2 How did countries perform in PISA?

This chapter compares students' mean scores and the variation in their performance in mathematics, reading and science across the countries and economies that participated in the PISA 2022 assessment.

For Netherlands, Newfoundland and Labrador, Alberta, Hong Kong (China), Manitoba, United States, Latvia, Scotland, Quebec, New Zealand, United Kingdom, Northern Ireland, England, Wales, Denmark, Ontario, Panama, Nova Scotia, Australia, British Columbia, Ireland, Jamaica and Canada, caution is required when interpreting estimates because one or more PISA sampling standards were not met (see Reader's Guide, Annexes A2 and A4).

What the data tell us

- Singapore scored significantly higher, on average, than all other countries and economies that participated in PISA 2022 in mathematics (575 points), reading (543 points) and science (561 points).
- In mathematics, six East Asian education systems (Hong Kong [China]*, Japan, Korea, Macao [China], Singapore and Chinese Taipei) outperformed all other countries and economies. In reading, behind top-performing education system Singapore, Ireland* performed as well as Estonia, Japan, Korea and Chinese Taipei and better than 75 other countries and economies. In science, the highest performing countries are the same six East Asian countries/economies, Canada* and Estonia.
- The gap in performance between the highest- and lowest-performing countries is 153 score points in mathematics among OECD countries and 238 points among all education systems that took part in PISA 2022.
- The gap between the 90th percentile of mathematics performance (the score above which only 10% of students scored) and the 10th percentile of performance (the score below which only 10% of students scored) is more than 135 score points in all countries and economies. On average across OECD countries, 235 score points separate these extremes.

PISA measures student performance as the extent to which 15-year-old students near the end of their compulsory education have acquired the knowledge and skills that are essential for full participation in modern societies, particularly in the core domains of reading, mathematics, and science.

This chapter examines student performance in PISA 2022. In its first section, the chapter reports the average performance in mathematics, reading and science for each country and economy, comparing it to other countries and economies, and to the average performance across OECD countries. The second section examines variation in performance within and between countries and economies; for example, it shows how large the score gap that separates the highest-performing and lowest-performing students within each country and economy is. It also examines how variation in performance is related to the average performance across PISA-participating countries and economies. A student performance ranking among all countries and economies that took part in PISA 2022 is provided in the third section.

Trends in student performance over time are considered in Chapters 5 and 6 of this report. For short-term changes between PISA 2018 and 2022, see Chapter 5; for long-term trajectories in student performance over countries' entire participation in PISA, see Chapter 6.

Average performance in mathematics, reading and science

In PISA 2022, the mean mathematics score among OECD countries is 472 points; the mean score in reading is 476 points; and the mean score in science is 485 points. Singapore scored significantly higher than all other countries/economies that participated in PISA 2022 in mathematics (575 points), reading (543 points) and science (561 points).

Table I.2.1, Table I.2.2 and Table I.2.3 show each country's/economy's mean score and indicate pairs of countries/economies where the differences between the means are statistically significant[1]. For each country/economy shown in the middle column, the countries/economies whose mean scores are not statistically significantly different are listed in the right column. In these tables, countries and economies are divided into three broad groups: those whose mean scores are statistically around the OECD mean (highlighted in light grey); those whose mean scores are above the OECD mean (highlighted in blue); and those whose mean scores are below the OECD mean (highlighted in dark grey).

In mathematics, six East Asian education systems (Hong Kong [China]*, Japan, Korea, Macao [China], Singapore and Chinese Taipei) outperformed all other countries and economies (Table I.2.1). Another 17 countries also performed above the OECD average in mathematics, ranging from Estonia (mean score of 510 points) to New Zealand* (mean score of 479 points).

In reading, behind the top-performing education system (Singapore), Ireland* performed as well as Estonia, Japan, Korea and Chinese Taipei; and outperformed all other countries/economies (Table I.2.1). In addition to those six countries and economies, another 14 education systems performed above the OECD average in reading, ranging from Macao (China) (mean score of 510) to Italy (mean score of 482 points).

All countries and economies that performed above the OECD average in mathematics also performed above the OECD average in reading, except for Austria, Belgium, Latvia*, the Netherlands* and Slovenia. Similarly, all countries and economies that performed above the OECD average in reading also performed above the OECD average in mathematics, except for Italy and the United States*.

In science, the highest-performing education systems are Canada*, Estonia, Hong Kong (China)*, Japan, Korea, Macao (China), Singapore and Chinese Taipei (Table I.2.2). Finland performed as well as Canada* in science. In addition to these nine countries and economies, another 15 education systems also performed above the OECD average in science, ranging from Australia* (mean score of 507 points) to Belgium (mean score of 491 points).

All countries and economies that performed above the OECD average in science also performed above the OECD average in mathematics and reading, except for six countries/economies. Austria, Belgium, Latvia* and Slovenia performed above the OECD average in science and mathematics but not in reading; United States performed above the OECD average in science and reading but not in mathematics; and Germany performed above the OECD average in science but not in mathematics or reading. In both of these subjects, Germany's mean score is not statistically significantly different from the OECD average.

Eighteen countries and economies performed above the OECD average in mathematics, reading and science (Australia*, Canada*, the Czech Republic, Denmark*, Estonia, Finland, Hong Kong [China]*, Ireland*, Japan, Korea, Macao [China], New Zealand*, Poland, Singapore, Sweden, Switzerland, Chinese Taipei and the United Kingdom*).

The gap in performance between the highest- and lowest-performing countries is 153 score points in mathematics among OECD countries and 238 points among all education systems that took part in PISA 2022. In reading, the gap in performance between the highest- and lowest-performing countries is 107 score points among OECD countries and 214 points among all education systems that took part in PISA 2022. In science, the gap in performance between the highest- and lowest-performing countries is 137 score points among OECD countries and 214 points among all education systems that took part in PISA 2022.

Table I.2.1. Comparing countries' and economies' performance in mathematics [1/2]

Statistically significantly **above** the OECD average
Not statistically significantly different from the OECD average
Statistically significantly **below** the OECD average

Mean score	Comparison country/economy	Countries and economies whose mean score is not statistically significantly different from the comparison country's/economy's score
575	**Singapore**	
552	***Macao (China)***	*Chinese Taipei*
547	***Chinese Taipei***	*Macao (China)*, *Hong Kong (China)**
540	***Hong Kong (China)****	*Chinese Taipei*, Japan
536	**Japan**	*Hong Kong (China)**, Korea
527	**Korea**	Japan
510	**Estonia**	Switzerland
508	**Switzerland**	Estonia
497	**Canada***	Netherlands*
493	**Netherlands***	Canada*, Ireland*, Belgium, Denmark*, United Kingdom*, Poland, Austria, Australia*, Czech Republic
492	**Ireland***	Netherlands*, Belgium, Denmark*, United Kingdom*, Poland, Austria, Australia*, Czech Republic
489	**Belgium**	Netherlands*, Ireland*, Denmark*, United Kingdom*, Poland, Austria, Australia*, Czech Republic, Slovenia, Finland
489	**Denmark***	Netherlands*, Ireland*, Belgium, United Kingdom*, Poland, Austria, Australia*, Czech Republic, Finland
489	**United Kingdom***	Netherlands*, Ireland*, Belgium, Denmark*, Poland, Austria, Australia*, Czech Republic, Slovenia, Finland, Latvia*
489	**Poland**	Netherlands*, Ireland*, Belgium, Denmark*, United Kingdom*, Austria, Australia*, Czech Republic, Slovenia, Finland, Latvia*
487	**Austria**	Netherlands*, Ireland*, Belgium, Denmark*, United Kingdom*, Poland, Australia*, Czech Republic, Slovenia, Finland, Latvia*, Sweden
487	**Australia***	Netherlands*, Ireland*, Belgium, Denmark*, United Kingdom*, Poland, Austria, Czech Republic, Slovenia, Finland, Latvia*, Sweden
487	**Czech Republic**	Netherlands*, Ireland*, Belgium, Denmark*, United Kingdom*, Poland, Austria, Australia*, Slovenia, Finland, Latvia*, Sweden
485	**Slovenia**	Belgium, United Kingdom*, Poland, Austria, Australia*, Czech Republic, Finland, Latvia*, Sweden
484	**Finland**	Belgium, Denmark*, United Kingdom*, Poland, Austria, Australia*, Czech Republic, Slovenia, Latvia*, Sweden, New Zealand*
483	**Latvia***	United Kingdom*, Poland, Austria, Australia*, Czech Republic, Slovenia, Finland, Sweden, New Zealand*
482	**Sweden**	Austria, Australia*, Czech Republic, Slovenia, Finland, Latvia*, New Zealand*, Germany
479	**New Zealand***	Finland, Latvia*, Sweden, Lithuania, Germany, France
475	**Lithuania**	New Zealand*, Germany, France, Spain, Hungary, Portugal, Italy, Viet Nam
475	**Germany**	Sweden, New Zealand*, Lithuania, France, Spain, Hungary, Portugal, Italy, Viet Nam, Norway
474	**France**	New Zealand*, Lithuania, Germany, Spain, Hungary, Portugal, Italy, Viet Nam, Norway, United States*
473	**Spain**	Lithuania, Germany, France, Hungary, Portugal, Italy, Viet Nam, Norway, United States*
473	**Hungary**	Lithuania, Germany, France, Spain, Portugal, Italy, Viet Nam, Norway, United States*
472	**Portugal**	Lithuania, Germany, France, Spain, Hungary, Italy, Viet Nam, Norway, United States*
471	**Italy**	Lithuania, Germany, France, Spain, Hungary, Portugal, Viet Nam, Norway, Malta, United States*, Slovak Republic
469	**Viet Nam**	Lithuania, Germany, France, Spain, Hungary, Portugal, Italy, Norway, Malta, United States*, Slovak Republic, Croatia
468	**Norway**	Germany, France, Spain, Hungary, Portugal, Italy, Viet Nam, Malta, United States*, Slovak Republic, Croatia
466	**Malta**	Italy, Viet Nam, Norway, United States*, Slovak Republic, Croatia
465	**United States***	France, Spain, Hungary, Portugal, Italy, Viet Nam, Norway, Malta, Slovak Republic, Croatia, Iceland, Israel
464	**Slovak Republic**	Italy, Viet Nam, Norway, Malta, United States*, Croatia, Iceland, Israel
463	**Croatia**	Viet Nam, Norway, Malta, United States*, Slovak Republic, Iceland, Israel
459	**Iceland**	United States*, Slovak Republic, Croatia, Israel
458	**Israel**	United States*, Slovak Republic, Croatia, Iceland, Türkiye
453	**Türkiye**	Israel
442	**Brunei Darussalam**	*Ukrainian regions (18 of 27)*, Serbia
441	***Ukrainian regions (18 of 27)***	Brunei Darussalam, Serbia
440	**Serbia**	Brunei Darussalam, *Ukrainian regions (18 of 27)*
431	**United Arab Emirates**	Greece, Romania
430	**Greece**	United Arab Emirates, Romania, Kazakhstan, Mongolia
428	**Romania**	United Arab Emirates, Greece, Kazakhstan, Mongolia
425	**Kazakhstan**	Greece, Romania, Mongolia
425	**Mongolia**	Greece, Romania, Kazakhstan, Bulgaria
418	***Cyprus***	Bulgaria, Moldova
417	**Bulgaria**	Mongolia, *Cyprus*, Moldova, Qatar, Chile
414	**Moldova**	*Cyprus*, Bulgaria, Qatar, Chile, Uruguay, Malaysia
414	**Qatar**	Bulgaria, Moldova, Chile
412	**Chile**	Bulgaria, Moldova, Qatar, Uruguay, Malaysia
409	**Uruguay**	Moldova, Chile, Malaysia, Montenegro

Countries and economies are ranked in descending order of the mean performance in mathematics.
Source: OECD, PISA 2022 Database, Table I.B1.2.1.

Table I.2.1. Comparing countries' and economies' performance in mathematics [2/2]

Statistically significantly **above** the OECD average
Not statistically significantly different from the OECD average
Statistically significantly **below** the OECD average

Mean score	Comparison country/economy	Countries and economies whose mean score is not statistically significantly different from the comparison country's/economy's score
409	**Malaysia**	Moldova, Chile, Uruguay, Montenegro
406	***Montenegro***	Uruguay, Malaysia
397	***Baku (Azerbaijan)***	Mexico, Thailand, Peru
395	**Mexico**	*Baku (Azerbaijan)*, Thailand, Peru, Georgia
394	**Thailand**	*Baku (Azerbaijan)*, Mexico, Peru, Georgia, Saudi Arabia, North Macedonia
391	**Peru**	*Baku (Azerbaijan)*, Mexico, Thailand, Georgia, Saudi Arabia, North Macedonia
390	**Georgia**	Mexico, Thailand, Peru, Saudi Arabia, North Macedonia, Costa Rica, Colombia
389	**Saudi Arabia**	Thailand, Peru, Georgia, North Macedonia, Costa Rica, Colombia
389	**North Macedonia**	Thailand, Peru, Georgia, Saudi Arabia, Costa Rica, Colombia
385	**Costa Rica**	Georgia, Saudi Arabia, North Macedonia, Colombia, Jamaica*
383	**Colombia**	Georgia, Saudi Arabia, North Macedonia, Costa Rica, Brazil, Argentina, Jamaica*
379	**Brazil**	Colombia, Argentina, Jamaica*
378	**Argentina**	Colombia, Brazil, Jamaica*
377	**Jamaica***	Costa Rica, Colombia, Brazil, Argentina
368	**Albania**	*Palestinian Authority*, Indonesia, Morocco, Uzbekistan
366	***Palestinian Authority***	Albania, Indonesia, Morocco, Uzbekistan, Jordan
366	**Indonesia**	Albania, *Palestinian Authority*, Morocco, Uzbekistan, Jordan
365	**Morocco**	Albania, *Palestinian Authority*, Indonesia, Uzbekistan, Jordan, Panama*
364	**Uzbekistan**	Albania, *Palestinian Authority*, Indonesia, Morocco, Jordan
361	**Jordan**	*Palestinian Authority*, Indonesia, Morocco, Uzbekistan, Panama*
357	**Panama***	Morocco, Jordan, *Kosovo*, Philippines
355	***Kosovo***	Panama*, Philippines
355	**Philippines**	Panama*, *Kosovo*
344	**Guatemala**	El Salvador, Dominican Republic
343	**El Salvador**	Guatemala, Dominican Republic
339	**Dominican Republic**	Guatemala, El Salvador, Paraguay, Cambodia
338	**Paraguay**	Dominican Republic, Cambodia
336	**Cambodia**	Dominican Republic, Paraguay

Countries and economies are ranked in descending order of the mean performance in mathematics.
Source: OECD, PISA 2022 Database, Table I.B1.2.1.

Table I.2.2. Comparing countries' and economies' performance in reading [1/2]

Statistically significantly **above** the OECD average
Not statistically significantly different from the OECD average
Statistically significantly **below** the OECD average

Mean score	Comparison country/economy	Countries and economies whose mean score is not statistically significantly different from the comparison country's/economy's score
543	Singapore	
516	Ireland*	Japan, Korea, *Chinese Taipei*, Estonia
516	Japan	Ireland*, Korea, *Chinese Taipei*, Estonia, *Macao (China)*
515	Korea	Ireland*, Japan, *Chinese Taipei*, Estonia, *Macao (China)*
515	*Chinese Taipei*	Ireland*, Japan, Korea, Estonia, *Macao (China)*
511	Estonia	Ireland*, Japan, Korea, *Chinese Taipei*, *Macao (China)*, Canada*, United States*
510	*Macao (China)*	Japan, Korea, *Chinese Taipei*, Estonia, Canada*, United States*
507	Canada*	Estonia, *Macao (China)*, United States*
504	United States*	Estonia, *Macao (China)*, Canada*, New Zealand*, *Hong Kong (China)**, Australia*, United Kingdom*
501	New Zealand*	United States*, *Hong Kong (China)**, Australia*
500	*Hong Kong (China)**	United States*, New Zealand*, Australia*, United Kingdom*
498	Australia*	United States*, New Zealand*, *Hong Kong (China)**, United Kingdom*
494	United Kingdom*	United States*, *Hong Kong (China)**, Australia*, Finland, Denmark*, Poland, Czech Republic
490	Finland	United Kingdom*, Denmark*, Poland, Czech Republic, Sweden
489	Denmark*	United Kingdom*, Finland, Poland, Czech Republic, Sweden, Switzerland, Italy
489	Poland	United Kingdom*, Finland, Denmark*, Czech Republic, Sweden, Switzerland, Italy
489	Czech Republic	United Kingdom*, Finland, Denmark*, Poland, Sweden, Switzerland
487	Sweden	Finland, Denmark*, Poland, Czech Republic, Switzerland, Italy, Austria, Germany
483	Switzerland	Denmark*, Poland, Czech Republic, Sweden, Italy, Austria, Germany, Belgium, Portugal
482	Italy	Denmark*, Poland, Sweden, Switzerland, Austria, Germany, Belgium, Portugal, Norway, Croatia, Latvia*, France, Israel
480	Austria	Sweden, Switzerland, Italy, Germany, Belgium, Portugal, Norway, Croatia, Latvia*, Spain, France, Israel, Hungary
480	Germany	Sweden, Switzerland, Italy, Austria, Belgium, Portugal, Norway, Croatia, Latvia*, Spain, France, Israel, Hungary, Lithuania
479	Belgium	Switzerland, Italy, Austria, Germany, Portugal, Norway, Croatia, Latvia*, Spain, France, Israel, Hungary
477	Portugal	Switzerland, Italy, Austria, Germany, Belgium, Norway, Croatia, Latvia*, Spain, France, Israel, Hungary, Lithuania
477	Norway	Italy, Austria, Germany, Belgium, Portugal, Croatia, Latvia*, Spain, France, Israel, Hungary, Lithuania
475	Croatia	Italy, Austria, Germany, Belgium, Portugal, Norway, Latvia*, Spain, France, Israel, Hungary, Lithuania
475	Latvia*	Italy, Austria, Germany, Belgium, Portugal, Norway, Croatia, Spain, France, Israel, Hungary, Lithuania
474	Spain	Austria, Germany, Belgium, Portugal, Norway, Croatia, Latvia*, France, Israel, Hungary, Lithuania
474	France	Italy, Austria, Germany, Belgium, Portugal, Norway, Croatia, Latvia*, Spain, Israel, Hungary, Lithuania, Slovenia
474	Israel	Italy, Austria, Germany, Belgium, Portugal, Norway, Croatia, Latvia*, Spain, France, Hungary, Lithuania, Slovenia
473	Hungary	Austria, Germany, Belgium, Portugal, Norway, Croatia, Latvia*, Spain, France, Israel, Lithuania, Slovenia
472	Lithuania	Germany, Portugal, Norway, Croatia, Latvia*, Spain, France, Israel, Hungary, Slovenia
469	Slovenia	France, Israel, Hungary, Lithuania, Viet Nam**
462	Viet Nam**	Slovenia, Netherlands*, Türkiye
459	Netherlands*	Viet Nam**, Türkiye
456	Türkiye	Viet Nam**, Netherlands*
448	Chile	Slovak Republic, Malta
447	Slovak Republic	Chile, Malta, Serbia
445	Malta	Chile, Slovak Republic, Serbia
440	Serbia	Slovak Republic, Malta, Greece, Iceland
438	Greece	Serbia, Iceland
436	Iceland	Serbia, Greece, Uruguay, Romania, *Ukrainian regions (18 of 27)*
430	Uruguay	Iceland, Brunei Darussalam, Romania, *Ukrainian regions (18 of 27)*
429	Brunei Darussalam	Uruguay, Romania, *Ukrainian regions (18 of 27)*
428	Romania	Iceland, Uruguay, Brunei Darussalam, *Ukrainian regions (18 of 27)*
428	*Ukrainian regions (18 of 27)*	Iceland, Uruguay, Brunei Darussalam, Romania
419	Qatar	United Arab Emirates, Mexico, Costa Rica
417	United Arab Emirates	Qatar, Mexico, Costa Rica, Jamaica*
415	Mexico	Qatar, United Arab Emirates, Costa Rica, Moldova, Brazil, Jamaica*, Colombia, Peru
415	Costa Rica	Qatar, United Arab Emirates, Mexico, Moldova, Brazil, Jamaica*, Colombia, Peru
411	Moldova	Mexico, Costa Rica, Brazil, Jamaica*, Colombia, Peru, Bulgaria
410	Brazil	Mexico, Costa Rica, Moldova, Jamaica*, Colombia, Peru, Bulgaria

** Caution is required when comparing estimates based on PISA 2022 with other countries/economies as a strong linkage to the international PISA reading scale could not be established (see Reader's Guide and Annex A4).
Countries and economies are ranked in descending order of the mean performance in reading.
Source: OECD, PISA 2022 Database, Table I.B1.2.2.

Table I.2.2. Comparing countries' and economies' performance in reading [2/2]

Statistically significantly **above** the OECD average
Not statistically significantly different from the OECD average
Statistically significantly **below** the OECD average

Mean score	Comparison country/economy	Countries and economies whose mean score is not statistically significantly different from the comparison country's/economy's score
410	**Jamaica***	United Arab Emirates, Mexico, Costa Rica, Moldova, Brazil, Colombia, Peru, Montenegro, Bulgaria, Argentina
409	**Colombia**	Mexico, Costa Rica, Moldova, Brazil, Jamaica*, Peru, Montenegro, Bulgaria, Argentina
408	**Peru**	Mexico, Costa Rica, Moldova, Brazil, Jamaica*, Colombia, Montenegro, Bulgaria
405	**Montenegro**	Jamaica*, Colombia, Peru, Bulgaria, Argentina
404	**Bulgaria**	Moldova, Brazil, Jamaica*, Colombia, Peru, Montenegro, Argentina
401	**Argentina**	Jamaica*, Colombia, Montenegro, Bulgaria
392	**Panama***	Malaysia, Kazakhstan
388	**Malaysia**	Panama*, Kazakhstan, Saudi Arabia
386	**Kazakhstan**	Panama*, Malaysia, Saudi Arabia
383	**Saudi Arabia**	Malaysia, Kazakhstan, *Cyprus*, Thailand, Mongolia
381	***Cyprus***	Saudi Arabia, Thailand, Mongolia
379	**Thailand**	Saudi Arabia, *Cyprus*, Mongolia, Guatemala, Georgia, Paraguay
378	**Mongolia**	Saudi Arabia, *Cyprus*, Thailand, Guatemala, Georgia, Paraguay
374	**Guatemala**	Thailand, Mongolia, Georgia, Paraguay
374	**Georgia**	Thailand, Mongolia, Guatemala, Paraguay
373	**Paraguay**	Thailand, Mongolia, Guatemala, Georgia
365	***Baku (Azerbaijan)***	El Salvador, Indonesia
365	**El Salvador**	*Baku (Azerbaijan)*, Indonesia, Albania
359	**Indonesia**	*Baku (Azerbaijan)*, El Salvador, North Macedonia, Albania, Dominican Republic
359	**North Macedonia**	Indonesia, Albania
358	**Albania**	El Salvador, Indonesia, North Macedonia
351	**Dominican Republic**	Indonesia, *Palestinian Authority*, Philippines
349	***Palestinian Authority***	Dominican Republic, Philippines
347	**Philippines**	Dominican Republic, *Palestinian Authority*, *Kosovo*, Jordan, Morocco
342	***Kosovo***	Philippines, Jordan, Morocco
342	**Jordan**	Philippines, *Kosovo*, Morocco
339	**Morocco**	Philippines, *Kosovo*, Jordan, Uzbekistan
336	**Uzbekistan**	Morocco
329	**Cambodia**	

** Caution is required when comparing estimates based on PISA 2022 with other countries/economies as a strong linkage to the international PISA reading scale could not be established (see Reader's Guide and Annex A4).
Countries and economies are ranked in descending order of the mean performance in reading.
Source: OECD, PISA 2022 Database, Table I.B1.2.2.

Table I.2.3. Comparing countries' and economies' performance in science [1/2]

Statistically significantly **above** the OECD average
Not statistically significantly different from the OECD average
Statistically significantly **below** the OECD average

Mean score	Comparison country/economy	Countries and economies whose mean score is not statistically significantly different from the comparison country's/economy's score
561	Singapore	
547	Japan	*Macao (China)*
543	*Macao (China)*	Japan, *Chinese Taipei*
537	*Chinese Taipei*	*Macao (China)*, Korea
528	Korea	*Chinese Taipei*, Estonia, *Hong Kong (China)**
526	Estonia	Korea, *Hong Kong (China)**
520	*Hong Kong (China)**	Korea, Estonia, Canada*
515	Canada*	*Hong Kong (China)**, Finland
511	Finland	Canada*, Australia*
507	Australia*	Finland, New Zealand*, Ireland*, Switzerland, United States*
504	New Zealand*	Australia*, Ireland*, Switzerland, Slovenia, United Kingdom*, United States*, Poland
504	Ireland*	Australia*, New Zealand*, Switzerland, Slovenia, United Kingdom*, United States*, Poland, Czech Republic
503	Switzerland	Australia*, New Zealand*, Ireland*, Slovenia, United Kingdom*, United States*, Poland, Czech Republic
500	Slovenia	New Zealand*, Ireland*, Switzerland, United Kingdom*, United States*, Poland, Czech Republic
500	United Kingdom*	New Zealand*, Ireland*, Switzerland, Slovenia, United States*, Poland, Czech Republic, Latvia*, Denmark*, Sweden, Germany
499	United States*	Australia*, New Zealand*, Ireland*, Switzerland, Slovenia, United Kingdom*, Poland, Czech Republic, Latvia*, Denmark*, Sweden, Germany , Austria, Belgium, Netherlands*
499	Poland	New Zealand*, Ireland*, Switzerland, Slovenia, United Kingdom*, United States*, Czech Republic, Latvia*, Denmark*, Sweden, Germany
498	Czech Republic	Ireland*, Switzerland, Slovenia, United Kingdom*, United States*, Poland, Latvia*, Denmark*, Sweden, German y, Austria
494	Latvia*	United Kingdom*, United States*, Poland, Czech Republic, Denmark*, Sweden, German y, Austria, Belgium, Netherlands*, France
494	Denmark*	United Kingdom*, United States*, Poland, Czech Republic, Latvia*, Sweden, German y, Austria, Belgium, Netherlands*, France
494	Sweden	United Kingdom*, United States*, Poland, Czech Republic, Latvia*, Denmark*, German y, Austria, Belgium, Netherlands*, France
492	Germany	United Kingdom*, United States*, Poland, Czech Republic, Latvia*, Denmark*, Sweden, Austria, Belgium, Netherlands*, France, Hungary, Lithuania, Portugal
491	Austria	United States*, Czech Republic, Latvia*, Denmark*, Sweden, German y, Belgium, Netherlands*, France, Hungary, Lithuania, Portugal
491	Belgium	United States*, Latvia*, Denmark*, Sweden, German y, Austria, Netherlands*, France, Hungary, Lithuania, Portugal
488	Netherlands*	United States*, Latvia*, Denmark*, Sweden, German y, Austria, Belgium, France, Hungary, Spain, Lithuania, Portugal, Croatia
487	France	Latvia*, Denmark*, Sweden, Germany, Austria, Belgium, Netherlands*, Hungary, Spain, Lithuania, Portugal, Croatia
486	Hungary	Germany, Austria, Belgium, Netherlands*, France, Spain, Lithuania, Portugal, Croatia
485	Spain	Netherlands*, France, Hungary, Lithuania, Portugal, Croatia
484	Lithuania	Germany, Austria, Belgium, Netherlands*, France, Hungary, Spain, Portugal, Croatia, Norway, Italy
484	Portugal	Germany, Austria, Belgium, Netherlands*, France, Hungary, Spain, Lithuania, Croatia, Norway, Italy
483	Croatia	Netherlands*, France, Hungary, Spain, Lithuania, Portugal, Norway, Italy
478	Norway	Lithuania, Portugal, Croatia, Italy, Türkiye, Viet Nam
477	Italy	Lithuania, Portugal, Croatia, Norway, Türkiye, Viet Nam
476	Türkiye	Norway, Italy, Viet Nam
472	Viet Nam	Norway, Italy, Türkiye, Malta, Israel
466	Malta	Viet Nam, Israel, Slovak Republic
465	Israel	Viet Nam, Malta, Slovak Republic
462	Slovak Republic	Malta, Israel
450	*Ukrainian regions (18 of 27)*	Serbia, Iceland, Brunei Darussalam, Chile
447	Serbia	*Ukrainian regions (18 of 27)*, Iceland, Brunei Darussalam, Chile, Greece
447	Iceland	*Ukrainian regions (18 of 27)*, Serbia, Brunei Darussalam, Chile, Greece
446	Brunei Darussalam	*Ukrainian regions (18 of 27)*, Serbia, Iceland, Chile, Greece
444	Chile	*Ukrainian regions (18 of 27)*, Serbia, Iceland, Brunei Darussalam, Greece
441	Greece	Serbia, Iceland, Brunei Darussalam, Chile, Uruguay
435	Uruguay	Greece, Qatar, United Arab Emirates, Romania
432	Qatar	Uruguay, United Arab Emirates, Romania
432	United Arab Emirates	Uruguay, Qatar, Romania
428	Romania	Uruguay, Qatar, United Arab Emirates, Kazakhstan, Bulgaria
423	Kazakhstan	Romania, Bulgaria
421	Bulgaria	Romania, Kazakhstan, Moldova, Malaysia
417	Moldova	Bulgaria, Malaysia, Mongolia, Colombia, Costa Rica
416	Malaysia	Bulgaria, Moldova, Mongolia, Colombia, Costa Rica, *Cyprus*, Mexico, Thailand

Countries and economies are ranked in descending order of the mean performance in science.
Source: OECD, PISA 2022 Database, Table I.B1.2.3.

Table I.2.3. Comparing countries' and economies' performance in science [2/2]

Statistically significantly **above** the OECD average
Not statistically significantly different from the OECD average
Statistically significantly **below** the OECD average

Mean score	Comparison country/economy	Countries and economies whose mean score is not statistically significantly different from the comparison country's/economy's score
412	**Mongolia**	Moldova, Malaysia, Colombia, Costa Rica, *Cyprus*, Mexico, Thailand, Peru, Argentina
411	**Colombia**	Moldova, Malaysia, Mongolia, Costa Rica, *Cyprus*, Mexico, Thailand, Peru, Argentina, Jamaica*
411	**Costa Rica**	Moldova, Malaysia, Mongolia, Colombia, *Cyprus*, Mexico, Thailand, Peru, Argentina, Jamaica*
411	***Cyprus***	Malaysia, Mongolia, Colombia, Costa Rica, Mexico, Thailand, Peru, Argentina, Jamaica*
410	**Mexico**	Malaysia, Mongolia, Colombia, Costa Rica, *Cyprus*, Thailand, Peru, Argentina, Jamaica*
409	**Thailand**	Malaysia, Mongolia, Colombia, Costa Rica, *Cyprus*, Mexico, Peru, Argentina, Brazil, Jamaica*
408	**Peru**	Mongolia, Colombia, Costa Rica, *Cyprus*, Mexico, Thailand, Argentina, Montenegro, Brazil, Jamaica*
406	**Argentina**	Mongolia, Colombia, Costa Rica, *Cyprus*, Mexico, Thailand, Peru, Montenegro, Brazil, Jamaica*
403	**Montenegro**	Peru, Argentina, Brazil, Jamaica*
403	**Brazil**	Thailand, Peru, Argentina, Montenegro, Jamaica*
403	**Jamaica***	Colombia, Costa Rica, *Cyprus*, Mexico, Thailand, Peru, Argentina, Montenegro, Brazil
390	**Saudi Arabia**	Panama*
388	**Panama***	Saudi Arabia, Georgia, Indonesia, *Baku (Azerbaijan)*
384	**Georgia**	Panama*, Indonesia, *Baku (Azerbaijan)*, North Macedonia
383	**Indonesia**	Panama*, Georgia, *Baku (Azerbaijan)*, North Macedonia
380	***Baku (Azerbaijan)***	Panama*, Georgia, Indonesia, North Macedonia, Albania, Jordan
380	**North Macedonia**	Georgia, Indonesia, *Baku (Azerbaijan)*, Albania
376	**Albania**	*Baku (Azerbaijan)*, North Macedonia, Jordan, El Salvador, Guatemala
375	**Jordan**	*Baku (Azerbaijan)*, Albania, El Salvador, Guatemala, *Palestinian Authority*
373	**El Salvador**	Albania, Jordan, Guatemala, *Palestinian Authority*, Paraguay, Morocco
373	**Guatemala**	Albania, Jordan, El Salvador, *Palestinian Authority*, Paraguay, Morocco
369	***Palestinian Authority***	Jordan, El Salvador, Guatemala, Paraguay, Morocco
368	**Paraguay**	El Salvador, Guatemala, *Palestinian Authority*, Morocco
365	**Morocco**	El Salvador, Guatemala, *Palestinian Authority*, Paraguay, Dominican Republic
360	**Dominican Republic**	Morocco, *Kosovo*, Philippines, Uzbekistan
357	***Kosovo***	Dominican Republic, Philippines, Uzbekistan
356	**Philippines**	Dominican Republic, *Kosovo*, Uzbekistan
355	**Uzbekistan**	Dominican Republic, *Kosovo*, Philippines
347	**Cambodia**	

Countries and economies are ranked in descending order of the mean performance in science.
Source: OECD, PISA 2022 Database, Table I.B1.2.3.

Box I.2.1. How is student mathematics anxiety related to their performance in mathematics?

Students who perform better in mathematics have, on average, lower levels of anxiety about mathematics. In PISA, this finding was first reported in 2012 (OECD, 2013[1]) and it is also found in PISA 2022.

As examined in this box, a negative association between mathematics performance and mathematics anxiety is found in every education system that took part in PISA 2022, without exceptions. At the system level, the cross-national association between average levels of mathematics anxiety and mean mathematics performance is also negative but more variation in anxiety levels exists among top-performing countries.

Furthermore, research suggests that positive attitudes towards mathematics and learning can help students reduce their levels of mathematics anxiety and its negative consequences on mathematics performance (Choe et al., 2019[2]; Dowker, Sarkar and Looi, 2016[3]; Carey et al., 2016[4]; Goetz et al., 2010[5]; Ashcraft and Kirk, 2001[6]). As shown in the second part of this box, a growth mindset – the belief that one's abilities and intelligence can be developed over time rather than being an invariant innate gift – is one of the positive attitudes towards learning that can alleviate mathematics anxiety.

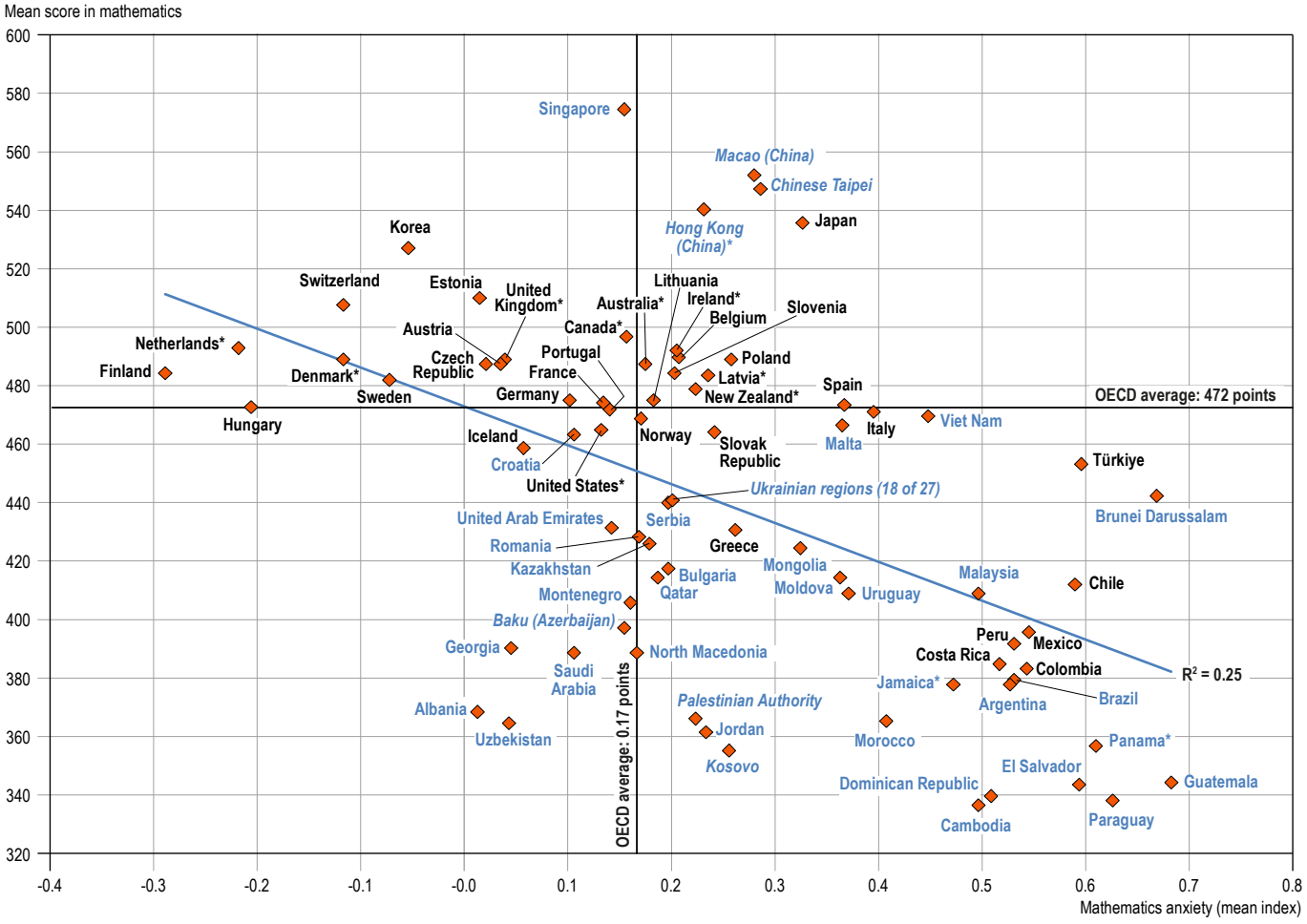
Mathematics anxiety in PISA 2022

To measure students' anxiety about mathematics, PISA 2022 asked students whether they agreed ("strongly disagree", "disagree", "agree", or "strongly agree") with the following six statements: "I often worry that it will be difficult for me in mathematics classes"; "I worry that I will get poor marks in mathematics"; "I get very tense when I have to do mathematics homework"; "I get very nervous doing mathematics problems"; "I feel helpless when doing a mathematics problem"; and "I feel anxious about failing in mathematics". Data from these items was combined to create the PISA index of mathematics anxiety (ANXMAT).

Within countries/economies, mathematics anxiety is negatively associated with student achievement in mathematics in every education system that took part in PISA 2022 regardless of student and school characteristics. On average across OECD countries, a one-point increase in the index of mathematics anxiety is associated with a decrease in mathematics achievement of 18 score points after accounting for students' and schools' socio-economic profile (Table I.B1.2.17).

Countries/economies with higher average levels of mathematics anxiety perform less well in mathematics. International differences in the index of mathematics anxiety account for about 25% of the variation in student performance in mathematics across all countries and economies that took part in PISA 2022 (Figure I.2.1).

Figure I.2.1. Mathematics anxiety and mean score in mathematics in PISA 2022



Note: Only countries and economies with available data are shown.
Source: OECD, PISA 2022 Database, Tables I.B1.2.1 and I.B1.2.16.

Mathematics anxiety is particularly high among countries/economies with low levels of performance in mathematics. The 17 countries/economies with the highest levels of mathematics anxiety in PISA 2022 (i.e. values higher than .47 in ANXMAT) performed below the OECD average in mathematics; out of those 17 countries/economies, 13 have a mean performance in mathematics below 400 points.

Conversely, the lowest levels of anxiety tend to be in countries whose mean score in mathematics is above the OECD average, most noticeably Denmark*, Finland, the Netherlands* and Switzerland (Figure I.2.1). Nevertheless, countries/economies with high levels of performance in mathematics differ widely in their levels of mathematics anxiety. Importantly, four out of the six East Asian countries/economies that outperformed all other countries/economies in mathematics in PISA 2022 show high levels of mathematics anxiety (Hong Kong [China]*, Japan, Macao [China] and Chinese Taipei); the exceptions are Korea and Singapore, where students show levels of mathematics anxiety similar to or lower than the OECD average.

Research has addressed anxiety as a multidimensional or multifaceted construct: sources of anxiety may be as diverse as its consequences (Zeidner et al., 2005[7]). Anxiety could have at least cognitive and somatic components, and could be further disentangled from test anxiety and other types of anxiety that may have a direct impact on student performance (Zeidner et al., 2005[7]). Treating anxiety as multidimensional may help to understand why, in some countries/economies, personal and situational aspects may affect anxiety differently (Putwain, Woods and Symes, 2010[8]), and more specifically, the relationship between anxiety and performance as measured by PISA. Further research is needed on how these individual factors and other cultural dimensions (Ho et al., 2000[9]; Zhang, Zhao and Kong, 2019[10]) interact and may differentially affect students' mathematics performance in PISA.

Growth mindset and mathematics anxiety

Growth mindset can help students overcome performance-related anxiety (Yeager and Walton, 2011[11]) potentially reducing its negative consequences on performance and, ultimately, well-being (OECD, 2021[12]; Yeager et al., 2019[13]). A growth mindset, as opposed to a fixed mindset, is the belief in the malleability of ability and intelligence, and is one possible explanation why some people fulfil their potential while others do not (Dweck, 2006[14]). People with a growth mindset are more likely to work to develop their skills and be motivated when experiencing drawbacks; by contrast, individuals with fixed mindsets (who believe that people are born with certain invariant characteristics that cannot be changed) tend to favour validation of their abilities, avoid challenges and stay within their comfort zone. One characteristic of students with a growth mindset is reduced anxiety about learning, which is linked to their positive view of failure and obstacles (Dweck and Yeager, 2019[15]).

PISA 2022 asked students whether they agreed (“strongly disagree”, “disagree”, “agree”, or “strongly agree”) with the following statement: “Your intelligence is something about you that you can’t change very much”. Students strongly disagreeing or disagreeing with the statement are considered to have a growth mindset.

PISA results show that students who reported having a growth mindset have less mathematics anxiety than students with a fixed mindset on average across OECD countries (difference of -0.13 points in the mathematics anxiety index) and in 42 out of 73 countries and economies with available data (Table I.BI.2.16). Furthermore, a growth mindset is positively associated with student performance in mathematics. Students who reported having a growth mindset score better in mathematics than students with a fixed mindset even after accounting for student and school socio-economic profile on average across OECD countries (difference of 18 score points) and in 57 countries and economies (Table I.BI.2.17).

Mathematics anxiety and growth mindset are considered together in Figure I.2.2, which shows the OECD average score in mathematics for four groups of students: those with (i) high mathematics anxiety and growth mindset, (ii) high mathematics anxiety and fixed mindset, (iii) low mathematics anxiety and growth mindset, and (iv) low mathematics anxiety and fixed mindset. Students who were more anxious about mathematics scored better in mathematics if they had a growth mindset (461 score points) than if they had a fixed mindset (443 score points).

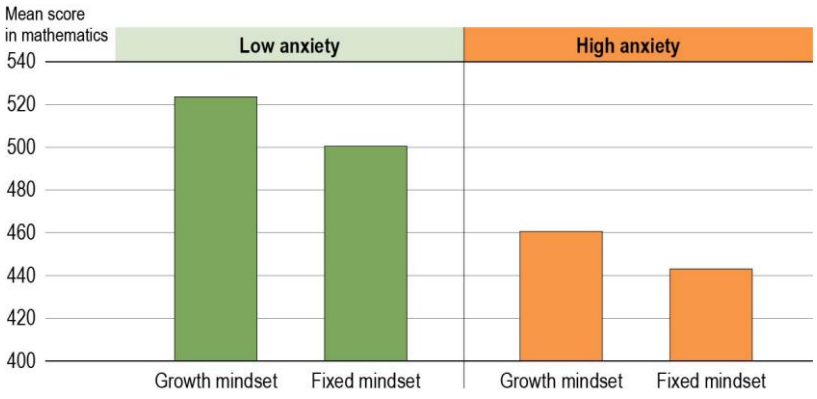
Similarly, students who were less anxious about mathematics scored better if they had a growth mindset (523 score points) than if they had a fixed mindset (500 score points).

This OECD pattern is also observed in most countries with available data. In 54 out of 73 countries/economies, students with low anxiety performed better in math if they had a growth mindset rather than fixed mindset. Also, in 46 out of 73 countries/economies, students with high anxiety performed better in math if they had a growth mindset rather than fixed (Table I.BI.2.17).

This association holds even after accounting for student and school socio- economic profile (Table I.BI.2.17).

Figure I.2.2. Mathematics performance and anxiety in mathematics among students with fixed and growth mindsets

OECD Average



Note: Low/high anxiety are students in the bottom/top quarter of the distribution in the ANXMAT index in their own countries/economies.
Source: OECD, PISA 2022 Database, Table I.B1.2.17.

Policy implications

Mathematics anxiety can be diminished by means of mathematics training but also by improving positive attitudes towards mathematics and learning, including role models, further support in schools and fostering growth mindsets (Beilock et al., 2010[16]). To develop students' ability to tackle real-world problems and apply mathematical knowledge successfully, schools and education systems need to go beyond formal mathematics education. To deal head-on with important barriers to mathematics learning, it is important to understand and address students' attitudes and emotions about mathematics, and to develop positive students' mindsets and disposition towards learning challenges and effort.

Variation in performance within and between countries and economies

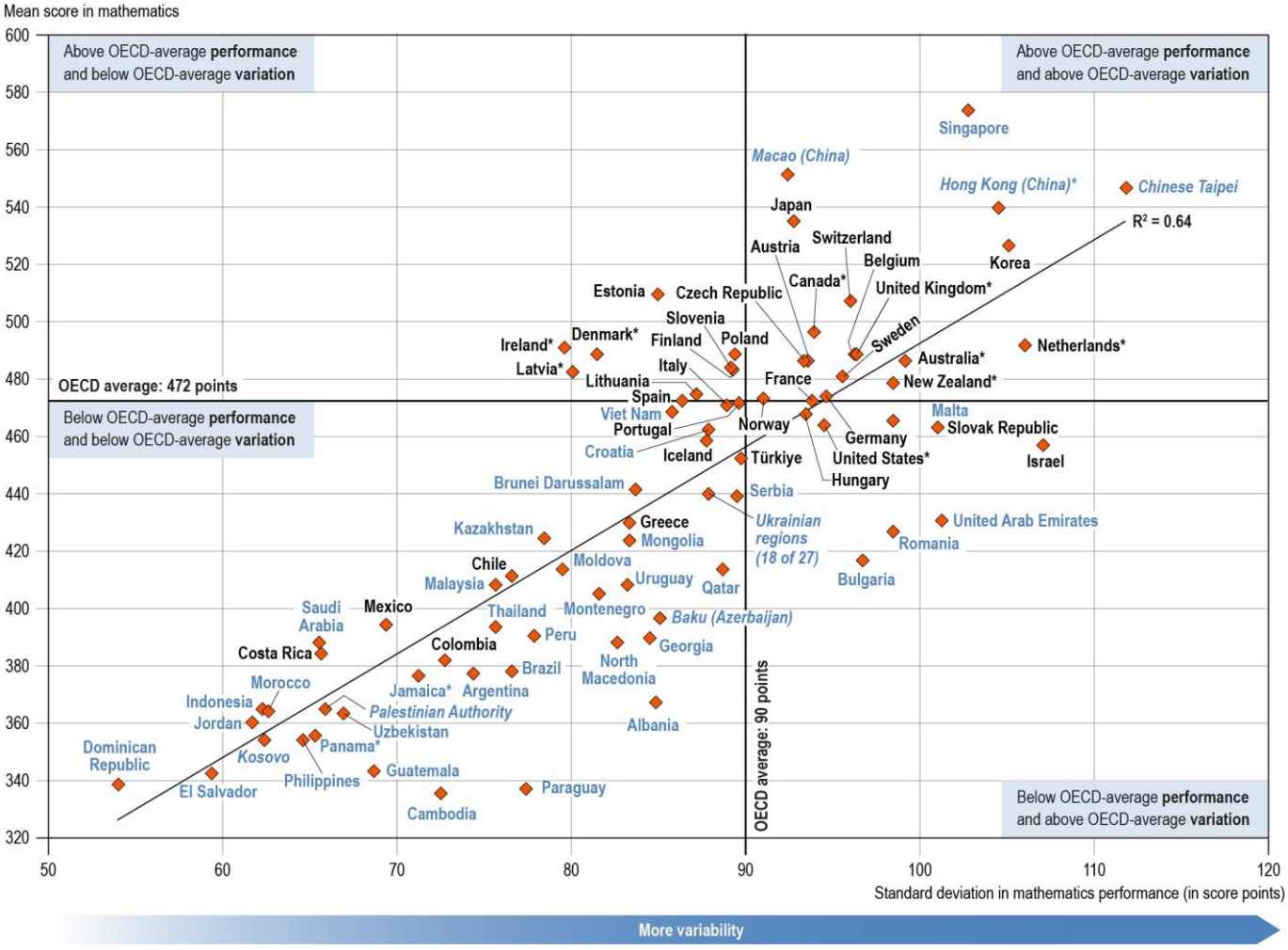
Variation in performance within countries

The Dominican Republic has the smallest variation in mathematics proficiency (54 score points) while several other countries and economies whose mean performance was below the OECD average also have small variations in performance[2]. Variation in student performance tends to be greater among high-performing than low-performing education systems. As shown in Figure I.2.3, there is a strong correlation between average performance in mathematics and variation in performance in mathematics. That said, this is not the case for all countries. For instance, Latvia* has a mean of 483 and a standard deviation of 80.

However, among countries that performed above the OECD average, Ireland*, Latvia* and Denmark* stand out for their relatively small variation in performance (standard deviation around 80 score points) (Figure I.2.3). Similarly,

among countries that performed below the OECD average, Bulgaria, Israel, Malta, Romania, the Slovak Republic and the United Arab Emirates, stand out for their relatively large variation in performance (standard deviation greater than 95 score points).

Figure I.2.3. Average performance in mathematics and variation in performance



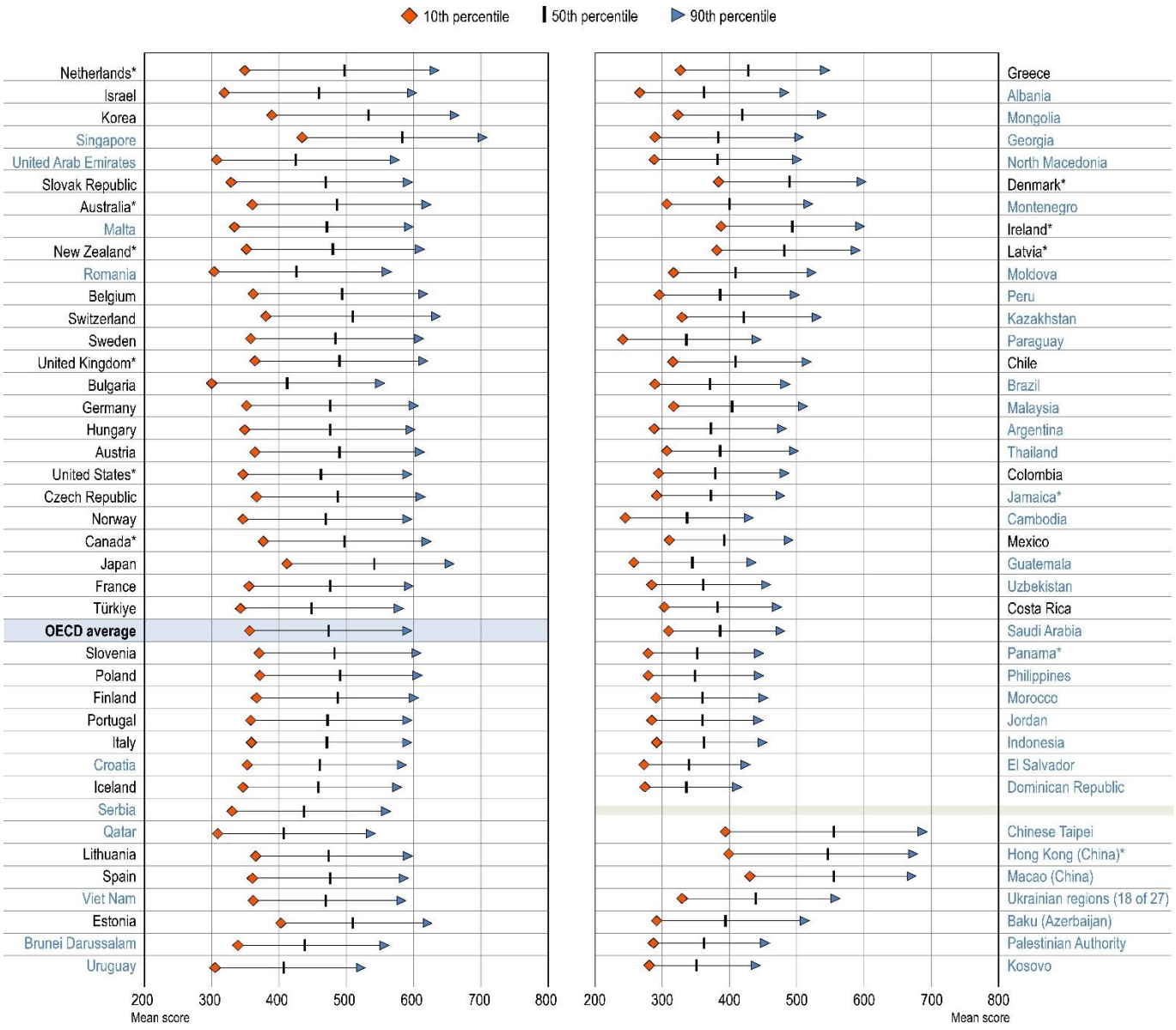
Source: OECD, PISA 2022 Database, Table I.B1.2.1.

Another measure of variation in performance within countries is the score gap that separates the highest- and lowest-performing students within a country (i.e. inter-decile range). In mathematics, the difference between the 90th percentile of performance (the score above which only 10% of students scored) and the 10th percentile of performance (the score below which only 10% of students scored) is more than 135 score points in all countries and economies; on average across OECD countries, 235 score points separate these extremes (Figure I.2.4).

The largest differences between top-performing and low-achieving students in mathematics are found in Israel, the Netherlands* and Chinese Taipei (Figure I.2.4). In these countries, the inter-decile range is 280 score points or more, which means that student performance in mathematics is highly unequal across 15-year-olds.

By contrast, the smallest differences between high- and low-achieving students are found among countries and economies with low (i.e. lower than 370 points) mean scores (the Dominican Republic, El Salvador, Indonesia, Jordan and Kosovo). In these countries, the 90th percentile of the mathematics distribution is below the average score across OECD countries.

Figure I.2.4. Mean score in mathematics at 10th, 50th and 90th percentile of performance distribution



Note: All differences between the 90th and the 10th percentiles are statistically significant (see Annex A3).
Countries and economies are ranked in descending order of the difference in mathematics performance between 90th percentile and 10th percentile.
Source: OECD, PISA 2022 Database, Table I.B1.2.1.

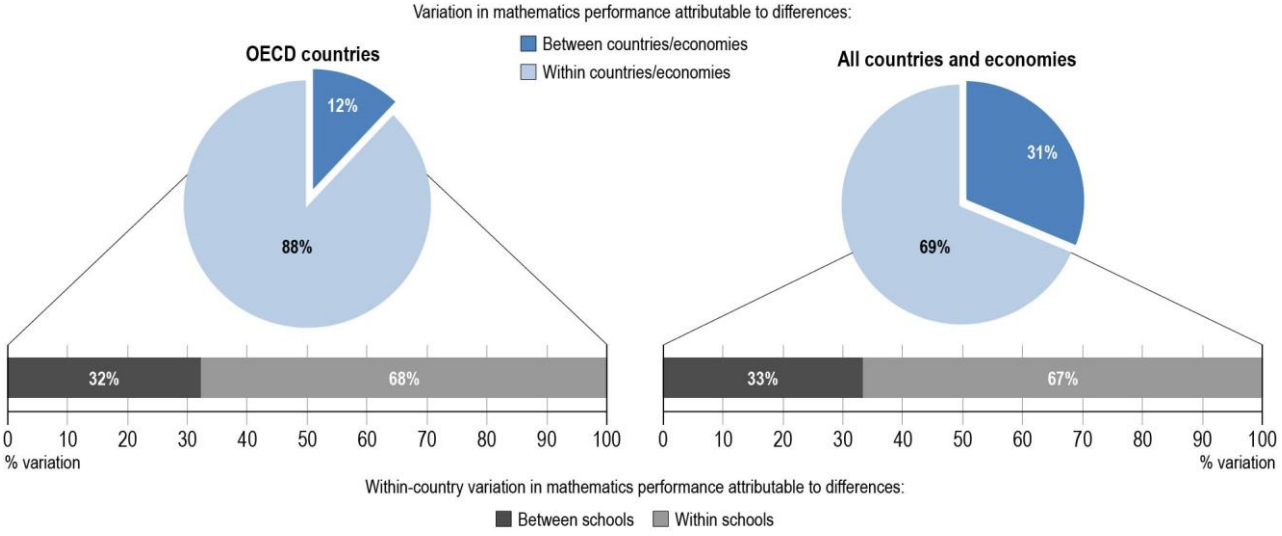
Performance differences among educational systems, schools and students

Student performance varies widely among 15-year-olds and that variation can be broken down into differences at the student, school and education system levels[3]. This analysis is important from a policy perspective. Pinpointing where differences in student performance lie enables education stakeholders to target policy[4]. For example, if a large percentage of the total variation in student performance is linked to differences in student performance between education systems, this means that education system characteristics (e.g. economic and social conditions, education policies) strongly influence student performance. Similarly, if differences between schools account for a significant part of the overall variation in performance within a country/economy, then differences in school characteristics are important for policy to consider.

In PISA 2022, about 31% of the variation in mathematics performance is linked to mean differences in student performance between participating education systems (Figure I.2.5) across all countries and economies. This means that the characteristics of education systems have a great deal of influence on student performance. As shown in Chapter 4, the economic and social conditions of different countries/economies, which are often beyond the control of education policy makers and educators, can influence student performance by means of, for example, wealthier countries spending more on education than mid- and low-income countries. On the other hand, it is education policy makers and educators who determine education policies and practices, including the organisation of schooling and learning, and the allocation of available resources across schools and students.

Across OECD countries, however, only 12% of the variation in mathematics performance is between education systems. In other words, the characteristics of education systems do not play an important role in explaining differences in student performance among OECD countries. This is likely because the economic and social conditions of OECD countries are very similar to each other. It is also possible that education policies and practices vary less across OECD countries than across all PISA-participating countries.

Figure I.2.5. Variation in mathematics performance between systems, schools and students

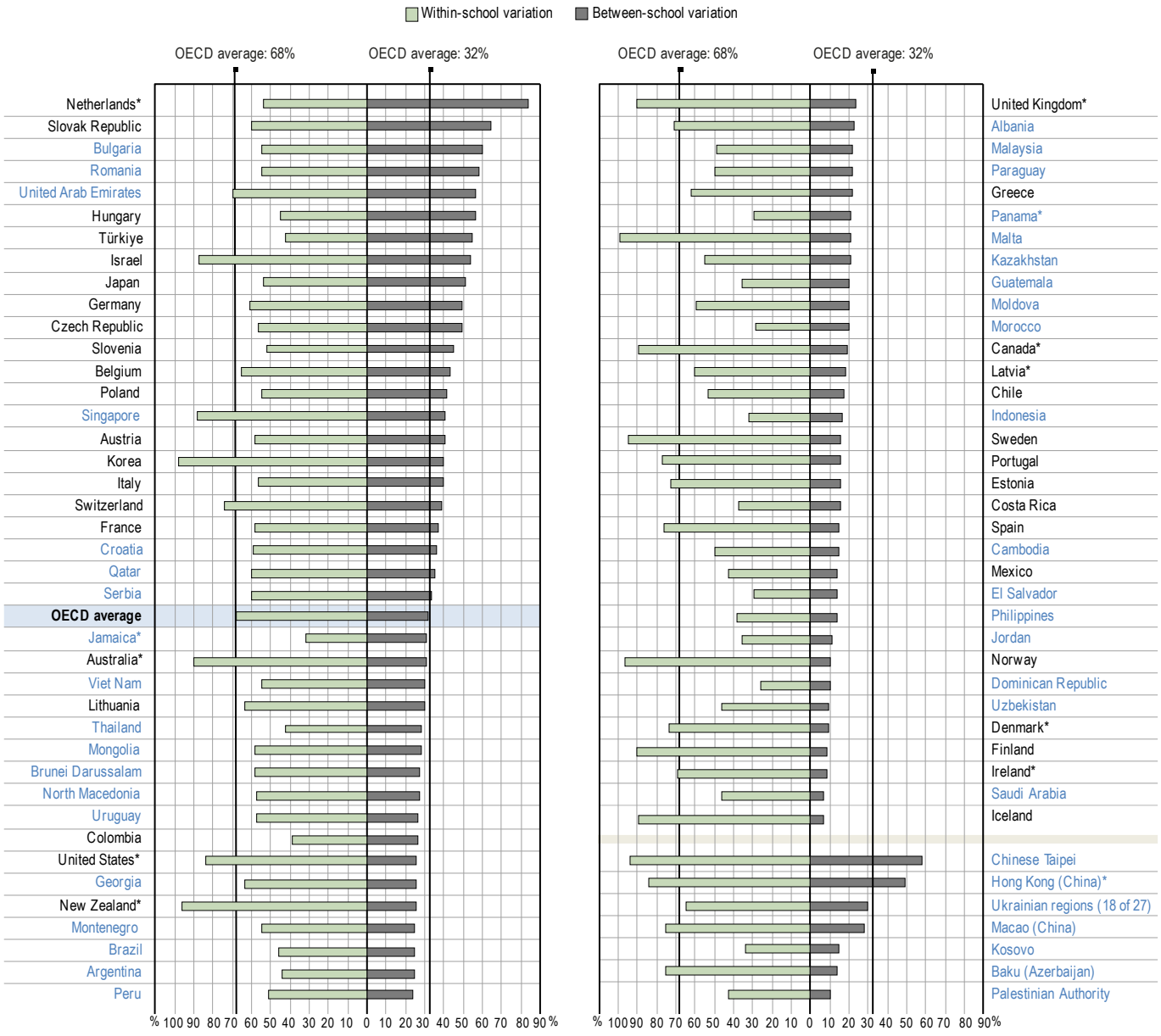


Source: OECD, PISA 2022 Database.

Out of the variation observed within countries in PISA 2022, 32% of the OECD average variation in mathematics performance is between schools (right side of Figure I.2.6); the remaining part of the variation (68%) is within schools (left side of the figure). This means that school characteristics do not play a dominant role in explaining student performance; instead, it is the characteristics of students themselves (i.e. their background, attitudes and behaviour, etc.), and the characteristics of different classrooms and different grades within schools that account for most of the overall variation in student performance.

The extent of between-school variation in mathematics performance differs widely across countries/economies. In six countries and economies between-school differences account for 10% or less of the total variation in performance (Iceland, Saudi Arabia, Ireland*, Finland, Denmark* and Uzbekistan, in ascending order). By contrast, in 10 other countries (Bulgaria, Hungary, Israel, Japan, the Netherlands*, Romania, the Slovak Republic, Chinese Taipei, Türkiye and the United Arab Emirates) differences between schools account for at least 50% of the total variation in the country's performance.

Figure I.2.6. Variation in mathematics performance between and within schools



Note: This figure is restricted to schools with the modal ISCED level for 15-year-old students[5].
Countries and economies are ranked in descending order of the between-school variation in mathematics performance as a percentage of the total variation in performance across OECD countries.
Source: OECD, PISA 2022 Database, Table I.B1.2.12.

Ranking countries' and economies' performance in PISA

The goal of PISA is to provide useful information to educators and policy makers on the strengths and weaknesses of their country's education system, their progress made over time, and opportunities for improvement. When ranking countries' and economies' student performance in PISA, it is important to consider the social and economic context of schooling (see next section). Moreover, many countries and economies score at similar levels; small differences that are not statistically significant or practically meaningful should not be considered (see Box 1 in Reader's Guide).

Table I.2.4, Table I.2.5 and Table I.2.6 show for each country and economy an estimate of where its mean performance ranks among all other countries and economies that participated in PISA as well as, for OECD countries, among all OECD countries. Because mean-score estimates are derived from samples and are thus associated with statistical uncertainty, it is often not possible to determine an exact ranking for all countries and economies. However, it is possible to identify the range of possible rankings for the country's or economy's mean performance[6]. This range of ranks can be wide, particularly for countries/economies whose mean scores are similar to those of many other countries/economies.

Table I.2.4, Table I.2.5 and Table I.2.6 also include the results of provinces, regions, states or other subnational entities within the country for countries where the sampling design supports such reporting. For these subnational entities, a rank order was not estimated. Still, the mean score and its confidence interval allow the performances of subnational entities and countries/economies to be compared. For example, Quebec (Canada*) scored below top-performers Macao (China), Singapore, Chinese Taipei and Hong Kong (China)*, but close to Korea in mathematics.

Table I.2.4. Mathematics performance at national and subnational levels [1/2]

	Mean score	95% confidence interval	All countries/economies		OECD countries	
			Lower rank	Upper rank	Lower rank	Upper rank
Singapore	575	572 - 577	1	1		
Macao (China)	552	550 - 554	2	4		
Chinese Taipei	547	540 - 554	2	6		
Hong Kong (China)*	540	534 - 546	2	6		
Japan	536	530 - 541	3	6	1	2
Korea	527	520 - 535	3	7	1	2
*Quebec (Canada)**	514	506 - 521				
Estonia	510	506 - 514	6	9	3	4
Switzerland	508	504 - 512	7	10	3	5
*Alberta (Canada)**	504	492 - 515				
Flemish community (Belgium)	501	495 - 507				
Castile and Leon (Spain)	499	492 - 507				
Canada*	497	494 - 500	8	18	5	13
*British Columbia (Canada)**	496	488 - 505				
*Ontario (Canada)**	495	489 - 501				
Asturias (Spain)	495	486 - 504				
Cantabria (Spain)	495	486 - 504				
Madrid (Spain)	494	487 - 501				
Netherlands*	493	485 - 500	7	26	4	20
La Rioja (Spain)	493	485 - 501				
Navarre (Spain)	492	484 - 501				
*England (United Kingdom)**	492	487 - 497				
Ireland*	492	488 - 496	9	22	5	18
Trento (Italy)	491	487 - 494				
Belgium	489	485 - 494	9	24	5	20
Denmark*	489	485 - 493	9	24	5	19
United Kingdom*	489	485 - 493	9	24	5	20
Poland	489	485 - 493	9	24	5	20
Austria	487	483 - 492	9	28	5	20
Australia*	487	484 - 491	9	25	6	20
Czech Republic	487	483 - 491	9	26	5	20
Aragon (Spain)	487	478 - 496				
Galicia (Spain)	486	479 - 494				
Slovenia	485	482 - 487	10	28	6	21
Finland	484	480 - 488	10	30	6	24
German-speaking community (Belgium)	483	473 - 494				
Latvia*	483	479 - 487	10	32	6	25
Basque Country (Spain)	482	474 - 490				
Sweden	482	478 - 486	10	32	6	27
Bolzano (Italy)	482	476 - 488				
Northern (Viet Nam)	480	467 - 494				
New Zealand*	479	475 - 483	11	33	7	28
Prince Edward Island (Canada)	478	465 - 491				
Lithuania	475	472 - 479	18	36	16	29
*Northern Ireland (United Kingdom)**	475	469 - 481				
Germany	475	469 - 481	11	37	8	30
France	474	469 - 479	16	37	15	29
French community (Belgium)	474	468 - 480				
Spain	473	470 - 476	21	36	18	29
Hungary	473	468 - 478	19	37	16	30
Comunidad Valenciana (Spain)	473	465 - 480				
Portugal	472	467 - 477	20	37	17	30
Italy	471	465 - 477	18	38	16	31
Balearic Islands (Spain)	471	463 - 478				
*Scotland (United Kingdom)**	471	465 - 476				
*Manitoba (Canada)**	470	465 - 476				
*Nova Scotia (Canada)**	470	463 - 477				
Viet Nam	469	462 - 477	16	39		
Catalonia (Spain)	469	458 - 481				
Extremadura (Spain)	469	459 - 479				
Norway	468	464 - 472	23	38	19	31
New Brunswick (Canada)	468	462 - 474				
Saskatchewan (Canada)	468	462 - 473				
Malta	466	463 - 469	24	38		
*Wales (United Kingdom)**	466	460 - 472				
United States*	465	457 - 473	21	39	18	32
Slovak Republic	464	458 - 470	24	39	20	32
Castile-La Mancha (Spain)	464	457 - 470				
Southern (Viet Nam)	463	450 - 477				
Murcia (Spain)	463	455 - 472				
Croatia	463	458 - 468	24	39		
Central (Viet Nam)	461	449 - 474				
Iceland	459	456 - 462	30	40	26	32
*Newfoundland and Labrador (Canada)**	459	448 - 469				

Notes: OECD countries are shown in bold black. Partner countries and economies are shown in bold blue. Provinces, regions, states or other subnational entities are shown in black italics (OECD countries) or blue italics (partner countries).
Range-of-rank estimates are computed based on mean and standard-error-of-the-mean estimates for each country/economy, and take into account multiple comparisons amongst countries and economies at similar levels of performance. For an explanation of the method, see Annex A3. For subnational entities, a rank order was not estimated.
Countries and economies are ranked in descending order of the mean performance in mathematics.
Source: OECD, PISA 2022 Database, Tables I.B1.2.1 and I.B2.2.1.

Table I.2.4 Mathematics performance at national and subnational levels [2/2]

	Mean score	95% confidence interval	All countries/economies		OECD countries	
			Lower rank	Upper rank	Lower rank	Upper rank
Israel	458	451 - 464	26	41	23	32
Andalusia (Spain)	457	448 - 467				
Türkiye	453	450 - 456	33	41	28	32
Almaty (Kazakhstan)	453	440 - 465				
Astana (Kazakhstan)	449	434 - 463				
Canary Islands (Spain)	447	438 - 456				
Central (Mongolia)	443	436 - 449				
Brunei Darussalam	442	440 - 444	40	43		
Ukrainian regions (18 of 27)	441	433 - 449	37	47		
North-Kazakhstan region (Kazakhstan)	441	431 - 451				
Kostanay region (Kazakhstan)	440	424 - 456				
Serbia	440	434 - 446	38	46		
Aktobe region (Kazakhstan)	437	429 - 445				
Zhambyl region (Kazakhstan)	433	422 - 444				
East-Kazakhstan region (Kazakhstan)	432	418 - 446				
United Arab Emirates	431	429 - 433	41	48		
Greece	430	426 - 435	41	48	33	33
Romania	428	420 - 436	40	53		
Pavlodar region (Kazakhstan)	426	416 - 435				
Kazakhstan	425	422 - 429	42	50		
Mongolia	425	420 - 430	41	52		
West-Kazakhstan region (Kazakhstan)	424	417 - 432				
Bogota (Colombia)	423	413 - 432				
Karagandy region (Kazakhstan)	421	412 - 429				
Akmola region (Kazakhstan)	419	408 - 430				
Cyprus	418	416 - 421	45	54		
Bulgaria	417	411 - 424	43	55		
Moldova	414	410 - 419	45	55		
Qatar	414	412 - 416	46	54		
Kyzyl-Orda region (Kazakhstan)	414	404 - 423				
Almaty region (Kazakhstan)	412	403 - 421				
Chile	412	408 - 416	46	55	34	34
Khangai (Mongolia)	409	397 - 421				
Uruguay	409	405 - 413	48	56		
Malaysia	409	404 - 413	47	58		
Shymkent (Kazakhstan)	407	397 - 416				
Montenegro	406	403 - 408	50	58		
Atyrau region (Kazakhstan)	405	393 - 417				
Melilla (Spain)	404	392 - 416				
Baku (Azerbaijan)	397	392 - 402	53	64		
Mexico	395	391 - 399	54	64	35	37
Ceuta (Spain)	395	382 - 407				
Thailand	394	389 - 399	54	65		
South (Brazil)	394	387 - 401				
Peru	391	387 - 396	56	65		
Georgia	390	385 - 395	56	67		
Turkestan region (Kazakhstan)	389	375 - 403				
Saudi Arabia	389	385 - 392	56	66		
North Macedonia	389	387 - 390	56	65		
Southeast (Brazil)	388	383 - 394				
Costa Rica	385	381 - 388	56	67	35	37
Middle-West (Brazil)	384	370 - 397				
Colombia	383	377 - 389	56	69	35	37
Western (Mongolia)	381	372 - 391				
Brazil	379	376 - 382	62	69		
Argentina	378	373 - 382	61	71		
Jamaica*	377	371 - 384	58	72		
Albania	368	364 - 372	64	75		
Palestinian Authority	366	362 - 369	66	75		
Indonesia	366	361 - 370	66	76		
Morocco	365	358 - 371	64	76		
Uzbekistan	364	360 - 368	67	76		
Northeast (Brazil)	363	356 - 369				
Jordan	361	357 - 365	68	76		
North (Brazil)	357	348 - 366				
Panama*	357	351 - 362	68	78		
Kosovo	355	353 - 357	70	76		
Philippines	355	350 - 360	68	78		
Guatemala	344	340 - 349	75	81		
El Salvador	343	340 - 347	75	81		
Dominican Republic	339	336 - 342	77	81		
Paraguay	338	333 - 342	77	81		
Cambodia	336	331 - 342	77	81		

Notes: OECD countries are shown in bold black. Partner countries and economies are shown in bold blue. Provinces, regions, states or other subnational entities are shown in black italics (OECD countries) or blue italics (partner countries).
Range-of-rank estimates are computed based on mean and standard-error-of-the-mean estimates for each country/economy, and take into account multiple comparisons amongst countries and economies at similar levels of performance. For an explanation of the method, see Annex A3. For subnational entities, a rank order was not estimated.
Countries and economies are ranked in descending order of the mean performance in mathematics.
Source: OECD, PISA 2022 Database, Tables I.B1.2.1 and I.B2.2.1.

Table I.2.5. Reading performance at national and subnational levels [1/2]

	Mean score	95% confidence interval	All countries/economies		OECD countries	
			Lower rank	Upper rank	Lower rank	Upper rank
Singapore	543	539 - 546	1	1		
*Alberta (Canada)**	525	512 - 537				
Ireland*	516	511 - 521	2	9	1	6
Japan	516	510 - 522	2	11	1	6
Korea	515	508 - 523	2	12	1	7
Chinese Taipei	515	509 - 522	2	11		
*Ontario (Canada)**	512	504 - 519				
Estonia	511	506 - 516	2	12	1	7
*British Columbia (Canada)**	511	499 - 522				
Macao (China)	510	508 - 513	2	11		
Canada*	507	503 - 511	2	13	1	8
United States*	504	495 - 512	2	18	1	14
*Quebec (Canada)**	501	492 - 510				
New Zealand*	501	497 - 505	3	17	3	12
Hong Kong (China)*	500	494 - 505	3	18		
Australia*	498	494 - 502	6	18	5	14
Castile and Leon (Spain)	498	489 - 507				
Asturias (Spain)	497	486 - 508				
Prince Edward Island (Canada)	496	476 - 517				
*England (United Kingdom)**	496	491 - 502				
Madrid (Spain)	496	488 - 504				
United Kingdom*	494	490 - 499	8	22	6	17
Cantabria (Spain)	494	482 - 506				
Trento (Italy)	494	490 - 498				
*Scotland (United Kingdom)**	493	486 - 499				
Finland	490	486 - 495	9	26	6	20
*Nova Scotia (Canada)**	489	477 - 501				
Denmark*	489	484 - 494	9	30	6	23
Poland	489	483 - 494	9	30	6	24
Czech Republic	489	484 - 493	9	28	7	23
Aragon (Spain)	488	477 - 498				
Sweden	487	482 - 492	10	30	7	25
La Rioja (Spain)	487	472 - 502				
*Manitoba (Canada)**	486	478 - 493				
Galicia (Spain)	485	476 - 495				
*Northern Ireland (United Kingdom)**	485	479 - 492				
Saskatchewan (Canada)	484	476 - 492				
Switzerland	483	479 - 488	13	32	9	27
Flemish community (Belgium)	483	476 - 490				
Bolzano (Italy)	482	470 - 494				
Comunidad Valenciana (Spain)	482	474 - 490				
Italy	482	476 - 487	13	33	9	27
Austria	480	475 - 486	13	34	10	28
Germany	480	473 - 487	13	34	9	29
Belgium	479	474 - 484	14	34	10	28
*Newfoundland and Labrador (Canada)**	478	464 - 492				
Navarre (Spain)	478	463 - 492				
Portugal	477	471 - 482	14	34	10	29
Norway	477	472 - 482	14	34	11	29
Croatia	475	471 - 480	15	34		
Latvia*	475	470 - 479	16	34	13	29
Spain	474	471 - 478	19	34	15	29
France	474	468 - 480	15	34	11	29
Israel	474	467 - 481	14	34	11	29
French community (Belgium)	474	466 - 481				
Hungary	473	467 - 479	16	34	14	29
Lithuania	472	468 - 476	19	34	15	29
Balearic Islands (Spain)	472	459 - 484				
*Northern (Viet Nam)***	469	457 - 482				
New Brunswick (Canada)	469	461 - 477				
Slovenia	469	465 - 472	20	34	17	29
Murcia (Spain)	468	458 - 478				
Extremadura (Spain)	468	456 - 481				
Castile-La Mancha (Spain)	468	459 - 477				
German-speaking community (Belgium)	467	448 - 485				
Basque Country (Spain)	466	457 - 476				
*Wales (United Kingdom)**	466	458 - 473				
Canary Islands (Spain)	463	452 - 474				
Catalonia (Spain)	462	450 - 475				
Bogota (Colombia)	462	451 - 474				
Viet Nam**	462	454 - 470				
*Southern (Viet Nam)***	461	448 - 474				
Andalusia (Spain)	461	451 - 471				
Netherlands*	459	451 - 468	21	40	19	32

** Caution is required when comparing estimates based on PISA 2022 with other countries/economies as a strong linkage to the international PISA reading scale could not be established (see Reader's Guide and Annex A4).

Notes: OECD countries are shown in bold black. Partner countries and economies are shown in bold blue. Provinces, regions, states or other subnational entities are shown in black italics (OECD countries) or blue italics (partner countries).

Range-of-rank estimates are computed based on mean and standard-error-of-the-mean estimates for each country/economy, and take into account multiple comparisons amongst countries and economies at similar levels of performance. For an explanation of the method, see Annex A3. For subnational entities, a rank order was not estimated.

Countries and economies are ranked in descending order of the mean performance in reading.

Source: OECD, PISA 2022 Database, Table I.B1.2.2 and Table I.B2.2.

Table I.2.5. Reading performance at national and subnational levels [2/2]

	Mean score	95% confidence interval	All countries/economies		OECD countries	
			Lower rank	Upper rank	Lower rank	Upper rank
Türkiye	456	452 - 460	34	38	29	32
*Central (Viet Nam)***	452	438 - 466				
Chile	448	443 - 453	34	42	29	34
Slovak Republic	447	441 - 453	34	43	29	34
Malta	445	442 - 449	34	43		
Serbia	440	435 - 446	35	45		
Greece	438	433 - 444	35	45	31	34
Iceland	436	432 - 440	36	45	31	34
Uruguay	430	426 - 435	39	47		
Brunei Darussalam	429	427 - 432	39	45		
Romania	428	421 - 436	36	54		
Ukrainian regions (18 of 27)	428	420 - 435	37	54		
Kostanay region (Kazakhstan)	427	410 - 443				
South (Brazil)	427	418 - 435				
Astana (Kazakhstan)	424	410 - 438				
Middle-West (Brazil)	424	406 - 442				
Almaty (Kazakhstan)	423	412 - 435				
Southeast (Brazil)	420	413 - 427				
Qatar	419	416 - 422	43	55		
United Arab Emirates	417	415 - 420	44	55		
North-Kazakhstan region (Kazakhstan)	417	405 - 429				
Mexico	415	410 - 421	43	57	35	37
Costa Rica	415	410 - 420	44	57	35	37
Moldova	411	406 - 416	44	57		
East-Kazakhstan region (Kazakhstan)	410	396 - 425				
Brazil	410	406 - 414	44	57		
Jamaica*	410	401 - 418	44	58		
Colombia	409	401 - 416	44	58	35	37
Peru	408	403 - 414	44	58		
Melilla (Spain)	405	386 - 424				
Montenegro	405	402 - 408	48	58		
Ceuta (Spain)	404	383 - 426				
Bulgaria	404	398 - 411	46	59		
Karagandy region (Kazakhstan)	402	393 - 411				
Argentina	401	396 - 406	48	59		
Pavlodar region (Kazakhstan)	400	387 - 412				
Akmola region (Kazakhstan)	399	386 - 413				
Central (Mongolia)	398	392 - 404				
Northeast (Brazil)	392	385 - 400				
Panama*	392	385 - 399	52	64		
Malaysia	388	383 - 393	56	67		
West-Kazakhstan region (Kazakhstan)	387	377 - 398				
Kazakhstan	386	383 - 390	58	65		
Aktobe region (Kazakhstan)	383	375 - 391				
Saudi Arabia	383	379 - 386	58	67		
North (Brazil)	382	370 - 395				
Cyprus	381	379 - 383	58	67		
Thailand	379	373 - 384	58	69		
Mongolia	378	374 - 383	58	69		
Atyrau region (Kazakhstan)	378	366 - 390				
Almaty region (Kazakhstan)	375	364 - 386				
Guatemala	374	369 - 379	59	70		
Georgia	374	369 - 378	60	70		
Paraguay	373	368 - 378	60	70		
Shymkent (Kazakhstan)	366	355 - 377				
Baku (Azerbaijan)	365	360 - 370	63	73		
El Salvador	365	359 - 370	63	74		
Kyzyl-Orda region (Kazakhstan)	364	356 - 371				
Khangai (Mongolia)	363	353 - 373				
Indonesia	359	353 - 364	65	76		
North Macedonia	359	357 - 360	68	74		
Albania	358	355 - 362	68	75		
Zhambyl region (Kazakhstan)	353	343 - 363				
Dominican Republic	351	347 - 356	68	78		
Palestinian Authority	349	345 - 353	71	78		
Turkestan region (Kazakhstan)	347	333 - 360				
Philippines	347	340 - 353	69	79		
Kosovo	342	340 - 344	73	79		
Jordan	342	337 - 347	73	80		
Morocco	339	332 - 347	72	80		
Uzbekistan	336	332 - 339	75	80		
Cambodia	329	325 - 333	77	80		
Western (Mongolia)	326	318 - 335				

** Caution is required when comparing estimates based on PISA 2022 with other countries/economies as a strong linkage to the international PISA reading scale could not be established (see Reader's Guide and Annex A4).

Notes: OECD countries are shown in bold black. Partner countries and economies are shown in bold blue. Provinces, regions, states or other subnational entities are shown in black italics (OECD countries) or blue italics (partner countries).

Range-of-rank estimates are computed based on mean and standard-error-of-the-mean estimates for each country/economy, and take into account multiple comparisons amongst countries and economies at similar levels of performance. For an explanation of the method, see Annex A3. For subnational entities, a rank order was not estimated.

Countries and economies are ranked in descending order of the mean performance in reading.

Source: OECD, PISA 2022 Database, Table I.B1.2.2 and Table I.B2.2.

Table I.2.6. Science performance at national and subnational levels [1/2]

	Mean score	95% confidence interval	All countries/economies		OECD countries	
			Lower rank	Upper rank	Lower rank	Upper rank
Singapore	561	559 - 564	1	1		
Japan	547	541 - 552	2	5	1	1
Macao (China)	543	541 - 545	2	5		
Chinese Taipei	537	531 - 544	2	7		
Alberta (Canada)*	534	520 - 547				
Korea	528	521 - 535	2	9	2	5
Estonia	526	522 - 530	4	8	2	4
Hong Kong (China)	520	515 - 526	4	11		
British Columbia (Canada)*	519	509 - 528				
Ontario (Canada)*	517	510 - 524				
Canada*	515	511 - 519	5	13	2	9
Quebec (Canada)*	512	504 - 520				
Finland	511	506 - 516	6	18	3	14
Australia*	507	503 - 511	7	21	4	15
Castile and Leon (Spain)	506	498 - 515				
Galicia (Spain)	506	496 - 516				
New Zealand*	504	500 - 509	8	25	4	20
Cantabria (Spain)	504	493 - 515				
Ireland*	504	499 - 508	8	25	4	20
Asturias (Spain)	503	491 - 515				
England (United Kingdom)*	503	497 - 508				
Switzerland	503	498 - 507	9	25	5	21
Madrid (Spain)	502	495 - 510				
Slovenia	500	497 - 503	9	26	5	21
United Kingdom*	500	495 - 504	9	27	5	23
La Rioja (Spain)	500	481 - 518				
Aragon (Spain)	499	489 - 510				
United States*	499	491 - 508	7	32	4	26
Poland	499	494 - 504	9	28	5	23
Flemish community (Belgium)	499	493 - 506				
Czech Republic	498	493 - 502	9	29	5	24
Prince Edward Island (Canada)	496	470 - 522				
Trento (Italy)	495	491 - 499				
Bolzano (Italy)	495	486 - 504				
Latvia*	494	489 - 498	11	32	7	26
Denmark*	494	489 - 499	10	32	7	26
Saskatchewan (Canada)	494	488 - 500				
Sweden	494	489 - 498	11	32	7	26
Germany	492	486 - 499	10	35	6	28
Manitoba (Canada)*	492	484 - 500				
Nova Scotia (Canada)*	492	484 - 500				
Newfoundland and Labrador (Canada)*	491	481 - 502				
Austria	491	486 - 496	11	33	7	28
Belgium	491	486 - 495	11	34	9	28
Navarre (Spain)	489	478 - 500				
Northern Ireland (United Kingdom)*	488	482 - 495				
Netherlands*	488	480 - 496	10	35	7	29
German-speaking community (Belgium)	487	470 - 505				
France	487	482 - 493	14	35	11	29
Hungary	486	481 - 491	15	35	11	29
Spain	485	481 - 488	18	35	14	29
Lithuania	484	480 - 489	17	35	14	29
Portugal	484	479 - 489	16	35	13	29
Scotland (United Kingdom)*	483	477 - 489				
Comunidad Valenciana (Spain)	483	474 - 492				
New Brunswick (Canada)	483	474 - 491				
Croatia	483	478 - 487	18	35		
Murcia (Spain)	482	471 - 492				
Balearic Islands (Spain)	480	470 - 490				
Basque Country (Spain)	480	470 - 489				
French community (Belgium)	479	472 - 486				
Extremadura (Spain)	479	467 - 492				
Norway	478	474 - 483	22	37	18	30
Northern (Viet Nam)	478	466 - 489				
Italy	477	471 - 484	18	38	18	31
Catalonia (Spain)	477	466 - 489				
Türkiye	476	472 - 480	24	38	21	31
Castile-La Mancha (Spain)	475	466 - 484				
Southern (Viet Nam)	474	462 - 486				
Andalusia (Spain)	473	464 - 483				
Wales (United Kingdom)*	473	465 - 480				
Canary Islands (Spain)	473	463 - 482				
Viet Nam	472	465 - 479	23	38		
Malta	466	462 - 469	33	39		

Notes: OECD countries are shown in bold black. Partner countries and economies are shown in bold blue. Provinces, regions, states or other subnational entities are shown in black italics (OECD countries) or blue italics (partner countries).
Range-of-rank estimates are computed based on mean and standard-error-of-the-mean estimates for each country/economy, and take into account multiple comparisons amongst countries and economies at similar levels of performance. For an explanation of the method, see Annex A3. For subnational entities, a rank order was not estimated.
Countries and economies are ranked in descending order of the mean performance in science.
Source: OECD, PISA 2022 Database, Table I.B1.2.3 and Table I.B2.3.

Table I.2.6. Science performance at national and subnational levels [2/2]

	Mean score	95% confidence interval	All countries/economies		OECD countries	
			Lower rank	Upper rank	Lower rank	Upper rank
Israel	465	458 - 471	32	40	27	31
Central (Viet Nam)	463	450 - 475				
Slovak Republic	462	456 - 468	32	40	28	31
Bogota (Colombia)	459	448 - 470				
Almaty (Kazakhstan)	458	446 - 470				
Astana (Kazakhstan)	455	440 - 470				
Kostanay region (Kazakhstan)	455	438 - 471				
Ukrainian regions (18 of 27)	450	443 - 458	36	46		
North-Kazakhstan region (Kazakhstan)	450	439 - 461				
Serbia	447	442 - 453	37	46		
Iceland	447	443 - 450	39	45	32	34
Brunei Darussalam	446	443 - 448	39	45		
Chile	444	439 - 448	39	48	32	34
East-Kazakhstan region (Kazakhstan)	441	427 - 455				
Greece	441	435 - 446	39	48	32	34
Uruguay	435	431 - 440	39	50		
Qatar	432	430 - 435	43	50		
Pavlodar region (Kazakhstan)	432	420 - 444				
United Arab Emirates	432	429 - 435	43	50		
Central (Mongolia)	430	425 - 435				
Akmola region (Kazakhstan)	428	416 - 441				
Romania	428	420 - 435	41	58		
Karagandy region (Kazakhstan)	427	418 - 436				
Aktobe region (Kazakhstan)	425	416 - 434				
West-Kazakhstan region (Kazakhstan)	424	416 - 432				
Kazakhstan	423	420 - 427	45	55		
Bulgaria	421	415 - 427	45	61		
South (Brazil)	421	412 - 430				
Moldova	417	412 - 422	48	61		
Malaysia	416	412 - 421	48	61		
Melilla (Spain)	414	392 - 437				
Almaty region (Kazakhstan)	414	403 - 425				
Southeast (Brazil)	413	406 - 419				
Mongolia	412	408 - 417	48	63		
Colombia	411	405 - 418	48	63	35	37
Costa Rica	411	406 - 416	48	63	35	37
Cyprus	411	408 - 414	49	63		
Middle-West (Brazil)	411	395 - 426				
Ceuta (Spain)	410	385 - 436				
Mexico	410	405 - 415	49	63	35	37
Thailand	409	404 - 415	49	63		
Peru	408	403 - 413	50	63		
Shymkent (Kazakhstan)	407	395 - 419				
Argentina	406	401 - 411	50	63		
Atyrau region (Kazakhstan)	406	395 - 417				
Montenegro	403	401 - 405	53	64		
Brazil	403	399 - 407	53	64		
Jamaica*	403	395 - 411	50	66		
Kyzyl-Orda region (Kazakhstan)	402	393 - 411				
Zhambyl region (Kazakhstan)	400	390 - 410				
Khangai (Mongolia)	396	385 - 408				
Saudi Arabia	390	387 - 394	63	68		
Turkestan region (Kazakhstan)	389	377 - 401				
Panama*	388	381 - 395	61	73		
Northeast (Brazil)	386	378 - 394				
Georgia	384	380 - 389	63	73		
Indonesia	383	378 - 388	64	74		
Baku (Azerbaijan)	380	376 - 384	64	76		
North Macedonia	380	378 - 382	65	74		
North (Brazil)	380	367 - 392				
Albania	376	372 - 380	65	76		
Jordan	375	370 - 379	65	76		
El Salvador	373	368 - 378	65	78		
Guatemala	373	369 - 377	65	77		
Palestinian Authority	369	365 - 373	69	78		
Paraguay	368	364 - 372	69	78		
Western (Mongolia)	367	358 - 375				
Morocco	365	359 - 372	67	80		
Dominican Republic	360	356 - 364	72	80		
Kosovo	357	355 - 359	76	81		
Philippines	356	350 - 362	73	81		
Uzbekistan	355	351 - 359	76	81		
Cambodia	347	343 - 351	78	81		

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Range-of-rank estimates are computed based on mean and standard-error-of-the-mean estimates for each country/economy, and take into account multiple comparisons amongst countries and economies at similar levels of performance. For an explanation of the method, see Annex A3. For subnational entities, a rank order was not estimated.
Countries and economies are ranked in descending order of the mean performance in science.
Source: OECD, PISA 2022 Database, Table I.B1.2.3 and Table I.B2.3.

Average performance in different aspects of mathematics competence

This section focuses on student performance in two sets of mathematics subscales: process subscales and content subscales. Each item in the PISA 2022 computer-based mathematics assessment was classified into one of the four mathematics-processes subscales of *formulating*, *employing*, *interpreting*, and *reasoning*. Similarly, each item in the PISA 2022 computer-based mathematics assessment was classified into one of the four mathematics-content subscales of *change and relationships*, *space and shape*, *quantity*, and *uncertainty and data*.

The relative strengths and weaknesses of each country's/economy's education system are analysed by looking at differences in mean performance across the PISA mathematics subscales within the process and content subscales. See Annex A1 for detailed definitions of subscales.

Table I.2.7 shows the country/economy mean for the overall mathematics scale and for each of the four mathematics-process subscales. It also points to which differences along the (standardised) subscale means are significant, indicating a country's/economy's relative strengths and weaknesses.

For example, in Japan mean performance in mathematics is 536 score points. Japan's score is also 536 points in the mathematics-processes subscales of *formulating* and *employing,* and the score is very similar (534 points) in the process subscale of *reasoning*. However, in the *interpreting* process, the score is considerably higher (544 points). Compared to differences in how students performed in different subscales on average across PISA-participating countries/economies (i.e. hereafter, for simplicity, the "worldwide average"), students in Japan are stronger at *interpreting* than all other mathematics-process subscales.

On average across OECD countries, students are relatively stronger at *interpreting* than *formulating* and stronger at *interpreting* than *employing*, compared to the worldwide average. In addition, students are relatively stronger at *reasoning* than *formulating* and *employing,* and relatively stronger at *employing* than *formulating* on average across OECD countries compared to the worldwide average. The same pattern of relative strengths was observed in Spain and the United Kingdom*. In Belgium, Canada*, Korea and New Zealand*, the pattern is the same as the OECD average except that there are no significant differences in how students performed in *formulating* and *employing*.

In 22 countries/economies, students are relatively stronger at *reasoning* than *formulating*; in 23 countries/economies, students are relatively stronger at *reasoning* than *employing*; and in 17 countries/economies, students are relatively stronger at *reasoning* than *interpreting*, compared to the worldwide average.

In six countries/economies, there are no significant differences in how students performed across different mathematics-process subscales. For example, in Latvia*, overall mean performance in mathematics is 483 score points with 483 points in *formulating*; 484 points in *employing*; 485 points in *interpreting*; and 481 points in reasoning. The same homogeneity in performance across mathematics-process subscales is observed in Malta, Panama*, Qatar, Serbia and Türkiye.

Table I.2.7. Comparing countries and economies on the mathematics-process subscales [1/2]

	Mean performance in mathematics (overall mathematics scale)	Mean performance on each mathematics-process subscale				Relative strengths in mathematics: Standardised mean performance on the mathematics-process subscale...[1]			
		Formulating	Employing	Interpreting	Reasoning	... formulating (fs) is higher than on...	... employing (em) is higher than on...	... interpreting (in) is higher than on...	... reasoning (re) is higher than on...
Singapore	575	576	580	577	572		fs in re		
Macao (China)	552	556	552	550	553				in
Chinese Taipei	547	550	550	548	547		in		
Hong Kong (China)	540	542	547	540	538		fs in re		
Japan	536	536	536	544	534			fs em re	
Korea	527	526	523	531	528			fs em	fs em
Estonia	510	507	513	511	509		fs in	fs	fs
Switzerland	508	507	508	506	513				fs em in
Canada*	497	494	495	503	499			fs em	fs em
Netherlands*	493	492	499	496	490		fs in re	re	
Ireland*	492	487	494	495	490		fs	fs re	fs
Belgium	489	486	488	494	490			fs em	fs em
Denmark*	489	485	488	491	495			fs	fs em in
United Kingdom*	489	484	489	492	490		fs	fs em	fs em
Poland	489	485	491	490	488		fs	fs	
Austria	487	484	488	482	492	in	in		fs em in
Australia*	487	484	486	493	486			fs em re	
Czech Republic	487	489	489	484	486	in	in		in
Slovenia	485	482	483	487	485			fs em	
Finland	484	482	482	486	486				fs em
Latvia*	483	483	484	485	481				
Sweden	482	474	481	478	491		fs in		fs em in
New Zealand*	479	474	477	486	481			fs em	fs em
Lithuania	475	471	477	477	471		fs re	fs re	
Germany	475	469	477	475	473		fs re	fs	fs
France	474	463	472	482	473		fs	fs em re	fs
Spain	473	465	470	477	477		fs	fs em	fs em
Hungary	473	467	477	475	469		fs re	fs re	
OECD average	472	469	472	474	473		fs	fs em	fs em
Portugal	472	467	467	481	470			fs em re	
Italy	471	464	470	471	474		fs	fs	fs em in
Norway	468	465	466	467	476				fs em in
Malta	466	464	465	465	466				
United States*	465	463	459	475	464	em		fs em re	em
Slovak Republic	464	462	467	461	467		fs in		fs in
Croatia	463	455	463	467	466		fs	fs	fs em
Iceland	459	455	462	457	460		fs in		fs
Israel	458	459	456	456	463	em in			em in
Türkiye	453	451	452	455	454				
Brunei Darussalam	442	433	443	447	435		fs re	fs em re	
Ukrainian regions (18 of 27)	441	442	441	439	435	re			
Serbia	440	437	437	438	440				
United Arab Emirates	431	429	428	433	429	em		em	
Greece	430	428	421	435	434	em		em	em
Romania	428	425	428	428	423		re		

1. Relative strengths that are statistically significant are highlighted in a darker tone; empty cells indicate cases where the standardised subscale score is not significantly higher compared to other subscales, including cases in which it is lower. A country/economy is relatively stronger in one subscale than another if its standardised score, as determined by the mean and standard deviation of student performance in that subscale across all participating countries/economies, is significantly higher in the first subscale than in the second subscale. Process subscales are indicated by the following abbreviations: fs - formulating; em - employing; in - interpreting; re - reasoning.

Notes: Only countries and economies where PISA 2022 was delivered on computer are shown.

Although the OECD mean is shown in this table, the standardisation of subscale scores was performed according to the mean and standard deviation of students across all PISA-participating countries/economies.

The standardised scores that were used to determine the relative strengths of each country/economy are not shown in this table.

Countries and economies are ranked in descending order of mean mathematics performance.

Source: OECD, PISA 2022 Database, Tables I.B1.2.1, I.B1.2.4, I.B1.2.5, I.B1.2.6 and I.B1.2.7.

Table I.2.7. Comparing countries and economies on the mathematics-process subscales [2/2]

	Mean performance in mathematics (overall mathematics scale)	Mean performance on each mathematics-process subscale				Relative strengths in mathematics: Standardised mean performance on the mathematics-process subscale...[1]			
		Formulating	Employing	Interpreting	Reasoning	... formulating (fs) is higher than on...	... employing (em) is higher than on...	... interpreting (in) is higher than on...	... reasoning (re) is higher than on...
Kazakhstan	425	425	428	418	420	in re	in re		
Mongolia	425	423	428	423	411	re	in re	re	
Cyprus	418	420	413	419	420	em in		em	em
Bulgaria	417	420	420	411	414	in re	in re		in
Moldova	414	408	417	412	409		fs in re		
Qatar	414	410	414	414	413				
Chile	412	406	409	415	407			fs em re	
Uruguay	409	404	407	409	410				fs em
Malaysia	409	403	411	409	403		fs re	re	
Montenegro	406	403	404	401	412	em in			fs em in
Baku (Azerbaijan)	397	399	399	386	403	em in	in		em in
Mexico	395	389	398	391	389		fs in re		
Thailand	394	394	392	393	385	em in re	re	re	
Peru	391	388	391	389	386	re			
Georgia	390	392	392	383	384	in re	in re		
Saudi Arabia	389	387	385	388	391	em in			em in
North Macedonia	389	385	387	384	389	in			em in
Costa Rica	385	378	383	386	381			em	
Colombia	383	378	381	384	375			em re	
Brazil	379	377	376	378	376	em in re			
Argentina	378	373	373	379	373	em		em re	
Jamaica*	377	368	374	379	371			fs em re	
Albania	368	376	367	360	369	em in re	in		in
Palestinian Authority	366	368	366	362	358	em in re	re	re	
Indonesia	366	362	365	363	354	re	re	re	
Morocco	365	364	363	365	353	em re	re	re	
Uzbekistan	364	371	369	349	362	em in re	in re		in
Jordan	361	360	361	360	354	em in re			
Panama*	357	346	357	355	351				
Kosovo	355	352	357	350	353	in	in		
Philippines	355	347	352	357	350			em re	
El Salvador	343	345	343	340	339	em in re			
Dominican Republic	339	339	340	333	338	em in	in		

1. Relative strengths that are statistically significant are highlighted in a darker tone; empty cells indicate cases where the standardised subscale score is not significantly higher compared to other subscales, including cases in which it is lower. A country/economy is relatively stronger in one subscale than another if its standardised score, as determined by the mean and standard deviation of student performance in that subscale across all participating countries/economies, is significantly higher in the first subscale than in the second subscale. Process subscales are indicated by the following abbreviations: fs - formulating; em - employing; in - interpreting; re - reasoning.
Notes: Only countries and economies where PISA 2022 was delivered on computer are shown.
Although the OECD mean is shown in this table, the standardisation of subscale scores was performed according to the mean and standard deviation of students across all PISA-participating countries/economies.
The standardised scores that were used to determine the relative strengths of each country/economy are not shown in this table.
Countries and economies are ranked in descending order of mean mathematics performance.
Source: OECD, PISA 2022 Database, Tables I.B1.2.1, I.B1.2.4, I.B1.2.5, I.B1.2.6 and I.B1.2.7.

Content subscales

Table I.2.8 shows the country/economy mean for the overall mathematics scale and for each of the four mathematics-content subscales, and an indication of relative strengths in the mathematics content subscales.

On average across OECD countries, students are relatively stronger in *uncertainty and data* than *change and relationships*, and relatively stronger in *uncertainty and data* than *space and shape*, compared to the worldwide average. In addition, students are relatively stronger in *space and shape* than *change and relationships*; and relatively

stronger in *quantity* than *change and relationships* on average across OECD countries, compared to the worldwide average.

In 27 countries/economies, students are, as in the OECD average, relatively stronger in *uncertainty and data* than *space and shape*, compared to the worldwide average. In 13 countries/economies, students are relatively stronger in *uncertainty and data* than *change and relationships*, compared to the worldwide average.

By contrast, in 24 countries/economies, students are relatively stronger in *space and shape* than *uncertainty and data*. In 19 countries/economies, students are relatively stronger in *change and relationships* than *uncertainty and data*.

Table I.2.8. Comparing countries and economies on the mathematics-content subscales [1/2]

	Mean performance in mathematics (overall mathematics scale)	Mean performance on each mathematics-content subscale				Relative strengths in mathematics: Standardised mean performance on the mathematics-content subscale...[1]			
		Change and relationship	Quantity	Space and shape	Uncertainty and data	... change and relationship (cr) is higher than on...	... quantity (qn) is higher than on...	... space and shape (ss) is higher than on...	... uncertainty and data (ud) is higher than on...
Singapore	575	574	579	571	579	ss	cr ss ud		ss
Macao (China)	552	551	551	555	551			ud	
Chinese Taipei	547	549	547	551	546	ud		ud	
Hong Kong (China)	540	536	545	540	542		cr ss ud		
Japan	536	533	535	541	540			cr qn	cr
Korea	527	525	527	537	524			cr qn ud	
Estonia	510	508	515	513	503	ud	cr ud	cr ud	
Switzerland	508	504	510	518	502	ud	cr ud	cr qn ud	
Canada*	497	502	494	491	500	qn ss ud			qn ss
Netherlands*	493	489	497	485	496		cr ss		ss
Ireland*	492	492	494	474	499	ss	ss		cr ss
Belgium	489	488	488	490	493				qn
Denmark*	489	482	485	493	499			cr qn	cr qn ss
United Kingdom*	489	487	488	477	499	ss	ss		cr qn ss
Poland	489	483	493	487	489		cr ss ud		
Austria	487	482	491	490	485		cr ud	cr ud	
Australia*	487	486	483	486	494	qn			cr qn ss
Czech Republic	487	480	490	495	483		cr ud	cr qn ud	
Slovenia	485	479	485	492	483		cr ud	cr qn ud	
Finland	484	480	485	485	485		cr	cr	
Latvia*	483	484	485	488	478	ud	ud	cr qn ud	
Sweden	482	480	480	483	481				
New Zealand*	479	476	478	473	486				cr qn ss
Lithuania	475	473	479	472	470	ud	cr ss ud		
Germany	475	469	477	474	475		cr	cr	
France	474	475	470	472	477	qn			qn
Spain	473	474	471	463	478	qn ss	ss		qn ss
Hungary	473	467	479	469	472		cr ss ud		
OECD average	472	470	472	471	474		cr	cr	cr ss
Portugal	472	471	466	472	478	qn		qn	cr qn ss
Italy	471	469	470	471	473				
Norway	468	465	469	469	470			cr	
Malta	466	465	460	462	473	qn			cr qn ss
United States*	465	465	461	454	476	qn ss	ss		cr qn ss
Slovak Republic	464	458	468	472	456	ud	cr ud	cr ud	
Croatia	463	465	464	455	463	ss ud	ss		ss
Iceland	459	454	459	464	460		cr	cr qn ud	cr
Israel	458	460	459	450	456	ss ud	ss ud		
Türkiye	453	449	455	442	458	ss	cr ss		cr ss
Brunei Darussalam	442	445	436	444	444	qn		qn	qn
Ukrainian regions (18 of 27)	441	436	443	438	436		cr ud	ud	
Serbia	440	439	439	441	435	ud	ud	ud	
United Arab Emirates	431	434	425	423	432	qn ss			qn ss
Greece	430	431	424	429	435	qn		qn	qn
Romania	428	425	429	421	426		ss ud		

1. Relative strengths that are statistically significant are highlighted in a darker tone; empty cells indicate cases where the standardised subscale score is not significantly higher compared to other subscales, including cases in which it is lower. A country/economy is relatively stronger in one subscale than another if its standardised score, as determined by the mean and standard deviation of student performance in that subscale across all participating countries/economies, is significantly higher in the first subscale than in the second subscale. Content subscales are indicated by the following abbreviations: cr - change and relationship; qn - quantity; ss - space and shape; ud - uncertainty and data.
Notes: Only countries and economies where PISA 2022 was delivered on computer are shown.
Although the OECD mean is shown in this table, the standardisation of subscale scores was performed according to the mean and standard deviation of students across all PISA-participating countries/economies.
The standardised scores that were used to determine the relative strengths of each country/economy are not shown in this table.
Countries and economies are ranked in descending order of mean mathematics performance.
Source: OECD, PISA 2022 Database, Tables I.B1.2.1, I.B1.2.8, I.B1.2.9, I.B1.2.10 and I.B1.2.11.

Table I.2.8. Comparing countries and economies on the mathematics-content subscales [2/2]

	Mean performance in mathematics (overall mathematics scale)	Mean performance on each mathematics-content subscale				Relative strengths in mathematics: Standardised mean performance on the mathematics-content subscale...[1]			
		Change and relationship	Quantity	Space and shape	Uncertainty and data	... change and relationship (cr) is higher than on...	... quantity (qn) is higher than on...	... space and shape (ss) is higher than on...	... uncertainty and data (ud) is higher than on...
Kazakhstan	425	422	429	421	416	ud	cr ss ud	ud	
Mongolia	425	418	429	423	422		cr ud	cr ud	
Cyprus	418	422	412	424	417	qn ud		qn ud	qn
Bulgaria	417	418	419	412	413	ud	ud		
Moldova	414	411	418	409	407	ud	cr ss ud	ud	
Qatar	414	416	410	404	418	qn ss			qn ss
Chile	412	411	409	405	415	qn			qn ss
Uruguay	409	409	408	404	409				
Malaysia	409	406	404	416	409	qn		cr qn ud	qn
Montenegro	406	398	406	409	402		cr	cr qn ud	
Baku (Azerbaijan)	397	395	396	393	393	ud			
Mexico	395	391	397	388	391		cr ud		
Thailand	394	390	394	392	391				
Peru	391	390	391	383	389				
Georgia	390	384	392	389	383		cr ud	cr ud	
Saudi Arabia	389	389	386	383	390	qn			qn
North Macedonia	389	386	388	384	385				
Costa Rica	385	380	385	375	385		ss		cr ss
Colombia	383	381	381	370	385	ss	ss		qn ss
Brazil	379	377	376	370	381				cr qn ss
Argentina	378	377	375	368	375	ss			ss
Jamaica*	377	379	373	363	381	qn ss			qn ss
Albania	368	367	365	376	363	qn ud		cr qn ud	
Palestinian Authority	366	369	361	355	366	qn ss			qn ss
Indonesia	366	362	363	367	363			cr qn ud	
Morocco	365	366	360	362	363	qn ud		qn	
Uzbekistan	364	365	366	365	349	ud	ud	ud	
Jordan	361	365	355	348	364	qn ss			qn ss
Panama*	357	353	356	341	359	ss	ss		ss
Kosovo	355	352	356	357	348	ud	ud	cr qn ud	
Philippines	355	356	349	343	358	qn ss			qn ss
El Salvador	343	343	343	328	343	ss	ss		ss
Dominican Republic	339	339	339	332	337				

1. Relative strengths that are statistically significant are highlighted in a darker tone; empty cells indicate cases where the standardised subscale score is not significantly higher compared to other subscales, including cases in which it is lower. A country/economy is relatively stronger in one subscale than another if its standardised score, as determined by the mean and standard deviation of student performance in that subscale across all participating countries/economies, is significantly higher in the first subscale than in the second subscale. Content subscales are indicated by the following abbreviations: cr - change and relationship; qn - quantity; ss - space and shape; ud - uncertainty and data.
Notes: Only countries and economies where PISA 2022 was delivered on computer are shown.
Although the OECD mean is shown in this table, the standardisation of subscale scores was performed according to the mean and standard deviation of students across all PISA-participating countries/economies.
The standardised scores that were used to determine the relative strengths of each country/economy are not shown in this table.
Countries and economies are ranked in descending order of mean mathematics performance.
Source: OECD, PISA 2022 Database, Tables I.B1.2.1, I.B1.2.8, I.B1.2.9, I.B1.2.10 and I.B1.2.11.

Box I.2.2. How much do students improve in mathematics after age 15?

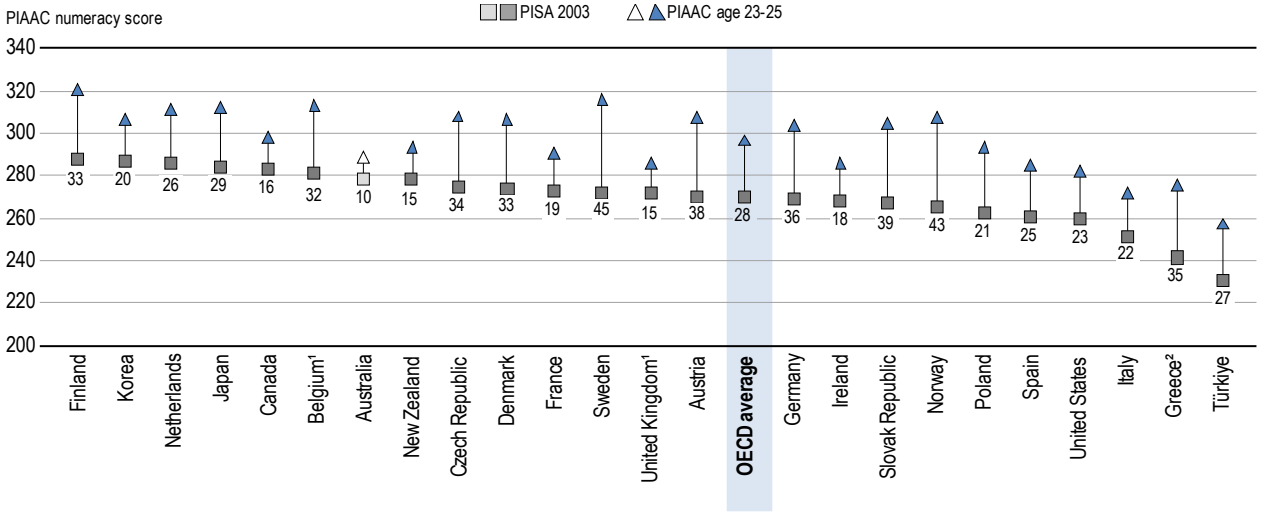
PISA offers a snapshot of 15-year-old students' proficiency in mathematics, reading and science. But how does proficiency in these areas continue to evolve over students' lives? Does it improve after they leave compulsory education? And, if it does, by how much?

The OECD Skills Outlook 2021 has published analyses combining data from PISA (2000, 2003 and 2006 assessments) and the Survey of Adult Skills, a product of the OECD Programme for the International Assessment of Adult Competencies (PIAAC) (2012 and 2015 assessment) to examine the growth in literacy and numeracy achievement between the ages of 15 and young adulthood (OECD, 2021[17]). These analyses show limited growth in achievement: across OECD countries, 15-year-olds have an average score of 268 on the PIAAC proficiency scale and in the years following compulsory schooling, their gain in literacy is on average 14 points. For numeracy, the gain in young adulthood is 28 points from a baseline PIAAC score of 269 at age 15[7]. Analyses also explore how this achievement growth relates to students' level of performance and their socio-economic status. In this box we present the analyses focusing on achievement growth in numeracy.

Performance growth in numeracy between age 15 and 24

Figure I.2.7 shows the growth in numeracy performance between the ages of 15 and 24 for 24 OECD countries with available data. The blue square represents the score of 15-year-olds from the 2003 PISA test and the black triangles represent the scores of the same cohort tested in the 2012 and 2015 PIAAC surveys at around the age of 24 (for coverage and representativeness reasons, the PIAAC age range was extended to include people born one year before and after the relevant PISA cohort, in this case 24-year-olds[8]).

Figure I.2.7. Performance growth in numeracy between ages 15 and 24



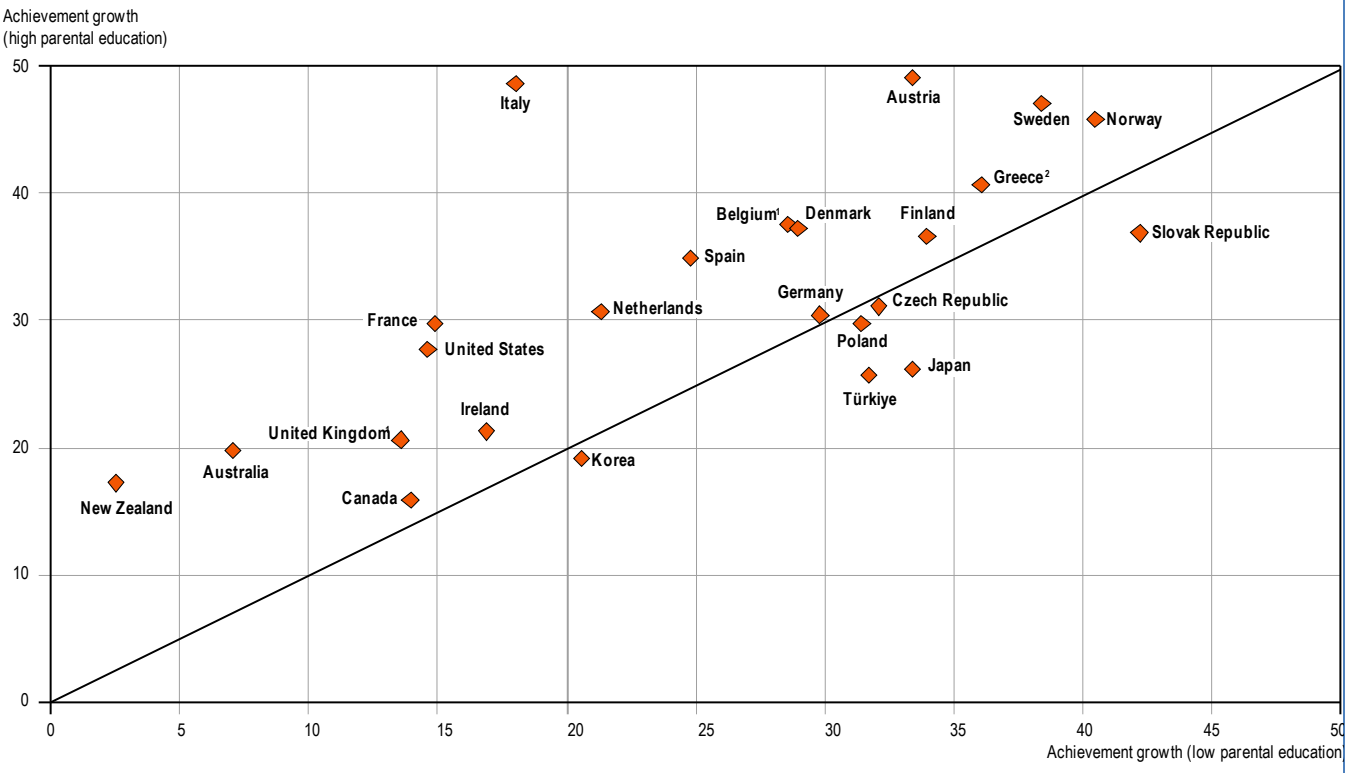
1. In PIAAC, data for Belgium refer only to Flanders and data for the United Kingdom* refer to England and Northern Ireland jointly.
2. The data for Greece include a large number of cases (1 032) in which there are responses to the background questionnaire but where responses to the assessment are missing. Proficiency scores have been estimated for these respondents based on their responses to the background questionnaire and the population model used to estimate plausible values for responses missing by design derived from the remaining 3 893 cases.
Notes: Only OECD countries with available information are shown. Differences between age 15 and ages 23-25 that are statistically significant are shown in a darker tone (see Annex A3).
PIAAC data refers to 2012 except for Chile, Greece, Israel and New Zealand, which refer to 2015. PISA mathematics scores are expressed in PIAAC numeracy scores, following (Borgonovi et al., 2017[18]) and based on methods described in the OECD Skills Outlook 2021 (OECD, 2021[17]), Chapter 3, Box 3.1.
Countries are ranked in descending level of achievement among 15 year olds.
Source: OECD Skills Outlook 2021 (OECD, 2021[17]), Table 3.8b.

As shown in the figure, performance in numeracy increased between the ages of 15 and 24 in every country with available data, except Australia*. On average across the 24 OECD countries, performance in numeracy increased by 28 points on the PIAAC numeracy scale, from 269 to 297 points. Performance in numeracy increased the most (more than 40 score points) in Norway and Sweden. In Austria, Germany and the Slovak Republic, performance in numeracy increased by more than 35 points. In Canada*, France, Ireland*, Korea, New Zealand*, and the United Kingdom* (i.e. England and Northern Ireland*), performance in numeracy increased the least (fewer than 20 points).

In addition, data show the numeracy performance of the 10% lowest and 10% highest performers (OECD, 2021, p. 128[17]). The 10% lowest-achieving 15-year-olds had an average score of 211 on the PIAAC scale compared with a score of 235 for the 10% lowest-achieving 24-year-olds: an increase of 24 points. In contrast, the numeracy score of the 10% best-performing 15-year-olds was 326 compared to 355 for the 10% best-performing 24-year-olds: an increase of 28 points. These results suggest that, on average, the gap in performance between the highest and lowest achievers in numeracy increased.

Figure I.2.8 shows the growth in numeracy skills between the ages of 15 and 24 in terms of students' parents' education level, which is used here as a proxy for socio-economic status. Results show that socio-economic inequalities not only persist but increase after leaving school in most countries with available data.

Figure I.2.8. Performance growth in numeracy between ages 15 and 24, by parental education



1. In PIAAC, data for Belgium refer only to Flanders and data for the United Kingdom* refer to England and Northern Ireland jointly.
2. The data for Greece include a large number of cases (1 032) in which there are responses to the background questionnaire but where responses to the assessment are missing. Proficiency scores have been estimated for these respondents based on their responses to the background questionnaire and the population model used to estimate plausible values for responses missing by design derived from the remaining 3 893 cases.
Notes: Only OECD countries with available information are shown. PIAAC data refers to 2012 except for Chile, Greece, Israel and New Zealand, which refer to 2015. PISA mathematics scores are expressed in PIAAC numeracy scores, following (Borgonovi et al., 2017[18]) and based on methods described in the OECD Skills Outlook 2021 (OECD, 2021[17]), Chapter 3, Box 3.1. Source: OECD Skills Outlook 2021 (OECD, 2021[17]), Table 3.15b.

On average across the 24 OECD countries represented in the figure, performance in numeracy increased by 25 score points among individuals whose parents had low levels of education (i.e. less than tertiary education completed) and by 32 points among individuals whose parents had high levels of education (i.e. tertiary education completed). Disparities in the growth of numeracy skills are marked in a number of countries, with the growth of skills especially high for individuals with highly educated parents. The vast majority of countries are in the upper triangle.

Policy implications

Once individuals leave compulsory education, their options for developing skills become very diverse. Some continue formal learning through adult education and training while others rely more on formal and informal learning at work and in everyday life. The impact of this differentiation on lifelong learning pathways can vary considerably between countries and within different groups within countries. An individual's ability to acquire new skills often depends on factors beyond the educational setting itself. Understanding what happens during this transition from school to young adulthood is essential. It is an opportunity for policy makers to promote foundational skills on a large scale and, where necessary, address educational deficits from earlier years.

Basic skills developed by age 15, including numeracy skills, are the foundation on which students develop their agency and transformative capacities (OECD, 2019[19]). While basic skills acquired early in school are perfected throughout life, the Skills Outlook 2021 shows the importance of acquiring a strong and solid foundation in school: data suggest that it is in the early years that essential skills are acquired and perfected.

Box I.2.3. The PISA 2022 framework for assessing mathematics

For the assessments of mathematics, reading and science, PISA develops subject-specific frameworks that define what it means to be proficient in the subject. These frameworks organise the subject according to key processes, contents and contexts that are measured in the assessment. The mathematics framework was updated for PISA 2022, while the reading and science frameworks remained identical to those used in 2018 (OECD, 2023[20]).

What's new in the PISA 2022 mathematics framework

The new PISA 2022 mathematics framework considers that large-scale social changes such as digitalisation and new technologies; the ubiquity of data for making personal decisions; and the globalising economy have reshaped what it means to be mathematically competent and well-equipped to participate as a thoughtful, engaged, and reflective citizen in the 21st century. What these changes mean for education is that being mathematically proficient is less about the reproduction of routine procedures and more about the use of mathematical reasoning; that is, thinking mathematically in ways that allow students to solve increasingly complex real-life problems in a variety of 21st-century contexts.

Reasoning does not necessarily require employing advanced mathematics, it requires a clear understanding of basic (i.e. foundational) mathematical concepts. It is about thinking independently, logically, and creatively to approach real-world tasks that cannot be easily automatised or solved using simple "recipes". Students at all levels of mathematics proficiency can demonstrate mathematical reasoning. At high levels of proficiency in mathematical reasoning, students understand that a problem is quantitative in nature and can formulate complex mathematical models to solve it. At lower levels of proficiency, mathematical reasoning is displayed by students who may not know much about formal mathematics but can intuitively spot a problem and solve it in informal ways, using elementary mathematics.

To develop students' ability to reason mathematically, schools and education systems need to go beyond teaching and evaluating routine mathematical procedures – students need to be ready to address unfamiliar real-world problems and apply the mathematical tools they have in new ways.

Mathematical processes

For each of the four mathematical processes examined in PISA 2022, a mathematics subscale was developed. Each PISA mathematics test item is designed to capture one of the processes, and students are not necessarily expected to use all four to respond to each test item.

Mathematical reasoning: i.e. "thinking mathematically", is the capacity to use mathematical concepts, tools, and logic to conceptualise and create solutions to real-life problems and situations. It involves recognising the mathematical nature inherent to a problem and developing strategies to solve it. This includes distinguishing between relevant and irrelevant information, using computational thinking, drawing logical conclusions, and recognising how solutions can be applied in a real-world context. Mathematical reasoning is also the capacity to construct arguments and provide evidence to support and explain ones' answers and solutions, and to develop awareness of ones' own thinking processes, including decisions made about which strategies to follow. Mathematical reasoning includes deductive and inductive reasoning. While reasoning underlies the other three mathematical processes described below, it nonetheless is different from them in that reasoning requires thinking through the whole problem-solving process rather than focusing on a specific part of it.

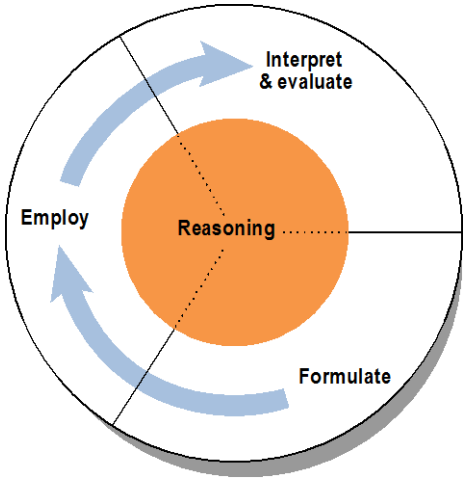
Formulating situations mathematically: mathematically literate students are able to recognise or identify the mathematical concepts and ideas underlying problems encountered in the real world, and then provide mathematical structure to the problems (i.e. formulate them in mathematical terms). This translation – from a contextualised situation to a well-defined mathematics problem – makes it possible to employ mathematical tools to solve real-world problems.

Employing mathematical concepts, facts and procedures: mathematically literate students are able to apply appropriate mathematics tools to solve mathematically formulated problems to obtain mathematical conclusions. This process involves activities such as performing arithmetic computations, solving equations, making logical deductions from mathematical assumptions, performing symbolic manipulations, extracting mathematical information from tables and graphs, representing and manipulating shapes in space, and analysing data.

Interpreting, applying, and evaluating mathematical outcomes: mathematically literate students are able to reflect upon mathematical solutions, results or conclusions and interpret them in the context of the real-life problem that started the process. This involves translating mathematical solutions or reasoning back into the context of the problem and determining whether the results are reasonable and make sense in the context of the problem.

Figure I.2.9. The mathematical modelling cycle in PISA 2022

Mathematical processes students go through to solve real-life problems and situations



Source: *PISA 2022 Assessment and Analytical Framework* (OECD, 2023[20]).

Mathematical content

PISA 2022 developed a mathematics subscale for each of these four content domains:

Quantity: number sense and estimation; quantification of attributes, objects, relationships, situations and entities in the world; understanding various representations of those quantifications, and judging interpretations and arguments based on quantity.

Uncertainty and data: recognising the place of variation in the real world, including having a sense of the quantification of that variation, and acknowledging its uncertainty and error in related inferences. It also includes forming, interpreting and evaluating conclusions drawn in situations where uncertainty is present. The presentation and interpretation of data are also included in this category, as well as basic topics in probability.

Change and relationships: understanding fundamental types of change and recognising when they occur in order to use suitable mathematical models to describe and predict change. Includes appropriate functions and equations/inequalities as well as creating, interpreting and translating among symbolic and graphical representations of relationships.

Space and shape: patterns; properties of objects; spatial visualisations; positions and orientations; representations of objects; decoding and encoding of visual information; navigation and dynamic interaction with real shapes as well as representations, movement, displacement, and the ability to anticipate actions in space.

Real-world contexts

Mathematical reasoning and problem-solving take place in real-world contexts. There are four different contexts used in PISA 2022, which were also used in previous cycles:

Personal context: related to one's self, one's family or one's peer group. For example, food preparation, shopping, games, personal health, personal transportation, recreation, sports, travel, personal scheduling and personal finance, etc.

Occupational context: related to the world of work. For example, measuring, costing and ordering materials for building payroll/accounting, quality control, scheduling/inventory, design/architecture and job-related decision making either with or without appropriate technology, etc.

Societal context: related to one's community, whether local, national or global. For example, voting systems, public transport, government, public policies, demographics, advertising, health, entertainment, national statistics and economics, etc.

Scientific context: related to the application of mathematics to the natural world, and issues and topics related to science and technology. For example, weather or climate, ecology, medicine, space science, genetics, measurement and the world of mathematics itself

Descriptors of performance at the lower end of the mathematics scale

Drawing from the PISA for Development framework (OECD, 2018[21]), the six proficiency levels used in previous PISA mathematics assessments have been expanded. Specifically, Level 1 has now been expanded to include Level 1a, 1b and 1c (see Chapter 3 for a description of what students can do at each proficiency level in mathematics). Five test items measure Level 1b in the computer-based mathematics assessment, and one item measures Level 1c in the paper-based mathematics assessment.

Box I.2.4. How PISA measures reading and science skills

How PISA measures reading skills

In PISA 2022, reading proficiency is defined as follows: "Reading literacy is understanding, using, evaluating, reflecting on and engaging with texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society" (OECD, 2019[22]).

PISA conceives of reading skills as a broad set of competencies that allows readers to engage with written information presented in one or more texts for a specific purpose (RAND Reading Study Group and Snow, 2022[23]; Perfetti, Landi and Oakhill, 2005[24]).

Readers must understand the text and integrate this with their pre-existing knowledge. They must examine the author's (or authors') point of view and decide whether the text is reliable and truthful, and whether it is relevant to their goals or purpose (Bråten, Strømsø and Britt, 2009[25]).

Reading in the 21st century involves not only the printed page but electronic formats (i.e. digital reading). It requires triangulating different sources, navigating through ambiguity, distinguishing between fact and opinion, and constructing knowledge. During the pandemic, remote teaching initiatives heavily relied on the availability of digital education resources.

The PISA reading framework developed in PISA 2018 was used again in PISA 2022.

How PISA measures science skills

As defined in PISA, scientific proficiency is the ability to engage with science-related issues and the ideas of science as a reflective citizen (OECD, 2019[22]). A scientifically proficient person, therefore, is willing to engage in reasoned discourse about science and technology, which requires the competencies of:

Explaining phenomena scientifically: recognising, offering, and evaluating explanations for a range of natural and technological phenomena.

Evaluating and designing scientific enquiry: describing and appraising scientific investigations and proposing ways of addressing questions scientifically.

Interpreting data and evidence scientifically: analysing and evaluating data, claims and arguments in a variety of representations and drawing appropriate scientific conclusions.

Within this framework, performance in science requires three forms of knowledge: content knowledge, knowledge of the standard methodological procedures used in science, and knowledge of the reasons and ideas used by scientists to justify their claims. Explaining scientific and technological phenomena, for instance, demands knowledge of the content of science. Evaluating scientific enquiry and interpreting evidence scientifically also require an understanding of how scientific knowledge is established and the degree of confidence with which it is held. Therefore, individuals who are scientifically literate understand the major concepts and ideas that form the foundation of scientific and technological thought; how such knowledge has been derived; and the degree to which such knowledge is justified by evidence or theoretical explanations.

The definition of science proficiency recognises that there is an affective element to a student's competency: students' attitudes or dispositions towards science can influence their level of interest, sustain their engagement and motivate them to take action.

Science was the major assessment subject in PISA 2006 and 2015. The science assessment was updated in 2015 and was used again in PISA 2018 and PISA 2022. The PISA science framework developed in PISA 2015 continued to be used in PISA 2018 and PISA 2022.

Table I.2.9. How did countries perform in PISA 2022? Chapter 2 figures and tables

Table I.2.1	Comparing countries' and economies' performance in mathematics
Table I.2.2	Comparing countries' and economies' performance in reading
Table I.2.3	Comparing countries' and economies' performance in science
Figure I.2.1	Mathematics anxiety and mean score in mathematics in PISA 2022
Figure I.2.2	Mathematics performance and anxiety in mathematics among students with fixed and growth mindsets
Figure I.2.3	Average performance in mathematics and variation in performance
Figure I.2.4	Mean score in mathematics at 10th, 50th and 90th percentile of performance distribution
Figure I.2.5	Variation in mathematics performance between systems, schools and students
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Table I.2.4	Mathematics performance at national and subnational levels
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Table I.2.6	Science performance at national and subnational levels
Table I.2.7	Comparing countries and economies on the mathematics-process subscales
Table I.2.8	Comparing countries and economies on the mathematics-content subscales
Figure I.2.7	Performance growth in numeracy between ages 15 and 24
Figure I.2.8	Performance growth in numeracy between ages 15 and 24, by parental education
Figure I.2.9	The mathematical modelling cycle in PISA 2022

StatLink https://stat.link/xluqor

Notes

[1] When comparing mean performance across countries/economies, only differences that are statistically significant should be considered (see Box 1 in Reader's Guide).

[2] The standard deviation summarises variation in performance among 15-year-old students within each country/economy. The average standard deviation in mathematics performance within OECD countries is 90 score points. If the standard deviation is larger than 90 score points, it indicates that student performance varies more from a particular country's/economy's average performance than it varies internationally. A smaller standard deviation means that student performance varies less in a country/economy than it varies internationally.

[3] This analysis was carried out in two steps. In the first step, the share of the variation in student performance that occurs between education systems was identified. In the second step, out of the remaining variation, the between-school and within-school was identified. Within-school variation are differences in performance between students.

[4] PISA results do not establish causality. PISA identifies empirical correlations between student achievement and the characteristics of schools and education systems, correlations that show consistent patterns across countries. Implications for policy are based on this correlational evidence and previous research.

[5] The reason for this restriction is the following: while the students sampled in PISA represent all 15-year-old students, whatever type of school they are enrolled in, they may not be representative of the students enrolled in their school. As a result, comparability at the school level may be compromised. For example, if grade repeaters in a country are enrolled in different schools than students in the modal grade because the modal grade in this country is the first year of upper secondary school (ISCED 3) while grade repeaters are enrolled in lower secondary school (ISCED 2), the average performance of schools where only students who had repeated a grade were assessed may be a poor

indicator of the actual average performance of these schools. By restricting the sampling to schools with the modal ISCED level for 15-year-old students, PISA ensures that the characteristics of the students sampled are as close as possible to the profiles of the students attending the school. The "modal ISCED level" is defined here as the level attended by at least one-third of the PISA sample. In 15 education systems (Baku [Azerbaijan], Cambodia, Colombia, Costa Rica, the Czech Republic, the Dominican Republic, Hong Kong [China]*, Indonesia, Jamaica, Kazakhstan, Morocco, the Netherlands, the Slovak Republic, Switzerland, and Chinese Taipei) both lower secondary (ISCED level 2) and upper secondary (ISCED level 3) schools meet this definition. In all other countries, analyses are restricted to either lower secondary or upper secondary schools (see Table I.B1.2.14 for details). In several countries, lower and upper secondary education are provided in the same school. As the restriction is made at the school level, some students from a grade other than the modal grade in the country may also be used in the analysis.

[6] See Annex A3 for a technical note on how the range of ranks were computed in PISA 2022.

[7] The PIAAC numeracy scale that is used here has a mean of 263 and a standard deviation of 47. Thus, for example, the gain in young adulthood of 28 points from a baseline PIAAC score of 269 at age 15, represents about 60% of a standard deviation.

[8] As discussed in Box 3.1, Chapter 3, of the OECD Skills Outlook 2021, in order to analyse literacy and numeracy performance growth between age 15 and young adulthood, analyses were conducted on synthetic cohorts, matching data from PISA and the relevant birth cohort in PIAAC: "Sample sizes used to construct the synthetic cohorts vary markedly: in PISA, the cohort comprises around 4 500 students per country, compared to only around 150 individuals in PIAAC. For this reason, the PIAAC age band was expanded to include people born one year before and after the relevant PISA cohort. For example, PISA 2000 results were matched to data for 26-28 year-olds surveyed in PIAAC in 2012 – which, unlike PISA, had been conducted only once so far – for the 17 countries that participated in both. To increase international coverage, data from PISA 2003 were added for three countries that administered PIAAC in 2015. Similarly, data for PISA 2003 were matched to data for 23-25 year-olds in PIAAC." For further reference, see Annex Table 3.A.1 in the OECD Skills Outlook 2021.

References

Ashcraft, M. and E. Kirk (2001), "The relationships among working memory, math anxiety, and performance.", *Journal of Experimental Psychology: General*, Vol. 130/2, pp. 224-237, https://doi.org/10.1037/0096-3445.130.2.224. [6]

Beilock, S. et al. (2010), "Female teachers' math anxiety affects girls' math achievement", *Proceedings of the National Academy of Sciences*, Vol. 107/5, pp. 1860-1863, https://doi.org/10.1073/pnas.0910967107. [16]

Borgonovi, F. et al. (2017), *Youth in Transition: How Do Some of The Cohorts Participating in PISA Fare in PIAAC?*, OECD Publishing, https://doi.org/10.1787/51479ec2-en. [18]

Bråten, I., H. Strømsø and M. Britt (2009), "Trust Matters: Examining the Role of Source Evaluation in Students' Construction of Meaning Within and Across Multiple Texts", *Reading Research Quarterly*, Vol. 44/1, pp. 6-28, https://doi.org/10.1598/rrq.44.1.1. [25]

Carey, E. et al. (2016), "The Chicken or the Egg? The Direction of the Relationship Between Mathematics Anxiety and Mathematics Performance", *Frontiers in Psychology*, Vol. 6, https://doi.org/10.3389/fpsyg.2015.01987. [4]

Choe, K. et al. (2019), "Calculated avoidance: Math anxiety predicts math avoidance in effort-based decision-making", *Science Advances*, Vol. 5/11, https://doi.org/10.1126/sciadv.aay1062. [2]

Dowker, A., A. Sarkar and C. Looi (2016), "Mathematics Anxiety: What Have We Learned in 60 Years?", *Frontiers in Psychology*, Vol. 7, https://doi.org/10.3389/fpsyg.2016.00508. [3]

Dweck, C. (2006), *Mindset: The new psychology of success*, Random House. [14]

Dweck, C. and D. Yeager (2019), "Mindsets: A View From Two Eras", *Perspectives on Psychological Science*, Vol. 14/3, pp. 481-496, https://doi.org/10.1177/1745691618804166. [15]

Elliot, A. and C. Dweck (eds.) (2005), *Evaluation anxiety*, The Guilford Press. [7]

Goetz, T. et al. (2010), "Academic self-concept and emotion relations: Domain specificity and age effects", *Contemporary Educational Psychology*, Vol. 35/1, pp. 44-58, https://doi.org/10.1016/j.cedpsych.2009.10.001. [5]

Ho, H. et al. (2000), "The Affective and Cognitive Dimensions of Math Anxiety: A Cross-National Study", *Journal for Research in Mathematics Education*, Vol. 31/3, pp. 362-379, https://doi.org/10.2307/749811. [9]

OECD (2023), *PISA 2022 Assessment and Analytical Framework*, PISA, OECD Publishing, Paris, https://doi.org/10.1787/dfe0bf9c-en. [20]

OECD (2021), *OECD Skills Outlook 2021: Learning for Life*, OECD Publishing, Paris, https://doi.org/10.1787/0ae365b4-en. [17]

OECD (2021), *Sky's the limit: growth mindset, students, and schools in PISA*, OECD publishing, Paris. [12]

OECD (2019), *OECD Future of Education and Skills 2030 Concept Note*. [19]

OECD (2019), *PISA 2018 Assessment and Analytical Framework*, PISA, OECD Publishing, Paris, https://doi.org/10.1787/b25efab8-en. [22]

OECD (2018), *PISA for Development Assessment and Analytical Framework: Reading, Mathematics and Science*, PISA, OECD Publishing, Paris, https://doi.org/10.1787/9789264305274-en. [21]

OECD (2013), *PISA 2012 Results: Ready to Learn (Volume III): Students' Engagement, Drive and Self-Beliefs*, PISA, OECD Publishing, Paris, https://doi.org/10.1787/9789264201170-en. [1]

Perfetti, C., N. Landi and J. Oakhill (2005), "The Acquisition of Reading Comprehension Skill", in *The Science of Reading: A Handbook*, Blackwell Publishing Ltd, Oxford, UK, https://doi.org/10.1002/9780470757642.ch13. [24]

Putwain, D., K. Woods and W. Symes (2010), *Personal and situational predictors of test anxiety of students in post-compulsory education*. [8]

RAND Reading Study Group and C. Snow (2022), *Reading for Understanding: Toward an R&D Program in Reading Comprehension*, RAND Corporation, http://www.jstor.org/stable/10.7249/mr1465oeri.8. [23]

Yeager, D. et al. (2019), *A national experiment reveals where a growth mindset improves achievement*, https://doi.org/10.1038/s41586-019-1466-y. [13]

Yeager, D. and G. Walton (2011), *Social-psychological interventions in education: They're not magic*, SAGE Publications Inc., http://rer.aera.net. [11]

Zhang, J., N. Zhao and Q. Kong (2019), “The Relationship Between Math Anxiety and Math Performance: A Meta-Analytic Investigation”, *Frontiers in Psychology*, Vol. 10, https://doi.org/10.3389/fpsyg.2019.01613. [10]