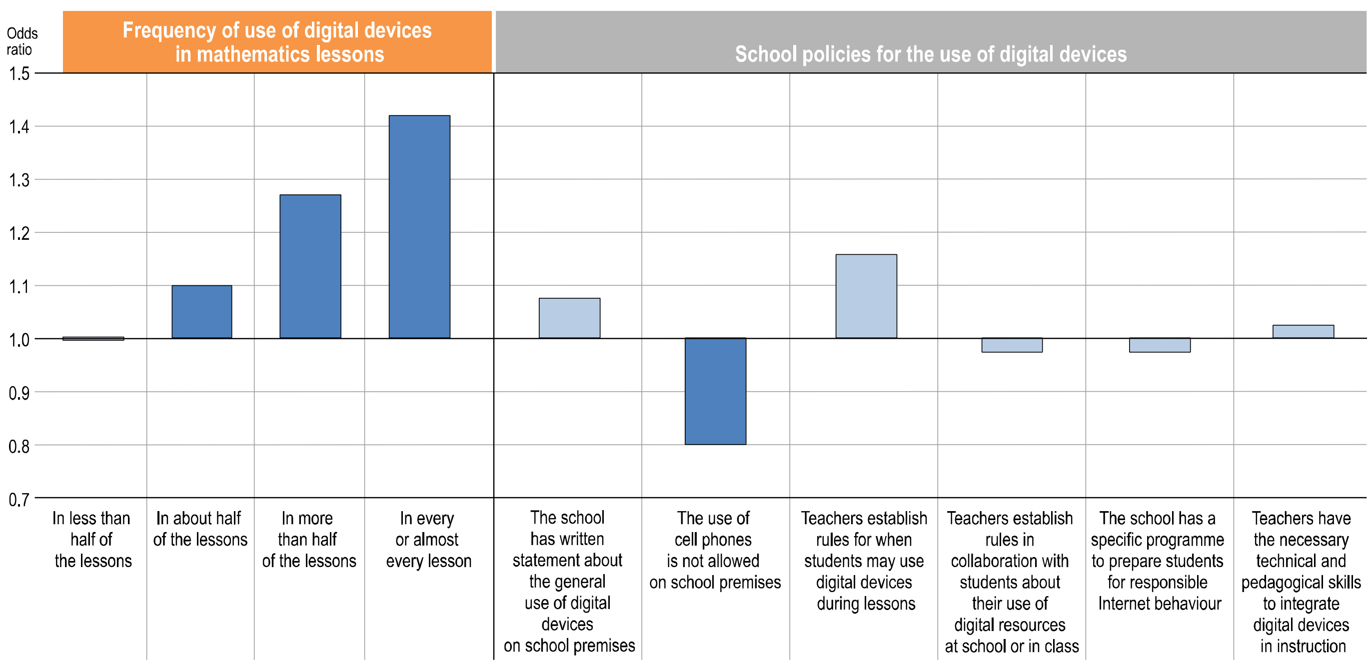
Many schools introduced guidelines addressing the problem of distraction when students use digital devices in school (Table II.B1.5.35). Whether these are written statements about the general use of devices, rules established by teachers concerning students' use of these devices during lessons, rules established by teachers in collaboration with students, or programmes to prepare students for responsible Internet behaviour, these types of school policies show little association with the likelihood of students becoming distracted when using digital devices in class. Additional analyses suggest that this also holds for school policies that specifically target the use of digital resources in mathematics instruction (for example, the amount of time computers are used in mathematics lessons or using specific mathematics computer programs) (Table II.B1.5.43).

The content and design of such rules, as well as the capacity to enforce them, likely play a critical role in determining their effectiveness. When a school's written statements or rules are too generally designed, imprecise or lenient, they are unlikely to support effective teaching and learning with digital devices. Schools and teachers also need the time and capacity to enforce such rules. Teachers are probably unable to monitor what their students are doing with their digital devices in class, even when they are used as part of the lesson. Indeed, teachers' preparedness in integrating digital devices in instruction bears little relationship with the possibility of students becoming distracted while using digital devices during mathematics class (Figure II.5.9).

At the same time, students are less likely to report being distracted by using digital devices in mathematics lessons when the use of cell phones on school premises is banned. While mobile phones have expanded access to learning resources and provide flexibility in using them (particularly in classrooms where other devices may not be available), they may also be the source of distractions for students. Banning cell phones in class can help reduce distractions – especially when those bans are enforced. Analyses based on PISA 2022 data show that school phone bans appear to be most effective in reducing distraction in education systems where students' use of smartphones is substantially lower in schools where smartphones are banned on school premises than in schools where they are not banned (as a proxy for enforcement) (Figure II.5.10). However, on average across OECD countries, 29% of students in schools where the use of cell phones is banned reported using a smartphone several times a day, and an additional 21% reported using one every day or almost every day at school (Table II.B1.5.39). This finding illustrates that cell phone bans are not always effectively enforced. Banning cell phones at school may also be related to students' use of digital devices outside of school. In Canada*, Chile, Indonesia, Korea, New Zealand*, Peru, the Philippines, the Slovak Republic and Chinese Taipei, when cell phones are banned at their school, students are less likely to turn off notifications from social networks and apps on their digital devices when going to sleep, even after taking into account students' and schools' socio-economic profile and students' performance (Table II.B1.5.45).

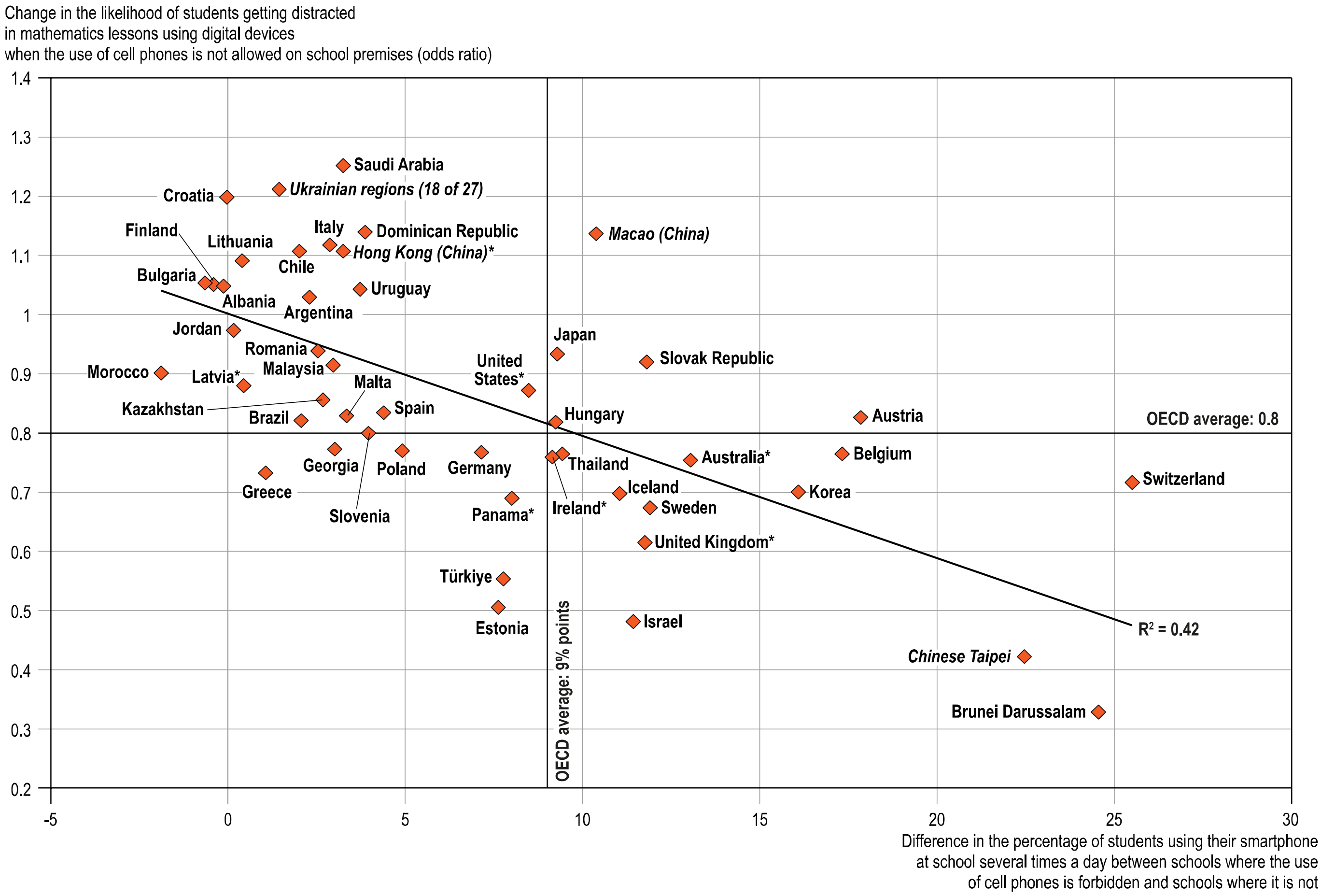
Figure II.5.9. Digital devices, distraction and school policies

Change in the likelihood of students becoming distracted by using digital devices in mathematics lessons when students reported that they use their smartphone at school and school principals reported the school's policy on smartphone use; OECD average



Note: Statistically significant differences are shown in a darker tone (see Annex A3).
Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

Figure II.5.10. Digital devices, distraction and cell phone bans



Note: Country/Economy coefficients for the change in the likelihood of students becoming distracted with digital devices in mathematics class when the use of cell phones is not allowed on school premises are derived from the analysis in Figure II.5.9.
Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

Components of resilience: Ensuring sufficient, but not excessive, time for learning

PISA 2022 found that in higher-performing education systems, most students spend a moderate amount of time in regular lessons.[9] Systems where more students spend 20 hours or less per week in regular school lessons (in all subjects combined) tended to score lower in mathematics (Table II.B1.5.102). Education systems where more students spend 39 hours or more per week in regular lessons (in all subjects combined) also tended to score lower in mathematics. These relationships were observed across OECD countries and across all countries/economies, even after accounting for per capita GDP.

Education systems where more students spend up to two hours per day doing homework tended to score higher in mathematics, on average (Table II.B1.5.102). By contrast, those systems where more students spend three hours or more on homework tended to score lower in mathematics. These relationships were observed both across OECD countries and across all countries/economies, even after accounting for per capita GDP. Education systems where more students spent up to an hour per day on homework tended to show a greater sense of belonging at school; but systems where students spent more than two hours per day on homework showed a weaker sense of belonging, after accounting for per capita GDP.

With these correlational results, it cannot be concluded that studying for longer is detrimental to students' learning. In systems with more low-performing students, students may need more time to master content. In these cases, more hours of learning may be for remedial purposes. Some systems may lack high-quality teachers and educational material, as discussed above, which can result in both lower student performance and longer learning hours. While further studies are necessary to fully understand why there is a negative relationship between more learning hours and performance, Figure II.5.11, which shows the ratio of PISA score points to dedicated learning hours in and outside of school, helps identify those systems that show outstanding learning time and performance patterns.[10]

The average score in mathematics associated with the number of hours spent in regular school lessons and doing homework varied between 8 and 19 points across all countries/economies (Figure II.5.11). On average across OECD countries, in 2022 students spent 24 hours in regular lessons and 10.8 hours doing homework per week (Tables II.B1.5.52 and II.B1.5.56). The average score-point increase in mathematics performance per hour of total learning time across OECD countries was 14 points. In Switzerland, the United States*, the Czech Republic, Finland, New Zealand*, the Slovak Republic, Canada*, the Netherlands, Korea, Denmark and Norway (in descending order), the score-point improvement in mathematics performance per hour of total learning time amounted to 15 points or more; in Morocco, Argentina, Colombia, Costa Rica, Uzbekistan, Mongolia, Peru, Albania and Cambodia (in ascending order), the improvement amounted to less than 10 score points.

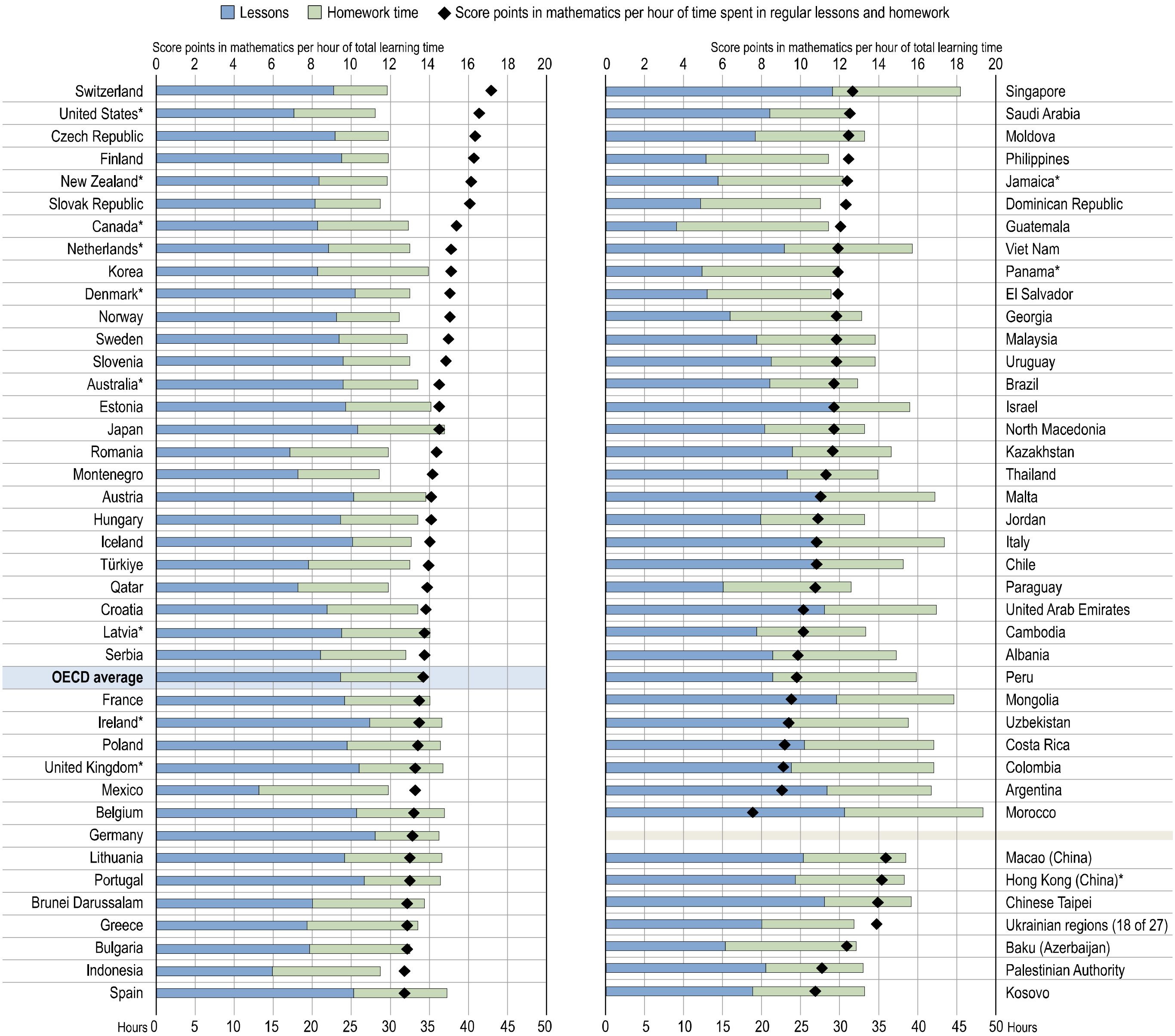
Investing more hours in regular lessons and on homework is not always related to higher scores

PISA measures learning time as the number of hours per week that students are required to attend regular school lessons.[11] In 2022, learning time in regular school lessons varied across countries. In Morocco, Singapore, Israel, Mongolia, Argentina, Chinese Taipei, Germany, the United Arab Emirates, Malta, Ireland* and Italy (in descending order) students attended regular lessons for more than 27 hours per week (Table II.B1.5.52), and in 24 countries/economies, students spent less than 20 hours per week in regular lessons.

Similar to the system-level relationship between learning time in regular lessons and student performance, on average across OECD countries, performance in mathematics is positively associated with each additional hour of regular lessons per week, up to 27 hours per week (Table II.B1.5.55). Students who spent 20 hour or less per week in regular lessons scored 432 points in mathematics. Students who spent between 20 and 24 hours per week in regular lessons scored 42 points higher, on average, after accounting for students' and schools' socio-economic profile. The relationship remained positive but not as strong as the number of hours in regular lessons increased: students who spent between 24 and 27 hours per week in regular lessons scored 7 points higher, on average, than students who spent between 20 and 24 hours, after accounting for students' and schools' socio-economic profile.[12] Figure II.5.12 shows case studies of countries/economies where the association between time spent in regular lessons and mathematics performance are markedly different. For example, students in Brunei Darussalam, the Czech Republic, Slovenia and Spain who spent up to 27 hours in regular lessons scored higher in mathematics, while students in Greece, Israel, Japan and Morocco who spent up to 32 hours in regular lessons scored higher in mathematics.

Figure II.5.11. Mathematics performance and time spent on learning activities

Based on students' reports

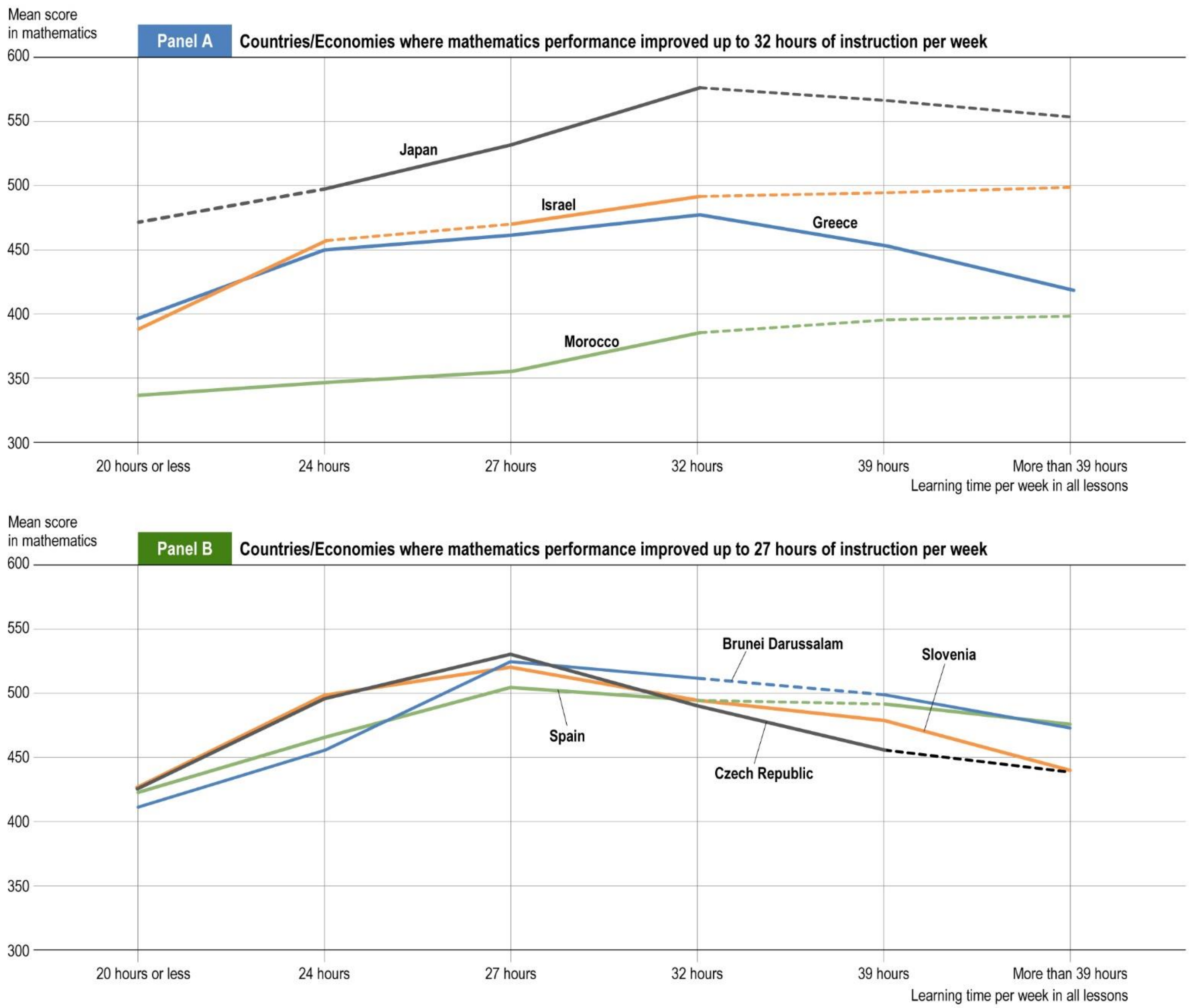


Countries and economies are ranked in descending order of the score points in mathematics per hour of total learning time.

Source: OECD, PISA 2022 Database, Annex B1, Chapter 5 and Table I.B1.2.1.

Figure II.5.12. Time spent in regular lessons and mathematics performance

Based on students' reports; selected cases



Notes: For each learning time displayed, the time range covered starts where the previous range ends; for example, for 24 hours, learning time could be 24 hours or less but more than 20 hours.
Differences between categories that are not statistically significant are marked with dotted lines (see Annex A3).
Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

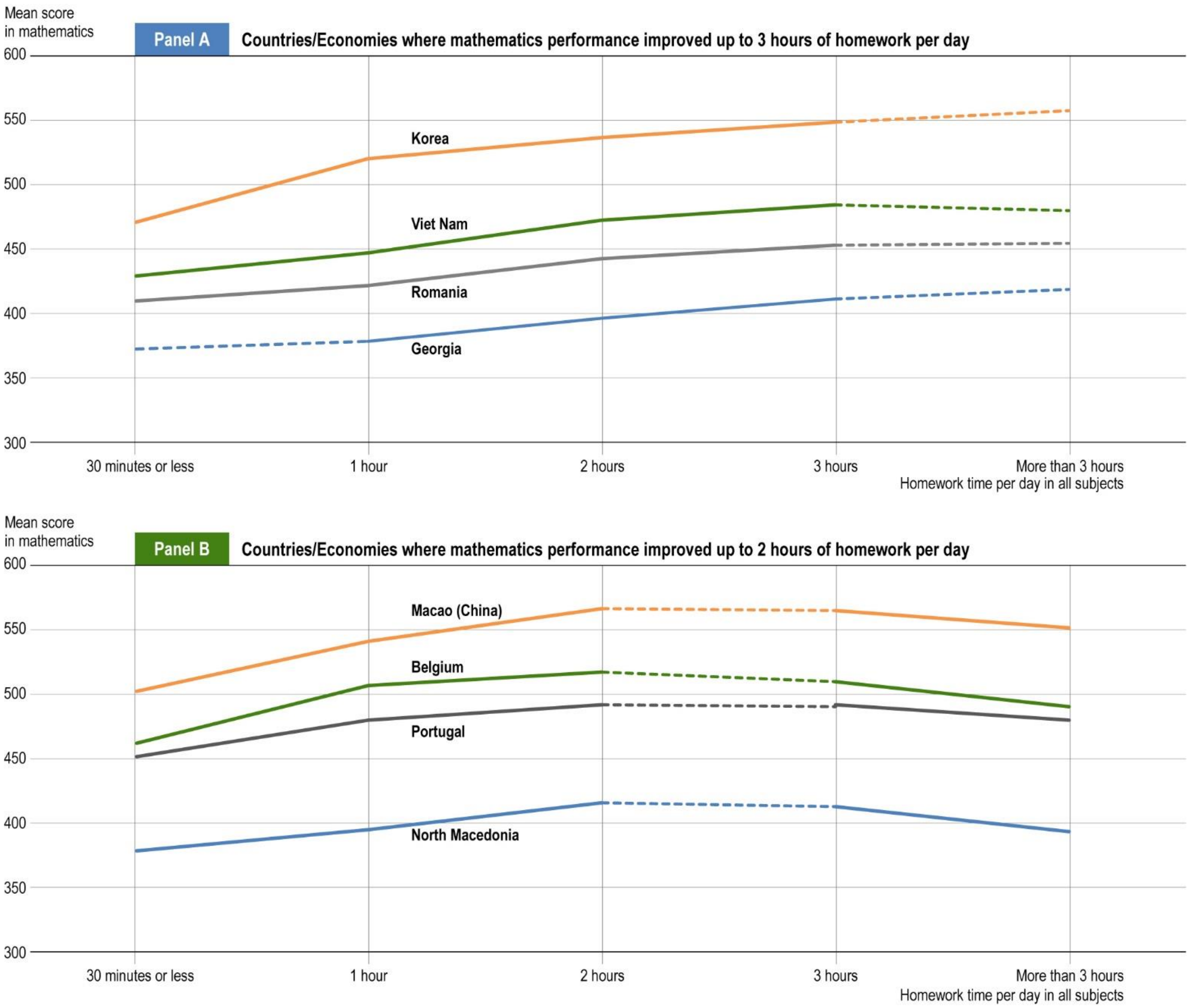
PISA 2022 collected information about how much time per day students spend doing homework[13] during a typical school week.[14] On average across OECD countries, students reported that they spend 1.5 hours per day on homework during a typical school week (Table II.B1.5.56): 27% of students spent up to half an hour a day on homework, 19% spent between half an hour and an hour a day, 23% spent between one and two hours per day and 31% spent more than two hours per day. In 54 countries/economies, students spent up two hours per day on homework. In Colombia, Guatemala, Morocco, Panama* and Peru students spent on average more than two and a half hours per day on homework. By contrast, students in the Czech Republic, Finland and Switzerland spent less than an hour per day on homework.

Performance in mathematics was positively associated with time spent on homework, on average across OECD countries, when students spent up to two hours per day on homework (Table II.B1.5.61). Students who spent between half an hour and an hour per day on homework scored 16 points higher in mathematics than students who spent less than half an hour on homework per day, on average and after accounting for students' and schools' socio-economic profile. The relationship remained positive but weaker after one hour per day of homework. Students who spent between one and two hours per day on homework scored two points higher in mathematics, on average, than students who spent between half an hour and an hour per day, after accounting for students' and schools' socio-economic profile. Above two hours, time spent on homework was negatively associated with mathematics performance. Figure II.5.13 shows case studies of countries/economies where the association between time spent on homework and mathematics performance are notably different. For example, students in Brunei Darussalam, Macao (China), the Netherlands*, North Macedonia and Portugal who spent up to 2 hours on homework scored higher in mathematics, while students in Georgia, Korea, Romania and Viet Nam who spent up to 3 hours on homework scored higher in mathematics

This result, showing an association between longer learning time in regular lessons and homework, on the one hand, and lower performance, on the other, may imply that low-performing students need more time to master the same content or complete the same homework as high-performing students. Most parents would like to see their children acquire academic knowledge and skills, and also have enough time to participate in non-academic activities, such as sports, theatre or music, playing with friends, volunteering – all of which develop children's social and emotional skills, and contribute to their well-being. Those students who spend long hours in class and on homework and still fail to achieve may need individualised support rather than more learning time.

Figure II.5.13. Time spent doing homework in all subjects, and mathematics performance

Based on students' reports; selected cases



Notes: For each homework time displayed, the time range covered starts where the previous range ends; for example, for 1 hour, homework time could be 1 hour or less but more than 30 minutes.

Differences between categories that are not statistically significant are marked with dotted lines (see Annex A3).

Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

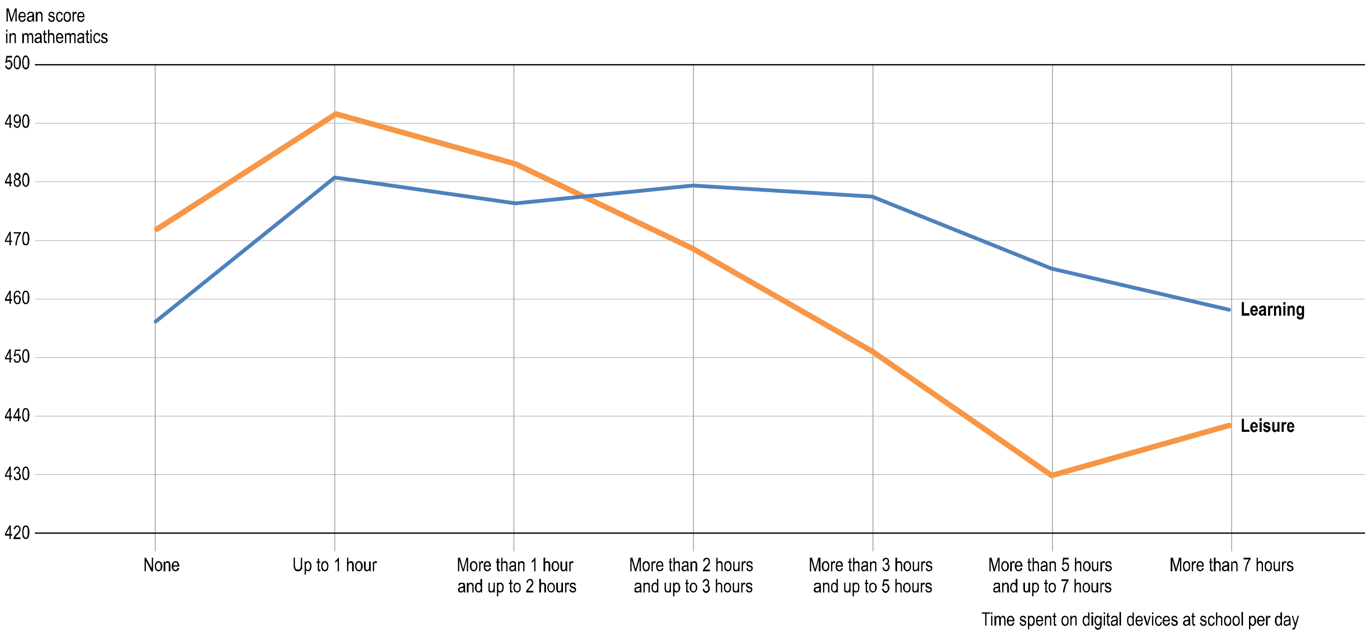
Moderate use of digital devices in school is related to higher performance

PISA 2022 asked students to report the number of hours they spend per day on digital devices for learning and leisure activities at school.[15] Figure II.5.14 shows the average mathematics performance of students according to the time they spent on digital devices for learning or leisure at school.

On average across OECD countries, students who did not spend time on digital devices for learning at school scored 456 points in mathematics (14% of students were in this category) (Tables II.B1.5.64 and II.B1.5.62). Students who spent up to one hour per day on digital devices for learning activities in school (31% of students) scored 25 points higher in mathematics than students who spent no time, on average across OECD countries. Even after accounting for students' and schools' socio-economic profile, students scored 14 points higher, and this positive relationship is observed in over half of all systems with available data (Table II.B1.5.66). However, on average across OECD countries, students who spent between 5 and 7 hours per day on digital devices for learning activities in school (7.8% of students) scored 12 points lower than students who spent between 3 and 5 hours per day; after accounting for students' and schools' socio-economic profile, the former group of students scored 10 points lower. Students who spent over 7 hours per day on digital devices for learning activities in school scored even lower.

Figure II.5.14. Time spent on digital devices at school and mathematics performance

Based on students' reports; OECD average



Note: Differences between categories are all statistically significant (see Annex A3).Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

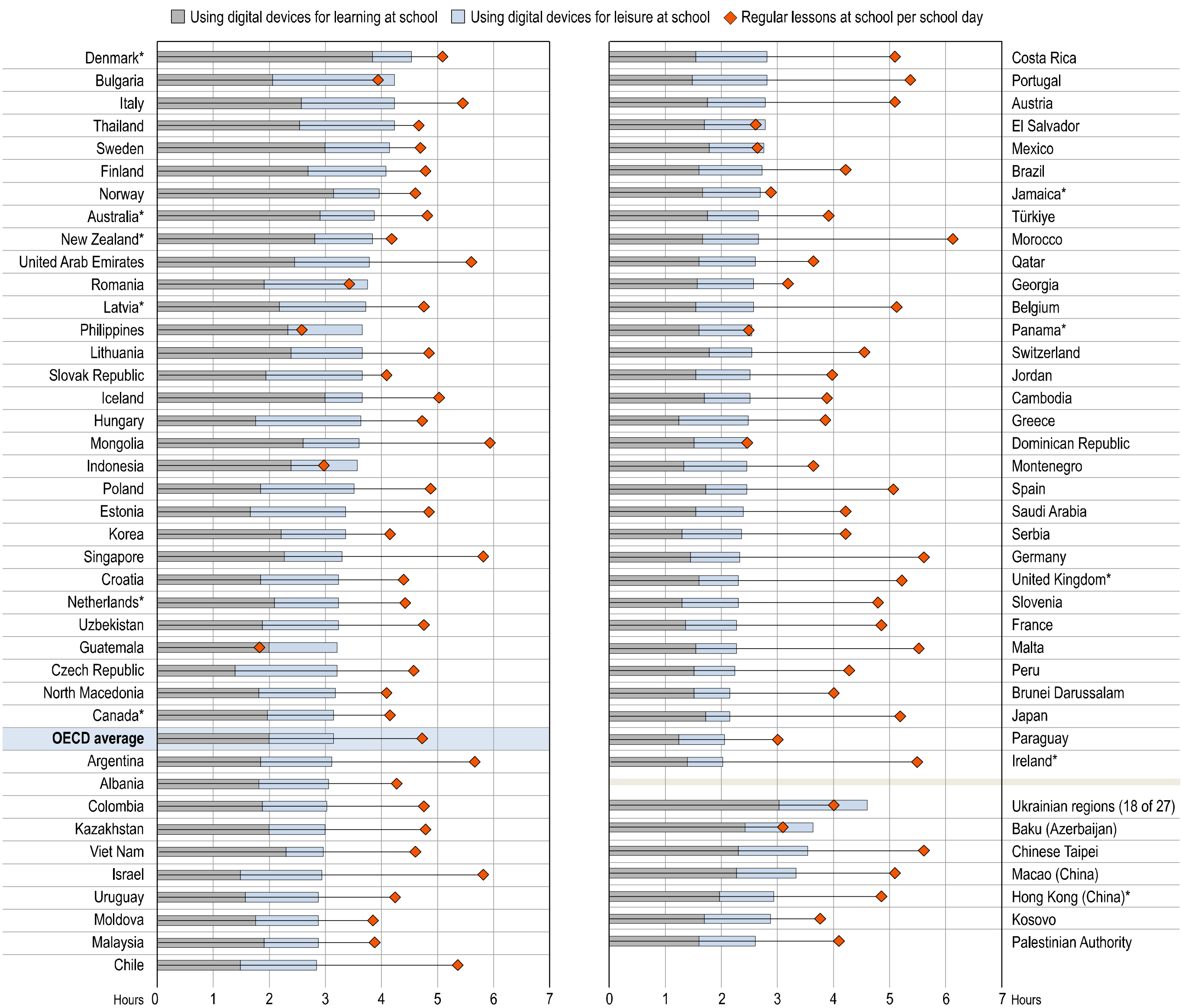
When it comes to the use of digital devices for leisure activities, on average across OECD countries, students who did not spend time on digital devices for leisure at school (19% of students were in this category) (Table II.B1.5.62) scored 472 points in mathematics. Students who spent up to one hour per day on digital devices for leisure activities (31% of students) scored 20 points higher in mathematics than students who spent no time. The difference in performance is equal to 10 points even after accounting for students' and schools' socio-economic profile; and a positive relationship is observed in around half of all systems with available data (Table II.B1.5.67). But students who spent more than an hour on digital devices for leisure scored lower in mathematics.

These findings are in line with the "Goldilocks hypothesis" (Przybylski and Weinstein, 2017[9]) that moderate use of digital devices is not intrinsically harmful and can even be positively associated with performance. It is the overuse and/or misuse of digital devices that is negatively associated with performance. These findings confirm the need for better guidelines on how to use digital devices at school.

The amount of time students spent on digital devices at school[16] in 2022 varied widely across education systems (Table II.B1.5.62). Figure II.5.15 shows the time spent on digital devices at school for learning and leisure activities and contrasts it to the time spent in regular lessons per day. It is important to keep in mind that students may use digital devices at school but outside of regular lessons. On average across OECD countries, students reported spending 2.0 hours per day on digital devices for learning activities and 1.1 hours per day on digital devices for leisure at school (Table II.B1.5.62). Students in Chile, the Czech Republic, France, Germany, Greece, Ireland*, Israel, Montenegro, Paraguay, Portugal, Serbia and Slovenia spent less than 1.5 hours per day learning on digital devices at school, while students in Denmark*, Norway and Ukrainian regions (18 of 27) spent more than 3 hours per day.

Figure II.5.15. Time spent at school in regular lessons and on digital devices

Time spent per day by students (in hours)



Notes: Only countries and economies with available data are shown.

Time spent in regular lessons at school per school day refers to the time spent in regular lessons per school week divided by five (with the assumption there are five days per school week).

Countries and economies are ranked in descending order of the time spent using digital devices at school for both learning and leisure.

Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

Box II.5.2. Student well-being, performance and use of digital devices

On average across OECD countries, 45% of students reported feeling nervous/anxious when they did not have their digital devices near them (Figure II.5.16). On average across OECD countries and in all countries/economies with available data, students who reported that they feel nervous/anxious when they don't have their digital devices near them also reported less satisfaction with life, and had lower values in the index of resistance to stress and in the index of emotional control, even after accounting for students' and schools' socio-economic profile (Figure II.5.17). The relationship between students' feeling nervous/anxious when they don't have their digital device near them was negatively correlated with mathematics performance, on average across OECD countries and in 45 countries/economies, even after accounting for students' and schools' socio-economic profile (Table II.B1.5.81). Only in Brunei Darussalam, Hong Kong (China)*, Indonesia, Kazakhstan, Malaysia, Chinese Taipei and Thailand was this association positive.

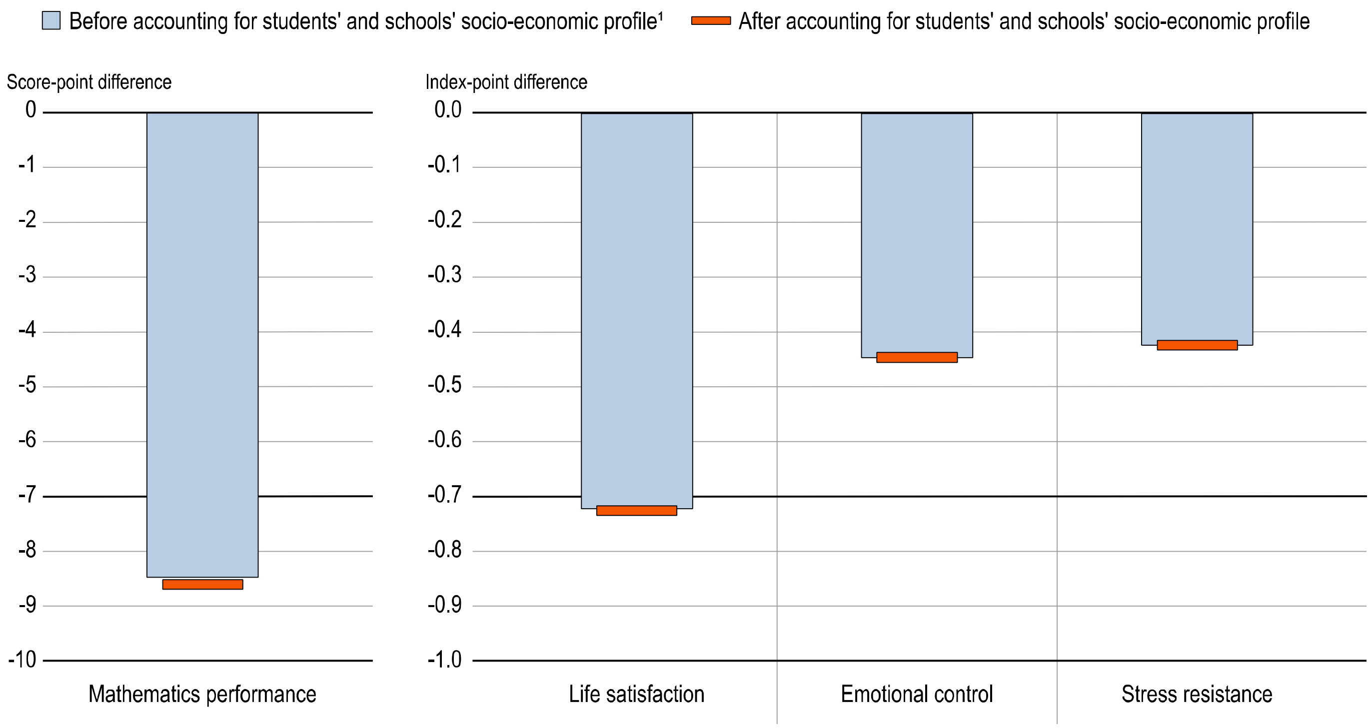
Figure II.5.16. Feeling nervous/anxious when digital devices are not near

Based on students' reports

Countries and economies are ranked in descending order of the percentage of students who never or almost never feel nervous/anxious when they don't have digital devices near them. Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

Figure II.5.17. Feeling nervous/anxious when digital devices are not near and selected student outcomes

Based on students' reports; OECD average



1. The socio-economic profile is measured by the PISA index of economic, social and cultural status.

Notes: All values are statistically significant before and after accounting for students' and schools' socio-economic profile (see Annex A3).

The results show the difference between students who feel nervous/anxious less than half of the time, about half of the time, more than half of the time or all or almost all of the time when they don't have their digital devices near them compared to those who never or almost never feel nervous/anxious when they don't have their digital devices near them.

Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

Components of resilience: Establishing schools as hubs for social interaction

The PISA 2022 results show that schools can serve as hubs not only for students' learning but also for well-being. In high-performing education systems, schools tend to provide a room where students can do their homework, and school staff provides help with students' homework (Table II.B1.5.102). This relationship is observed both across OECD countries, and across all countries/economies, even after accounting for per capita GDP.

PISA results also show that, across OECD countries, an increase in peer-to-peer tutoring is associated with an increase in students' sense of belonging at school. In systems where more students in 2022 than in 2018 attended schools that offer peer-to-peer tutoring, students' sense of belonging at school strengthened during the period (Table II.B1.5.105).

School support for homework and study varies across systems

Of the three kinds of school support for homework and study after regular school hours – a room where students can do their homework, staff providing help, and peer-to-peer tutoring – the most frequently observed is having a room where students can do their homework. On average across OECD countries in 2022, 74% of students attended a school that provides a room where students can do their homework (Table II.B1.5.82), 62% of students attended a school where staff provides help with homework, and 51% of students attended a school that provides peer-to-peer tutoring. In Canada*, France, Japan, Macao (China), the Netherlands*, Singapore, Sweden and the United Kingdom* at least 90% of students had access to a study room after regular hours. In 18 countries/economies, 75% of students or more were in schools where staff can help them with homework. Of those countries/economies, in Canada*, Kazakhstan, Singapore, Sweden, Ukrainian regions (18 of 27), the United Kingdom*, the United States* and Viet Nam 90% of students or more attended such schools. In 20 countries and economies, 75% of students or more were in schools with peer-to-peer tutoring after regular hours; in Macao (China), Thailand and Viet Nam 90% of students or more attended such schools.

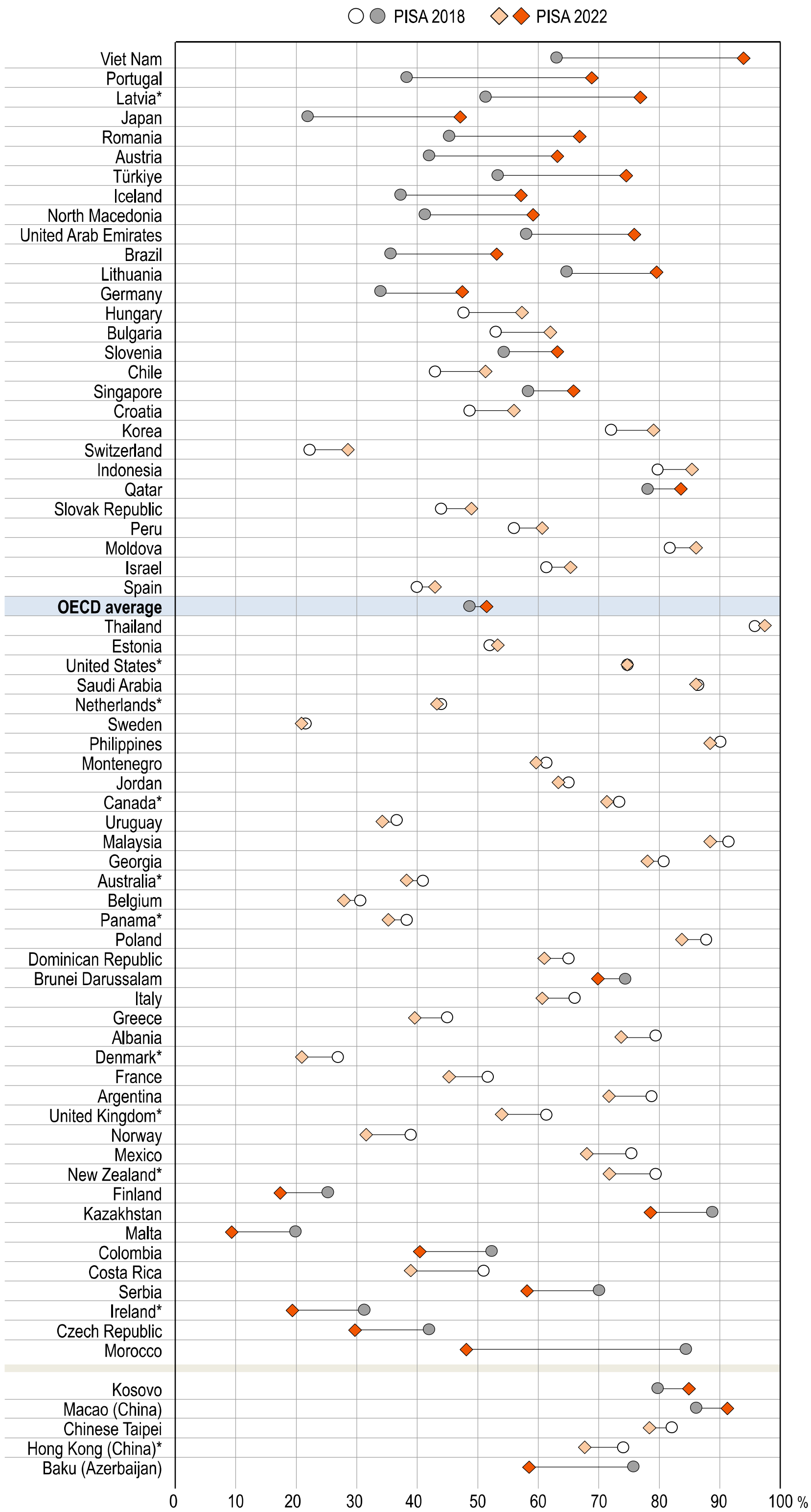
In 19 education systems, peer-to-peer tutoring became more prevalent between 2018 and 2022

The share of students in schools that provided a room for homework or where staff provides help with homework remained stable between 2018 and 2022, but the share of students in schools that offer peer-to-peer tutoring increased by three percentage points between 2018 and 2022, on average across OECD countries (Figure II.5.18). This proportion grew in 18 countries/economies and shrank in 11 countries/economies out of the 73 countries/economies for which data are available. In Viet Nam, Portugal, Latvia*, Japan, Romania, Austria, Türkiye and Iceland (in descending order), the share increased by more than 20 percentage points; but in Morocco, Baku (Azerbaijan), the Czech Republic, Ireland*, Serbia, Colombia and Malta (in descending order) the share decreased by more than 10 percentage points.

Differences related to socio-economic status were greater regarding the availability of peer-to-peer tutoring at school (Table II.B1.5.85). On average across OECD countries, the share of students in advantaged schools whose school provides peer-to-peer tutoring was about 13.5 percentage points larger than the share of students in disadvantaged schools whose school provides this form of study help. In 21 education systems, this disparity in favour of students in advantaged schools was statistically significant; in 8 education systems the disparity favoured students in disadvantaged schools.

Figure II.5.18. Change between 2018 and 2022 in peer-to-peer tutoring at school

Percentage of students in schools that provide peer-to-peer tutoring; based on principals' reports



Notes: Only countries and economies with available data are shown.

Statistically significant differences are shown in a darker tone (see Annex A3).

Countries and economies are ranked in descending order of the change in peer-to-peer tutoring between PISA 2018 and PISA 2022.

Source: OECD, PISA 2022 Database, Annex B1, Chapter 5.

Table II.5.1. Investments in a solid foundation for learning and well-being figures

Figure II.5.1	Resources covered in PISA 2022
Figure II.5.2	Mathematics performance and spending on education
Figure II.5.3	Change between 2018 and 2022 in shortage of education staff and material resources
Figure II.5.4	Shortage of education staff and school characteristics
Figure II.5.5	Certified teachers and mathematics performance
Figure II.5.6	Shortage of education staff and material resources and mathematics performance
Figure II.5.7	Shortage of educational material and school characteristics
Figure II.5.8	Relationship between preparedness for digital learning, availability of computers and school guidelines
Figure II.5.9	Digital devices, distraction and school policies
Figure II.5.10	Digital devices, distraction and cell phone bans
Figure II.5.11	Mathematics performance and time spent on learning activities
Figure II.5.12	Time spent on regular lessons and mathematics performance
Figure II.5.13	Time spent doing homework in all subjects, and mathematics performance
Figure II.5.14	Time spent on digital devices at school, and mathematics performance
Figure II.5.15	Time spent at school in regular lessons and on digital devices
Figure II.5.16	Feeling nervous/anxious when digital devices are not near
Figure II.5.17	Feeling nervous/anxious when digital devices are not near and selected student outcomes
Figure II.5.18	Change between 2018 and 2022 in peer-to-peer tutoring

StatLink https://stat.link/6jbfey

Notes

1 Averages using the Word Bank's classification of income groups, based on gross national income (GNI) per capita in 2021, calculated using the World Bank Atlas method.

2 Correlation between the change, between 2018 and 2022, in the proportion of students in schools whose principal reported that the school's capacity to provide instruction is hindered to some extent or a lot by inadequate or poorly qualified teaching staff (Table II.B1.5.4) and the change, during the same period, in the proportion of full-time teachers in schools attended by 15-year-olds (Table II.B1.5.98).

3 The literature clearly shows that effective teachers are the foundation on which successful education systems are built (OECD, 2005[24]; OECD, 2010[25]; OECD, 2019[33]; OECD, 2020[32]) and that assisting staff play an essential role in supporting students, parents and teachers (Farrell et al., 2010[38]; Blatchford et al., 2011[41]; Masdeu Navarro, 2015[40]).

4 The goal of teacher certification is to guarantee that schools are staffed with quality teachers; but not all countries have a formal teacher certification process, and teacher shortages may lead some schools or countries to resort to hiring a larger proportion of uncertified teachers. In general, research finds a positive association between teacher certification and student achievement (Clotfelter, Ladd and Vigdor, 2006[12]; Goldhaber and Brewer, 2000[13]).

5 PISA measures the availability and quality of material resources in schools by asking school principals if their school's capacity to provide instruction is hindered by: a lack of educational material (i.e. textbooks, ICT equipment, library or laboratory materials); inadequate or poor-quality educational material; a lack of physical infrastructure (i.e.

building, grounds, heating/cooling systems, lighting and acoustic systems); or inadequate or poor-quality physical infrastructure.

6 Figures of variability were calculated using each ratio available in Tables II.B1.5.24 and II.B1.5.27.

7 Digital technologies hold great potential for enhancing learning and teaching, including by creating new ways of engaging with content, peers and teachers, personalising instruction and reducing teachers' administrative work (Singh and Thurman, 2019[27]; van der Vlies, 2020[23]; OECD, 2021[35]). But to be able to tap this potential and use these technologies effectively, teachers and students need to be supported with dedicated policies (OECD, 2023[36]; Martin, Sun and Westine, 2020[42]; UNESCO, 2022[28]; OECD, 2019[37]).

8 Some of these aspects referred to the availability of professional and learning resources for teachers (e.g. professional resources to learn how to use digital devices and online learning-support platforms), while others referred to teachers' and the school's capacity to integrate digital devices into instruction (e.g. pedagogical and technical skills and technical assistance staff). Teachers' skills and online and professional resources are key components of schools' preparedness for digital learning, as are the time available for teachers to integrate digital technologies into their instructional practices, and incentives and support to teachers as they do so (OECD, 2023[36]).

9 The relationship between learning time and academic achievement is complex: additional learning time does not translate automatically into better outcomes (Gromada and Shewbridge, 2016[10]; Radinger and Boeskens, 2021[34]) and can differ widely depending on where (at school or outside of school) students learn and the tools (physical or digital) they use for learning.

10 The ratios between dedicated learning time and PISA scores can be interpreted in various ways. They can be an indication of the quality of a school system; they can also be indicative of the differences in learning time across education levels. For example, 15-year-olds in some education systems may be compensating for (or reaping the benefits of) the time spent learning in earlier stages of their education. Another explanation is that, to succeed academically, students in some education systems need to spend more time in "planned" or "deliberate" learning because they have fewer opportunities to learn informally outside of school.

11 To create measures of learning time, PISA 2022 asked each student to report the number of class periods she/he is required to attend in all subjects per week. The average number of minutes per class period attended by students in the modal grade for 15-year-old students was reported by school principals. See Annex A3 for more details.

12 Given the cross-sectional nature of the PISA surveys and the potential reverse causality between learning time and student outcomes (lower-performing students might need more hours in class to catch up), PISA cannot determine causality. However, these results are in line with recent research that shows that additional learning time has positive but diminishing effects on student performance, and that the benefits of additional learning time can be heterogeneous, depending on the type of student (e.g. low-performing or socio-economically disadvantaged) (Cattaneo, Oggenfuss and Wolter, 2017[14]; Patall, Cooper and Allen, 2010[15]; Gromada and Shewbridge, 2016[10]; Bellei, 2009[16]).

13 A longstanding and widely used instructional practice (Murillo and Martinez-Garrido, 2014[17]), homework can have a positive influence on student achievement (Cooper, Robinson and Patall, 2006[18]) and also on the development of attitudes towards achievement, such as motivation and self-regulation (Ramdass and Zimmerman, 2011[19]). However, critics argue that too much homework is ineffective, that it takes time away from leisure activities, or that it is stressful or harmful to children's development or family life (Baker and Letendre, 2005[20]; Dudley-Marling, 2015[21]). A key concern about homework is whether it might have the unintended consequence of widening the performance gap between students from different socio-economic backgrounds. PISA results show that socio-

economically advantaged students and students who attend socio-economically advantaged schools tend to spend more time doing homework (OECD, 2014[26]). The reasons disadvantaged students tend to spend less time doing homework may include the lack of a quiet space to study at home, the disparity in home Internet service and computer access, or possibly less parental support for their studies (Bolkan, 2017[22]).

14 To create measures of time spent on homework, PISA 2022 asked each student to report the time they spend on homework in a typical school week: “up to 30 minutes a day”, “more than 30 minutes and up to 1 hour a day”, etc., and “more than 4 hours a day”. The average time spent on homework was converted to a continuous variable by taking the median of each time interval, and assuming 4.5 hours if the answer was “more than 4 hours”.

15 To create measures of time spent on digital devices, PISA 2022 asked each student to report the number of hours they usually spend on digital devices per day during the current school year: “none”, “up to 1 hour”, “more than 1 hour and up to 2 hours”, etc., and “more than 7 hours”. The average time spent on digital devices was converted to a continuous variable by taking the median of each time interval, and assuming 7.5 hours if the answer was “more than 7 hours”.

16 The use of digital devices at school can, on the one hand, augment learning opportunities by providing a way to check information and offer personalised learning. On the other hand, digital devices can have an adverse impact on students’ cognitive skills and performance if they distract students and interfere with students’ capacity to focus in class or acquire language skills (Poulain et al., 2018[29]; Adelantado-Renau et al., 2019[30]; Madigan et al., 2020[31]; OECD, 2023[11]; OECD, 2021[7]).

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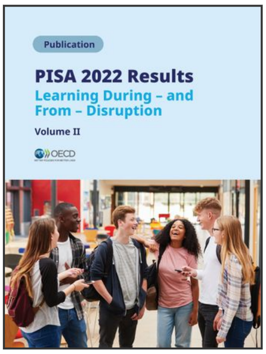

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