Student Achievement in Türkiye

FINDINGS FROM PISA AND TIMSS INTERNATIONAL ASSESSMENTS

OECD

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Preface

Few other countries have been able to expand education and raise performance at the same pace as Türkiye has over the past two decades. The data presented in this report – from successive cycles of the OECD Programme for International Student Assessment (PISA) and the IEA (International Association for the Evaluation of Educational Achievement)Trends in International Mathematics and Science Study (TIMSS) – shed light on the extent of the performance improvements that have been achieved in Türkiye in recent decades.

This report was developed at the request of the Ministry of National Education in Türkiye and the United Nations Children's Fund (UNICEF) to analyse the country's data from international assessments. It informs readers about how students in the country perform across different domains, at different stages in their schooling and in association with different aspects of their background, such as their socio-economic status and gender, and the school that they attend.

The data show that Türkiye is making important progress towards supporting all students to achieve good outcomes. They indicate that not only has average student performance in the country increased across levels of schooling but that it has been driven by an increase in the share of students who achieve the basic knowledge and competencies that they need for life and work. In particular, it is those students who come from the most disadvantaged backgrounds in Türkiye who have made some of the greatest progress in recent decades. They also convey that, as students move through school, some differences in performance associated with their background, such as socio-economic status or the language that they predominantly speak at home, decline.

While the data show many ways in which the education system is raising performance equitably, they also highlight areas that Türkiye may want to explore in the future so that more children and young people receive all of the support that they need to achieve their potential. For example, there appears to be scope in how resources are distributed across schools to help compensate for some of the initial disadvantages that some students experience.

We hope this report will be help Türkiye develop a more fine-grained understanding of its education system's strengths and challenges. The findings are discussed at a policy level in the related policy perspective – *Policy Options for Stronger, More Equitable Outcomes in Türkiye* – that sets out options for Türkiye to consider in order to promote greater equity in the future.

Andreas Schleicher

Director for Education and Skills

Organisation for Economic Co-operation and Development

Regina De Dominicis

Representative

UNICEF in Türkiye

Foreword

This report presents analysis of Türkiye's international assessment data to better understand how students in the country perform throughout schooling. It focuses on student performance in Türkiye as measured by two international assessments – PISA and TIMSS. It aims to understand how student performance has evolved over time and analyse whether factors related to student background – such as gender or socio-economic information – are associated with performance. In particular, through the analysis of PISA and TIMSS data, it seeks to answer the following questions:

- How do students in Türkiye perform in the main domains of mathematics, science and reading across schooling, compared to other countries?
- How has the student performance in Türkiye changed over time and across different levels of schooling?
- Are there certain student characteristics that are associated with lower (or higher) performance in Türkiye? How do these associations change and develop as students progress through school?
- How are school-level characteristics and features associated with performance? Do these associations change depending on the level of schooling?
- Are there certain domains or aspects of learning in specific domains on which students in Türkiye excel? What are the weaknesses of students in Türkiye across the main domains?

To answer these questions, the report analyses key aspects related to student and school background. Not all of the information collected by both international assessments, such as teaching and learning practices or student well-being, are explored in this report.

Acknowledgements

The project team that developed this report would like to thank the Turkish government, under the leadership of the Ministry of National Education (MoNE), for their support and contributions. In particular, the team would like to thank the Minister of Education, Professor Dr Mahmut Özer, as well as Deputy Ministers Professor Dr Petek Askar and Dr Sadri Sensoy for their direction and guidance.

This report was developed in co-operation with UNICEF, whose staff provided valuable guidance and direction. We are indebted to the support and insights of the UNICEF Türkiye office, notably Regina De Dominicis, UNICEF Representative in Türkiye, Rory Robertshaw, Chief of Education, Associate Professor Dr Mehmet Buldu, Education Specialist and Programme Manager, Dr Arif Yilmaz, Education Specialist, Zeynet Öztunca Aytuğan, Education Officer, Gözde Öztürk Nur, Education Officer, and Hazal Varol, Education Programme Associate.

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We would also like to extend our thanks to all the directors-general, section heads, specialists, associate specialists and teachers in the MoNE General Directorates of Basic Education, Secondary Education, Measurement Evaluation and Exam Services, Technical and Vocational Education, Religious Instruction, Lifelong Learning, Special Education and Counselling Services, Innovation and Education Technologies, Teacher Training and Development, Information Technology, European Union and Foreign Affairs, Private Education, Support Services, Strategy Development Directorate and the MoNE Board of Education along with the Assessment Specialists at the Government of Türkiye Measurement, Selection and Placement Center (OSYM).

The OECD project team was led by Hannah Kitchen and included Tarek Mostafa and Camilla Stronati, with oversight and support from Elizabeth Fordham, OECD Secretariat. The review team thanks Andreas Schleicher, Director, and Paulo Santiago, Head of the Policy Advice and Implementation Division, for their support and contributions. Lidia Gromadzka and Rachel Linden provided administrative support and oversaw the publication process and Eleonore Morena edited the report.

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Executive summary

Over the past two decades, participation in education in Türkiye has expanded significantly: participation in primary and lower secondary education is now universal and, in 2018, over 90% of 15-year-olds were enrolled in education.

Over the same period, student performance has improved. On average, 10-13 year-olds in Türkiye now perform better than children of the same age across other countries that participate in the International Association for the Evaluation of Educational Achievement (IEA) Trends in International Mathematics and Science Study (TIMSS). Fifteen-year-olds today score on average 45 points higher in the OECD Programme for International Student Assessment (PISA) than their peers in 2003.

This trajectory of improvement stands out internationally because Türkiye has been able to bring previously out-of-school children – who generally perform poorer than their in-school peers – into the education system and improve performance at the same time.

This report provides a picture of how student performance has evolved over this period and analyses how factors related to student backgrounds – such as gender or socio-economic status – are associated with performance. By analysing the PISA and TIMSS data, the report focuses on the following questions:

- How do students in Türkiye perform in the main domains of mathematics, science and reading across schooling, compared to other countries?
- How has the performance of students in Türkiye changed over time and across different levels of schooling?
- Are there certain student characteristics that are associated with lower (or higher) performance in Türkiye? How do these associations change and develop as students progress through school?
- How are school-level characteristics and features associated with performance? Do these associations change depending on the level of schooling?
- Are there certain domains or aspects of learning in specific domains where students in Türkiye excel? What are the weaknesses of students in Türkiye across the main domains?

Key findings

- Students' average performance in mathematics and science in TIMSS Grades 4 and 8 and reading, mathematics and science in PISA has improved substantially over time. The improvement in performance was driven by a significant decline in the share of low performers in all grades and subjects across both assessments.
- Science is an area of national strength, with students in Türkiye excelling in the subjects of physics and chemistry in particular.
- Students from advantaged backgrounds tend to participate more and for longer in early childhood education and care (ECEC) compared to students from disadvantaged backgrounds.

- In primary school, inequities in performance that are associated with student background such as their socio-economic background are among the highest of all countries that participate in TIMSS.
- There are also wide differences in performance across different types of schools. The difference in performance between schools in cities and less-populated towns or rural areas is one of the highest across the OECD. There are also wide performance differences across different types of upper secondary schools. At the top, Science High Schools score 216 points more than Multi-Programme High Schools at the bottom.
- Across the PISA and TIMSS data, schools, where the majority of students are from an advantaged background, report lower student-teacher ratios, fewer shortages in school resources and provide more study help to their students.
- As students move through school, some of the differences in performance related to student background and across different types of schools seem to decline. By TIMSS Grade 8, differences in performance between schools and between students from advantaged and disadvantaged backgrounds decline slightly. This might be driven by school attendance having an equalising effect on learning outcomes; put simply, school might be compensating for initial differences in support and resources related to students' home and wider environments.

1 Context and background

This chapter provides information about the two international assessments – the OECD Programme for International Student Assessment (PISA) and the International Association for the Evaluation of Educational Achievement (IEA) Trends in International Mathematics and Science Study (TIMSS) – the analysis in this report is based on. It also gives details on the students the two assessments assess, the assessment frameworks, how performance is reported and the background information about students and their schools that each assessment collects.

Scope of the report

This report presents analysis of Türkiye's international assessment data to better understand how students in the country perform throughout schooling. It focuses on student performance in Türkiye as measured by two international assessments – PISA and TIMSS. It aims to understand how student performance has evolved over time and analyse whether factors related to student background – such as gender or socio-economic information – are associated with performance. In particular, through the analysis of PISA and TIMSS data, it seeks to answer the following questions:

- How do students in Türkiye perform in the main domains of mathematics, science and reading across schooling, compared to other countries?
- How has the student performance in Türkiye changed over time and across different levels of schooling?
- Are there certain student characteristics that are associated with lower (or higher) performance in Türkiye? How do these associations change and develop as students progress through school?
- How are school-level characteristics and features associated with performance? Do these associations change depending on the level of schooling?
- Are there certain domains or aspects of learning in specific domains on which students in Türkiye excel? What are the weaknesses of students in Türkiye across the main domains?

To answer these questions, the report analyses key aspects related to student and school background. Not all of the information collected by both international assessments, such as teaching and learning practices or student well-being, are explored in this report.

Türkiye's participation in international assessments

Türkiye participates in two international assessments – PISA since 2003 and TIMSS Grade 8 since 1999 and TIMSS Grade 4 since 2007 (Table 1.1). PISA takes place every three years (although the 2021 assessment was pushed back to 2022 because of disruption related to the COVID-pandemic) and covers mathematics, science and reading. TIMSS takes place every four years and covers mathematics and science.

Table 1.1. Türkiye's participation in international assessments

	PISA 2000		PISA 2003		PISA 2006		PISA 2009		PISA 2012		PISA 2015		PISA 2018	
Participation			x		x		x		x		x		x	
Computer-based Assessment											x		x	
Türkiye's participation in TIMSS	TIMSS 1995		TIMSS 1999		TIMSS 2003		TIMSS 2007		TIMSS 2011		TIMSS 2015		TIMSS 2019	
Grade	4	8	4	8	4	8	4	8	4	8	4	8	4	8
Participation				x				x	x	x	x	x	x	x

Note: The grade of participation refers to the name of the assessment i.e. TIMSS Grade 4 or TIMSS Grade 8. In 2019, students in Türkiye taking the TIMSS Grade 4 assessment were in Grade 5.
Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021); OECD (2021[2]), "PISA: Programme for International Student Assessment", https://doi.org/10.1787/data-00365-en (accessed on 21 May 2021).

Comparison between PISA and TIMSS

While this report makes observations about student performance in Türkiye across different levels of schooling based on PISA and TIMSS data, the data are not directly comparable because each assessment

differs in its design. Most importantly, the assessments assess different knowledge and skills – mastery of an international, school-based curriculum in TIMSS compared with the application of competencies to real-life contexts in PISA. Contextual variables, such as students' socio-economic status or school resources, also differ.

Both PISA and TIMSS employ rigorous and professionally recognised sampling techniques to ensure that the sample of students selected represents the full target population in the participating countries (15-year-old students in PISA and students enrolled in Grades 4 and 8 in TIMSS) (OECD, 2018[3]; IEA, 2020[4]).

Who is assessed by PISA and TIMSS?

TIMSS, Grade 4

For the Grade 4 assessment, TIMSS assesses students in their fourth year of formal schooling, provided that the mean age of students at the time of testing is at least 9.5 years. Since education systems differ in structure and starting ages, some countries assess students in different grades (Martin, von Davier and Mullis, 2020[5]). In 2019, Türkiye chose to assess students in Grade 5 for the first time to provide a better match between the curricula that students are expected to cover in Türkiye and what is assessed by TIMSS (Table 1.2).[1] This meant that students in Türkiye's sample had an average age of 10.6 years. In previous rounds of TIMSS, Türkiye assessed students in the last grade of primary school, Grade 4, which meant that students in Türkiye's sample were on average, 9.9 years (Martin, Mullis and Hooper, 2016[6]). In this report, the terminology of "TIMSS, Grade 4" is used throughout since this is the official name of the assessment. However, the data from 2019 refer to Grade 5 students in lower secondary education in Türkiye.

Table 1.2. School structure in Türkiye and international assessments, 2018-19

ISCED level	Starting age	Grade	International assessments	Education programme in English	
3	13.5	12		Upper secondary general education	Upper secondary vocational education
		11			
		10	PISA		
		9			
2	9.5	8	TIMSS	Lower secondary education	
		7			
		6			
		5	TIMSS		
1	5.5	4		Primary education	
		3			
		2			
		1			

Note: ISCED - International Standard Classification of Education.
Source: Kitchen, H. et al. (2019[7]), *OECD Reviews of Evaluation and Assessment in Education: Student Assessment in Türkiye*, https://dx.doi.org/10.1787/5edc0abe-en; Martin, M., M. von Davier and I. Mullis (eds.) (2020[5]), *Methods and Procedures: TIMSS 2019 Technical Report*, https://timssandpirls.bc.edu/timss2019/methods/pdf/TIMSS-2019-MP-Technical-Report.pdf (accessed on 24 July 2021); OECD (2019[8]), *PISA 2018 Results (Volume I): What Students Know and Can Do*, https://dx.doi.org/10.1787/5f07c754-en.

In Türkiye, like in all countries, certain categories of students and schools were excluded from the TIMSS assessment. This included students with functional or intellectual disabilities and schools that cater solely to those students, as well as students not proficient in the Turkish language.

TIMSS, Grade 8

For the Grade 8 assessment, TIMSS assesses students in their eighth year of formal schooling, provided the mean age at the time of testing is 13.5 years. In 2019, Türkiye chose to assess students in Grade 8, as in previous years, with a mean age of 13.9 years (Martin, von Davier and Mullis, 2020[5]).

PISA

In contrast to TIMSS, PISA assesses students based on their age, rather than grade. The students assessed by PISA are aged between 15 years 3 months and 16 years 2 months at the time of the assessment, and they have completed at least 6 years of formal schooling. To be eligible for the PISA assessment, students must also be enrolled in at least Grade 7 in an educational institution (OECD, 2019[8]). In Türkiye, most of the students who sit the PISA assessment are in Grade 10, as is the case in the majority of OECD countries. A minority of students in Türkiye were still in Grade 9 when the assessment took place, while an even smaller minority were already in Grade 11 (Table 1.3). These differences might reflect misalignment between PISA testing and cut off dates for entry into formal schooling or grade retention or advancement policies.

Table 1.3. Share of students in PISA sample by grade, PISA 2018

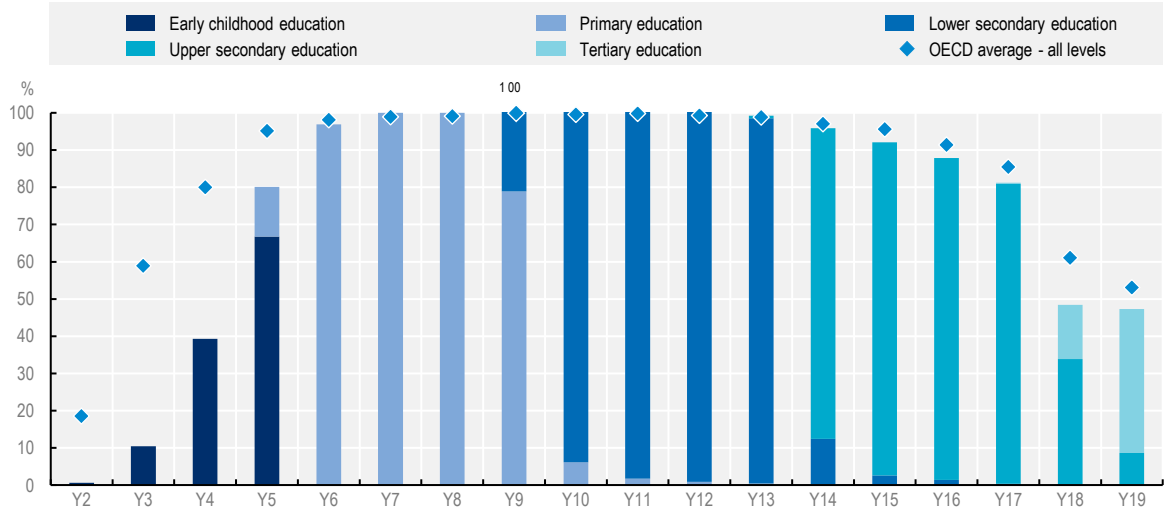
	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12 and above
Türkiye	0.1	0.4	17.7	78.8	2.9	0.1
OECD average	0.5	4.5	35.4	51.4	7.4	0.3

Source: OECD (2019[9]), *PISA 2018 Online Education Database*, http://www.oecd.org/pisa/data/.

Türkiye's PISA coverage index in 2018 was 73%. The coverage index is the proportion of 15-year-olds in a country or economy that were covered by the PISA sample (OECD, 2019[8]). Türkiye's PISA coverage index is almost 20% lower than the share of 15-year-olds who are enrolled in school at this age (Figure 1.1). There are a number of reasons why the PISA coverage index is lower than national enrolment rates. First, because countries may exclude up to 5% of otherwise-eligible 15-year-old students enrolled in Grade 7 or above for various reasons, including the remoteness and inaccessibility of their school, intellectual or physical disability, a lack of proficiency in the test language or a lack of test material in the language of instruction. In 2018, Türkiye excluded 5.66% of students (OECD, 2019[8]), including students with special learning needs and who do not speak Turkish fluently.

Second, the large difference in the PISA coverage index and the share of 15-year-olds enrolled at school according to national and international administrative data in Türkiye is likely explained by students who are enrolled in open high schools.[2] In Türkiye, open high schools provide distance learning programmes and offer an alternative for students to complete their compulsory education, such as those who have had to repeat two school years or have been unwell for an extended period (Kitchen et al., 2019[7]). Since PISA only assesses students attending physical schools, those attending open high schools are not covered by the assessment. However, open high schools are included in Türkiye's school enrolment statistics which explains the discrepancy between the PISA coverage index and enrolment rates in upper secondary education.

Figure 1.1. Enrolment rate by age and level of education, 2018

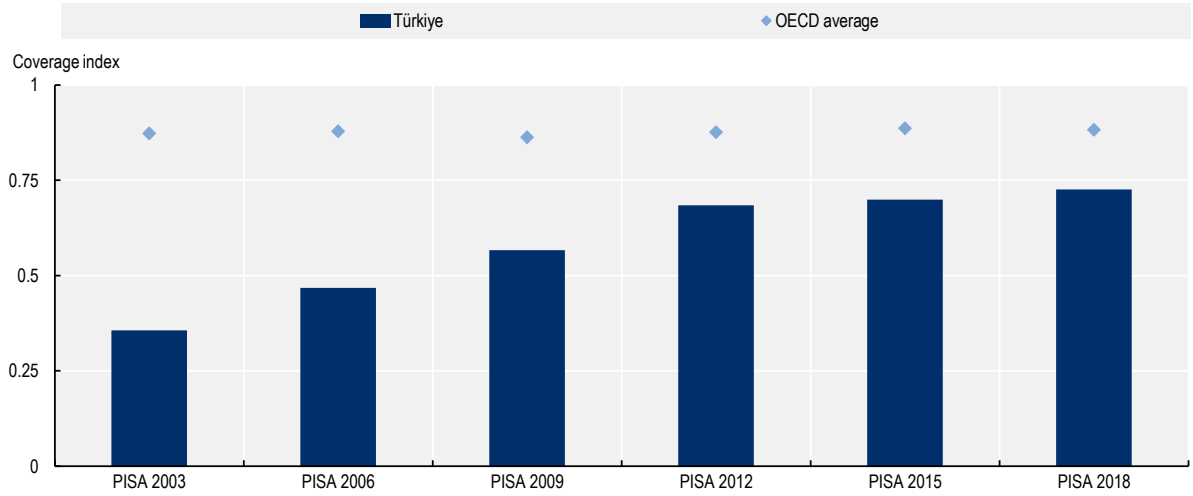


Note: The levels of education correspond to: Early childhood education and care (ISCED 2011 Level 0); Primary education (ISCED 2011 Level 1); Lower secondary education (ISCED 2011 Level 2); Upper secondary and post-secondary non-tertiary education (ISCED 2011 Levels 3 and 4); Total tertiary education (ISCED 2011 Levels 5 to 8).
The PISA coverage index is the proportion of 15-year-olds in a country or economy that were covered by the PISA sample (OECD, 2019[8]). The difference between the PISA coverage index for Türkiye (73% in 2018) and the enrolment rate for 15 year olds in 2018 (92%) in Türkiye is because of a number of factors including excluded students (5.66%) and students attending open high schools.
Source: Adapted from OECD (2021[10]), "Education Database: Enrolment by age", https://doi.org/10.1787/71c07338-en and OECD (2021[11]), "Education Database: Population data", https://doi.org/10.1787/ccca3172-en.

StatLink https://stat.link/rakq9b

Türkiye's coverage index has increased significantly over PISA cycles (Figure 1.2). However, the country continues to have one of the lowest coverage indices of all OECD countries, after Colombia, Costa Rica and Mexico (OECD, 2019[8]). The low coverage index has important implications for interpretations of Türkiye's PISA results because it means that the analysis of the PISA results presented in this report does not reflect the full population of 15-year-olds in the country.

Figure 1.2. PISA coverage index for Türkiye across PISA cycles



Source: OECD (2021[2]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/s16xal

Assessment frameworks

The PISA assessment framework

In each round of PISA, three domains are assessed – mathematics, reading and science – one of which is the major domain and focus of each cycle. The major domain rotates with each cycle. In the most recent PISA assessment, 2018, reading was the major domain. The PISA assessments are not designed to examine whether students can reproduce knowledge of a particular curriculum but rather if they can apply the knowledge and skills they have acquired in real-life settings.

The PISA 2018 framework for reading guided the development of the PISA 2018 reading literacy assessment. It conceptualises reading as an activity where the reader interacts with both the text that he or she reads and with the tasks that he or she wants to accomplish during or after reading the text. To be as complete as possible, the assessment covers different types of texts and tasks over a range of difficulty levels (OECD, 2019[8]).

The assessment also requires students to use a variety of processes or different ways in which they cognitively interact with the text. The PISA 2018 framework identifies processes that readers activate when engaging with a piece of text (Table 1.4). Information on the assessment of mathematics and science can be found in the report *PISA 2018 Assessment and Analytical Framework* (OECD, 2019[12]).

Table 1.4. Reading processes assessed by PISA across text source, 2018

Reading processes	Single-source text	Multiple-source text
Locating information (25%)	Scanning and locating (15%)	Searching for and selecting relevant text (10%)
Understanding (45%)	Representing literal meaning (15%) Integrating and generating inferences	Integrating and generating inferences (15%)

	(15%)	
Evaluating and reflecting (30%)	Assessing quality and credibility, and reflecting on content and form (20%)	Corroborating and handling conflict (10%)

Note: Percentages in parenthesis show the share of items by process and text source.
The PISA 2018 reading framework includes a fourth process, "reading fluently", which underpins the other three processes and is not included the table.
Source: OECD (2019[8]), *PISA 2018 Results (Volume I): What Students Know and Can Do*, https://dx.doi.org/10.1787/5f07c754-en.

The TIMSS assessment framework

The TIMSS assessment frameworks are based on a curriculum model that is updated each cycle by participating countries that review the frameworks describing the mathematics and science content to be assessed and take part in item development (Mullis et al., 2020[13]). The mathematics and science frameworks include content domains, which specify the content to be assessed, and cognitive domains, which specify the thinking processes to be assessed. Within each of these areas, further sub-domains are set out depending on the grade and subject (Table 1.5).

Table 1.5. Sub-domains assessed by TIMSS, 2019

	Mathematics		Science	
	Grade 4	Grade 8	Grade 4	Grade 8
Content domains	Number	Number	Life science	Biology
	Measurement and geometry	Algebra	Physical science	Chemistry
	Data	Geometry	Earth science	Physics
		Data and probability		
Cognitive domains	Knowing Applying Reasoning			

Source: Mullis, I. et al. (2020[13]), *Highlights from TIMSS 2019*, https://timss2019.org/reports/ (accessed on 24 July 2021).

Measuring performance

Performance in PISA

PISA reports performance in various ways. The most straightforward way is through the mean performance of a country's students. PISA also reports students' performance in terms of proficiency levels (Table 1.6). Summaries of the proficiency levels in mathematics and science can be found in the OECD report *PISA 2018 Results (Volume 1): What Students Know and Can Do* (OECD, 2019[8]). The scale summarises both the proficiency of a person in terms of his or her ability and the complexity of an item in terms of its difficulty. Level 2 is usually considered the minimum level of competency that students need for success in life and work, and students who perform below Level 2 are considered "low performers". In contrast, high performers are defined as students who attain Levels 5 or 6 of proficiency. Türkiye's average performance and share of students across proficiency levels are discussed in Chapter 2.

Table 1.6. Summary description of the eight levels of reading proficiency in PISA 2018

Level	Lower score limit	Percentage of students able to perform tasks at each level or above (OECD average)	Characteristics of tasks
6	698	1.3	• Readers at Level 6 can comprehend lengthy and abstract texts in which the information of interest is deeply embedded and only indirectly related to the task. They can compare, contrast and integrate information representing multiple and potentially conflicting perspectives, using multiple criteria and generating inferences across distant pieces of information to determine how the information may be used. • Tasks at Level 6 typically require the reader to set up elaborate plans, combining multiple criteria and generating inferences to relate the task and the text(s). Materials at this level include one or several complex and abstract text(s), involving multiple and possibly discrepant perspectives.
5	626	8.7	• Readers at Level 5 can comprehend lengthy texts, inferring which information in the text is relevant even though the information of interest may be easily overlooked. They can perform causal or other forms of reasoning based on a deep understanding of extended pieces of text. They can also answer indirect questions by inferring the relationship between the question and one or several pieces of information distributed within or across multiple texts and sources. • Readers can establish distinctions between content and purpose, and between fact and opinion as applied to complex or abstract statements. They can assess neutrality and bias based on explicit or implicit cues pertaining to both the content and/or source of the information. • For all aspects of reading, tasks at Level 5 typically involve dealing with concepts that are abstract or counterintuitive and going through several steps until the goal is reached.
4	553	27.6	• At Level 4, readers can comprehend extended passages in single or multiple-text settings. They interpret the meaning of nuances of language in a section of text by taking into account the text as a whole. They can compare perspectives and draw inferences based on multiple sources. • Readers can search, locate and integrate several pieces of embedded information in the presence of plausible distractors. They can generate inferences based on the task statement in order to assess the relevance of target information. • In addition, students at this level can evaluate the relationship between specific statements and a person's overall stance or conclusion about a topic. • Texts at Level 4 are often long or complex, and their content or form may not be standard. Many of the tasks are situated in multiple-text settings. The texts and the tasks contain indirect or implicit cues.
3	480	53.6	• Readers at Level 3 can represent the literal meaning of single or multiple texts in the absence of explicit content or organisational clues. Readers can integrate content and generate both basic and more advanced inferences. • They can search for information based on indirect prompts, and locate target information that is not in a prominent position and/or is in the presence of distractors. In some cases, readers at this level recognise the relationship between several pieces of information based on multiple criteria. • Level 3 readers can reflect on a piece of text or a small set of texts, and compare and contrast several authors' viewpoints based on explicit information. Reflective tasks at this level may require the reader to perform comparisons, generate explanations or evaluate a feature of the text. • Tasks at Level 3 require the reader to take many features into account when comparing, contrasting or categorising information. The required information is often not prominent or there may be a considerable amount of competing information.

Level	Lower score limit	Percentage of students able to perform tasks at each level or above (OECD average)	Characteristics of tasks
2	407	77.4	• Readers at Level 2 can identify the main idea in a piece of text of moderate length. They can understand relationships or construe meaning within a limited part of the text when the information is not prominent by producing basic inferences, and/or when the text(s) include some distracting information. • They can select and access a page in a set based on explicit though sometimes complex prompts, and locate one or more pieces of information based on multiple, partly implicit criteria. • Readers at Level 2 can, when explicitly cued, reflect on the overall purpose, or on the purpose of specific details, in texts of moderate length. Typical reflective tasks at this level require readers to make a comparison or several connections between the text and outside knowledge by drawing on personal experience and attitudes.
1a	335	92.3	• Readers at Level 1a can understand the literal meaning of sentences or short passages. Readers at this level can also recognise the main theme or the author's purpose in a piece of text about a familiar topic, and make a simple connection between several adjacent pieces of information, or between the given information and their own prior knowledge. • Most tasks at this level contain explicit cues regarding what needs to be done, how to do it and where in the text(s) readers should focus their attention.
1b	262	98.6	• Readers at Level 1b can evaluate the literal meaning of simple sentences. They can also interpret the literal meaning of texts by making simple connections between adjacent pieces of information in the question and/or the text. • Tasks at Level 1b explicitly direct readers to consider relevant factors in the task and in the text. Texts at this level are short and typically provide support to the reader, such as through repetition of information, pictures or familiar symbols.
1c	189	99.9	• Readers at Level 1c can understand and affirm the meaning of short, syntactically simple sentences on a literal level, and read for a clear and simple purpose within a limited amount of time. • Tasks at this level involve simple vocabulary and syntactic structures.

Source: OECD (2021[2]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

Performance in TIMSS

TIMSS also reports average scale scores by country, grade and subject. The TIMSS achievement scale centre point of 500 is located at the mean of the combined achievement distribution (TIMSS 2019).

TIMSS also describes achievement at four points along the scale as international benchmarks (Tables 1.7 and 1.8) Descriptions of benchmarks for mathematics and science for Grade 8 can be found in the report *TIMSS 2019 International Results in Mathematics and Science* (Mullis et al., 2020[13]). Türkiye's average performance and share of students across proficiency levels are discussed in Chapter 2.

Table 1.7. TIMSS international benchmark in Grade 4 mathematics, 2019

International benchmark	Lower score limit	Percentage of students reaching benchmarks (median across countries)	Description of benchmark
Low	400	92	Students have some basic mathematical knowledge. They can add, subtract, multiply and divide one- and two-digit whole numbers. They can solve simple word problems. They have some knowledge of simple fractions and common geometric shapes. Students can read and complete simple bar graphs and tables.
Intermediate	475	71	Students can apply basic mathematical knowledge in simple situations. They can

			compute with three- and four-digit whole numbers in a variety of situations. They have some understanding of decimals and fractions. Students can identify and draw shapes with simple properties. They can read, label and interpret information in graphs and tables.
High	550	34	Students apply conceptual understanding to solve problems. They can apply conceptual understanding of whole numbers to solve two-step word problems. They show understanding of the number line, multiples, factors and rounding numbers, and operations with fractions and decimals. Students can solve simple measurement problems. They demonstrate an understanding of the geometric properties of shapes and angles. Students can interpret and use data in tables and a variety of graphs to solve problems.
Advanced	625	7	Students can apply their understanding and knowledge in a variety of relatively complex situations and explain their reasoning. Students can solve a variety of multistep word problems involving whole numbers and show an understanding of fractions and decimals. They can apply knowledge of two- and three-dimensional shapes in a variety of situations. Students can interpret and represent data to solve multistep problems.

Source: Mullis, I. et al. (2020[13]), *Highlights from TIMSS 2019*, https://timss2019.org/reports/ (accessed on 24 July 2021).

Table 1.8. TIMSS international benchmark in Grade 4 science, 2019

International benchmark	Lower score limit	Percentage of students reaching benchmarks (median across countries)	Description of benchmark
Low	400	92	Students show limited understanding of scientific concepts and limited knowledge of foundational science facts.
Intermediate	475	71	Students show knowledge and understanding of some aspects of science. Students demonstrate some basic knowledge of plants and animals. They demonstrate knowledge about some properties of matter and some facts related to electricity and can apply elementary knowledge of forces and motion. They show some understanding of Earth's physical characteristics.
High	550	32	Students communicate and apply knowledge of life, physical and Earth sciences. Students communicate knowledge of characteristics of plants, animals and their life cycles and apply knowledge of ecosystems and humans' and organisms' interactions with their environment. Students demonstrate knowledge of states and properties of matter and energy transfer in practical contexts and show some understanding of forces and motion. Students know various facts about the Earth's physical characteristics and show a basic understanding of the Earth-Moon-Sun system.
Advanced	625	6	Students communicate their understanding of life, physical and Earth sciences and demonstrate some knowledge of the process of scientific inquiry. Students demonstrate knowledge of the characteristics and life processes of a variety of organisms. They can communicate an understanding of relationships in ecosystems and interactions between organisms and their environment. They communicate an understanding of properties and states of matter and physical and chemical changes. Students communicate an understanding of Earth's physical characteristics, processes and history and show knowledge of Earth's revolution and rotation.

Source: Mullis, I. et al. (2020[13]), *Highlights from TIMSS 2019*, https://timss2019.org/reports/ (accessed on 24 July 2021).

Background questionnaires

Both PISA and TIMSS include questionnaires that collect information about students' backgrounds, their schools and learning contexts to understand how these factors are associated with performance. TIMSS collects data on national and community, home, school and classroom contexts through questionnaires that are completed by students, teachers and school principals. For students participating in the Grade 4

assessment, TIMSS also asks parents or caregivers to complete a questionnaire (IEA, 2020[14]). PISA collects contextual information through questionnaires that are distributed to students and school principals. The questionnaire to students asked questions about the students themselves, their attitudes, dispositions and beliefs, their homes and their school and learning experiences. The questionnaire to school principals covered school management and organisation, and the learning environment (OECD, 2019[8]). PISA also has optional questionnaires which countries can distribute if they wish. Data from the optional questionnaires are not analysed in this report.

Benchmark countries

This report has selected a number of benchmark countries, whose performance is reported alongside Türkiye's throughout the report. The benchmark countries help to contextualise Türkiye's performance and provide more specific insights on country-level performance than international averages. The benchmark countries in this report are – Germany, Poland and Russia and were selected in 2020.[3]

These countries were selected based on similarities with Türkiye in terms of a number of demographics, socio-economic indicators and performance on international assessments (Table 1.9). Their participation in the same cycles of PISA and TIMSS as Türkiye also influenced the choice of benchmark countries (Table 1.10).

Table 1.9. Selected demographic and socio-economic indicators in benchmark countries

	PISA 2018 score in reading	Size of country in km²	Population	Public expenditure on education as a percentage of GDP	GDP per-capita	Gini Index 2016
Türkiye	466	769 630	83 429 615	4.1	9 127	41.9
Germany	498	349 360	83 132 799	4.0	46 445	31.9
Poland	512	306 190	37 970 874	3.9	15 693	31.2
Russia	479	16 376 870	144 373 535	3.1	115 85	36.8

Source: World Bank (2018[15]), *Land Area (sq.km) (dataset)*, https://data.worldbank.org/indicator/AG.LND.TOTL.K2?end=2018&start=2018 (accessed on 20 July 2021); World Bank (2020[16]), *Population, Total (dataset)*, https://data.worldbank.org/indicator/SP.POP.TOTL (accessed on 20 July 2021); OECD (2020[17]), *Education at a Glance 2020: OECD Indicators*, https://doi.org/10.1787/69096873-en; World Bank (2020[18]), *GDP Per-capita (current US$) (dataset)*, https://data.worldbank.org/indicator/NY.GDP.PCAP.CD (accessed on 20 July 2021); World Bank (2019[19]), *Gini Index (World Bank estimate) (dataset)*, https://data.worldbank.org/indicator/SI.POV.GINI (accessed on 20 July 2021).

Table 1.10. Participation of benchmark countries across PISA and TIMSS cycles

	PISA 2012	PISA 2015	PISA 2018	TIMSS 2011		TIMSS 2015		TIMSS 2019	
				Grade 4	Grade 8	Grade 4	Grade 8	Grade 4	Grade 8
Türkiye	X	X	X	X	X	X	X	X	X
Germany	X	X	X	X		X		X	
Poland	X	X	X	X		X		X	
Russia	X	X	X	X	X	X	X	X	X

Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021); OECD (2021[2]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

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Kitchen, H. et al. (2019), *OECD Reviews of Evaluation and Assessment in Education: Student Assessment in Turkey*, OECD Reviews of Evaluation and Assessment in Education, OECD Publishing, Paris, https://doi.org/10.1787/5edc0abe-en. [7]

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OECD (2021), "Education Database: Enrolment by age", *OECD Education Statistics (database)*, https://doi.org/10.1787/71c07338-en (accessed on 21 July 2021). [10]

OECD (2021), "Education Database: Population data", *OECD Education Statistics (database)*, https://doi.org/10.1787/ccca3172-en (accessed on 21 July 2021). [11]

OECD (2021), "PISA: Programme for International Student Assessment", *OECD Education Statistics (database)*, https://doi.org/10.1787/data-00365-en (accessed on 21 May 2021). [2]

OECD (2020), *Education at a Glance 2020: OECD Indicators*, OECD Publishing, Paris, https://doi.org/10.1787/69096873-en. [17]

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OECD (2018), *PISA 2018 Technical Report*, OECD, Paris, https://www.oecd.org/pisa/data/pisa2018technicalreport/ (accessed on 6 December 2021). [3]

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World Bank (2019), *Gini Index (World Bank estimate) (dataset)*, World Bank, Washington, DC, https://data.worldbank.org/indicator/SI.POV.GINI (accessed on 20 July 2021). [19]

World Bank (2018), *Land Area (sq.km) (dataset)*, World Bank, Washington, DC, https://data.worldbank.org/indicator/AG.LND.TOTL.K2?end=2018&start=2018 (accessed on 20 July 2021). [15]

Notes

[1] The Ministry of National Education in Türkiye examined the match between the TIMSS evaluation framework and the mathematics and science curricula for Grades 4 and 8 in Türkiye. The match with the Grade 4 science curriculum was low and as a consequence MoNE decided that Grade 5 in Türkiye would participate for the Grade 4 TIMSS assessment in 2019. The change also brought the average age of students in Türkiye's sample closer to the average age across other countries participating in TIMSS 2019 Grade 4 (10.2 years). Norway and South Africa also chose to participate at Grade 5 for the TIMSS 2019 Grade 4 assessment (IEA, 2020[1]).

[2] In Türkiye, students can pursue their education through distance learning courses in the open school system. Open schools enable students to continue their education in formal education institutions when they cannot attend a physical high school for various reasons. Reasons for attending an open high school include: being over 18 years which means that students can no longer enrol in physical high schools; students who are required to repeat a grade more than once; students who are expelled from physical high schools; and married students.

[3] This report was sent for comments to the Education Policy Committee at the OECD between 29 April and 20 May 2022. It should be noted that the Russian Federation no longer participates in the work of the Committee.

2 How does the performance of students in Türkiye compare to international benchmarks?

This chapter provides an overview of student performance in Türkiye in the International Association for the Evaluation of Educational Achievement (IEA) Trends in International Mathematics and Science Study (TIMSS) and the OECD Programme for International Student Assessment (PISA) international assessments from 2003 until 2019 in Grades 4 and 8, and at 15 years old. It explores how students performed on average in the latest round of each assessment – PISA 2018 and TIMSS 2019 – and then looks at how performance was spread across the student population, in particular across groups of low and high performers. Using data from previous cycles of PISA and TIMSS, it also looks at how student performance in Türkiye has evolved over time.

This chapter examines the performance of students in Türkiye in the IEA TIMSS (Grades 4[1] and 8) and OECD PISA (15-year-olds) international assessments from 2003 until 2019. It focuses on average performance across the different test domains – mathematics, science and reading (PISA) and mathematics and science (TIMSS) – as well as students' proficiency across different levels of performance and on trends in performance over time. The chapter compares the performance of students in Türkiye to the OECD average and to that of students in the selected benchmark countries – Germany, Poland and Russia (see Chapter 1 for an explanation of how benchmark countries were selected).

Box 2.1. What the data tell us

- Students' average performance in mathematics and science in TIMSS Grades 4 and 8 and in reading, mathematics and science in PISA has improved substantially over time.
- The improvement in performance was driven by a significant decline in the share of low performers in all grades, subjects and both assessments.
- At the same time as improving performance, the participation of 15-year-olds also increased significantly, with a rise in the PISA sample coverage from 36% in 2003 to 73% in 2018.[2]
- In TIMSS Grade 4 in 2019, average performance in mathematics and science exceeded the TIMSS international average and was equal to the average of OECD countries in science and slightly below the average of OECD countries in mathematics.[3]
- In TIMSS Grade 8 in 2019, average performance in mathematics was close to the TIMSS international average but below that of the OECD countries while, in science, it exceeded the average of TIMSS-participating countries but remained below that of OECD countries.
- At age 15 in PISA 2018, the average performance of students in Türkiye was below the average of OECD countries in all three subjects of assessment.

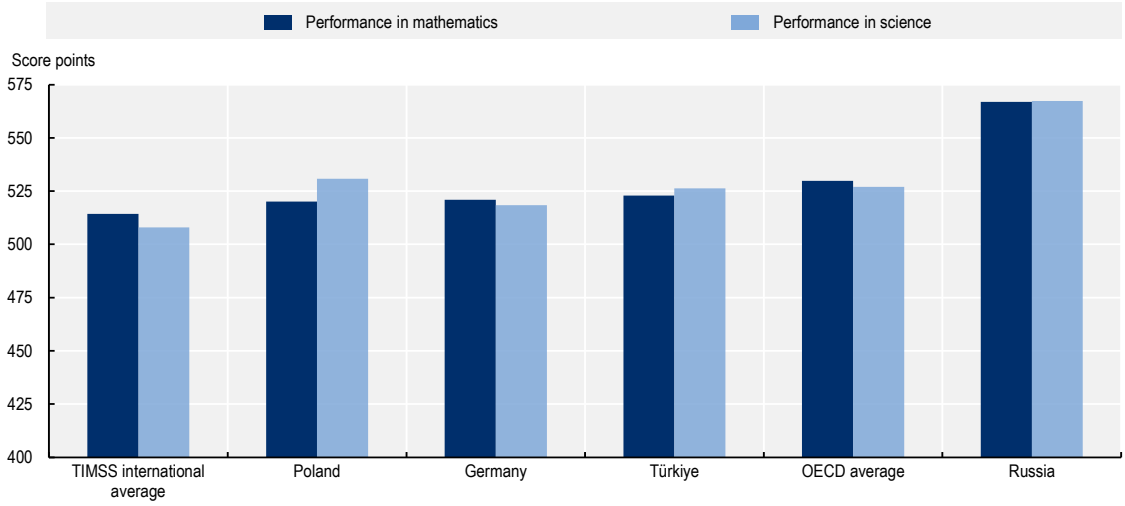
All students and adults require proficiency in mathematics, science and reading in order to thrive in modern societies. Proficiency in the different domains is not only needed in the labour market but also for performing basic daily tasks and for understanding the world surrounding us. By the end of compulsory education, students should have a solid mastery of mathematics, science and languages and be able to apply their knowledge to solve problems that they encounter in their daily lives. The proficiency levels used by the PISA and TIMSS assessments are fully described in Chapter 1.

Students' performance in mathematics and science in TIMSS Grade 4

In 2019, Grade 4 students performed at or above international averages

In 2019, for the first time in Türkiye's participation in TIMSS, Grade 4 students performed above the international average (i.e. average of all TIMSS-participating countries in 2019)[4] in both mathematics and science (Figure 2.1). Grade 4 students in Türkiye also performed very close to the OECD average in mathematics and at the same level as the OECD average in science. Statistically, Türkiye's performance was similar to many countries, including some countries that historically score above the OECD average, such as Germany, Poland and Sweden in mathematics, and Croatia, Hungary and Ireland in science.

Figure 2.1. Grade 4 students' performance in mathematics and science, TIMSS 2019



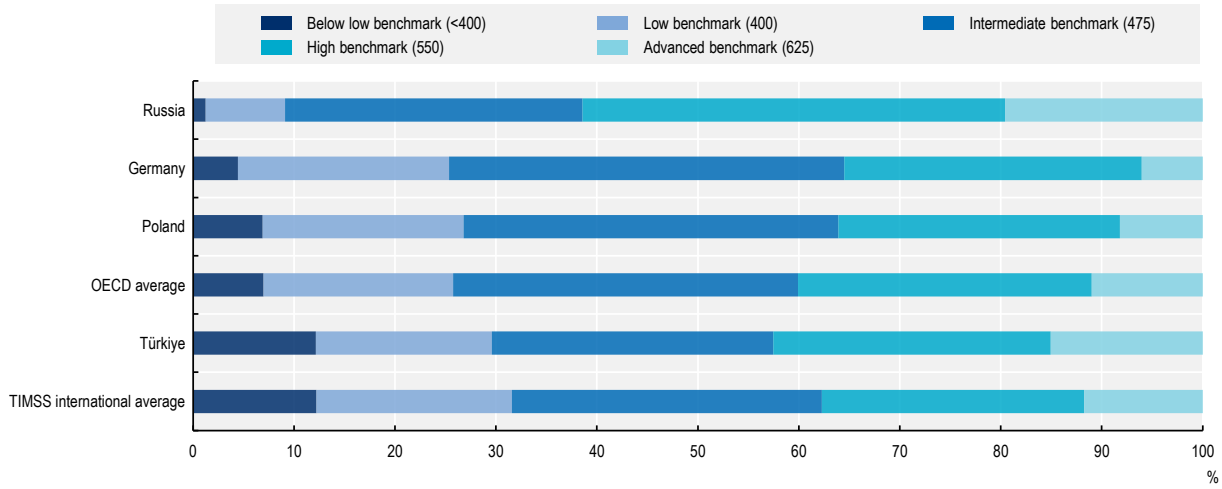
Note: Countries are ranked in ascending order of the average performance score in mathematics.
Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/81r0wg

In mathematics, Türkiye had relatively high shares of low and high performers with fewer students at intermediate levels

In 2019, almost a third (29.6%) of students in Türkiye performed at or below the low benchmark in mathematics (Figure 2.2). Students below the low benchmark are not able to use basic mathematics concepts or solve simple problems while those at the low benchmark can add, subtract, multiply and divide but struggle with more complex questions (see Chapter 1). While the share of students performing at or below the low benchmark in Türkiye was similar to the international average, it was higher than the OECD average (25.8%) and all of the benchmark countries.

Figure 2.2. Grade 4 students' proficiency levels in mathematics, TIMSS 2019



Note: Countries are ranked in ascending order of the percentage of students in Grade 4 who performed below 400 score points in mathematics.
Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/y25ljp

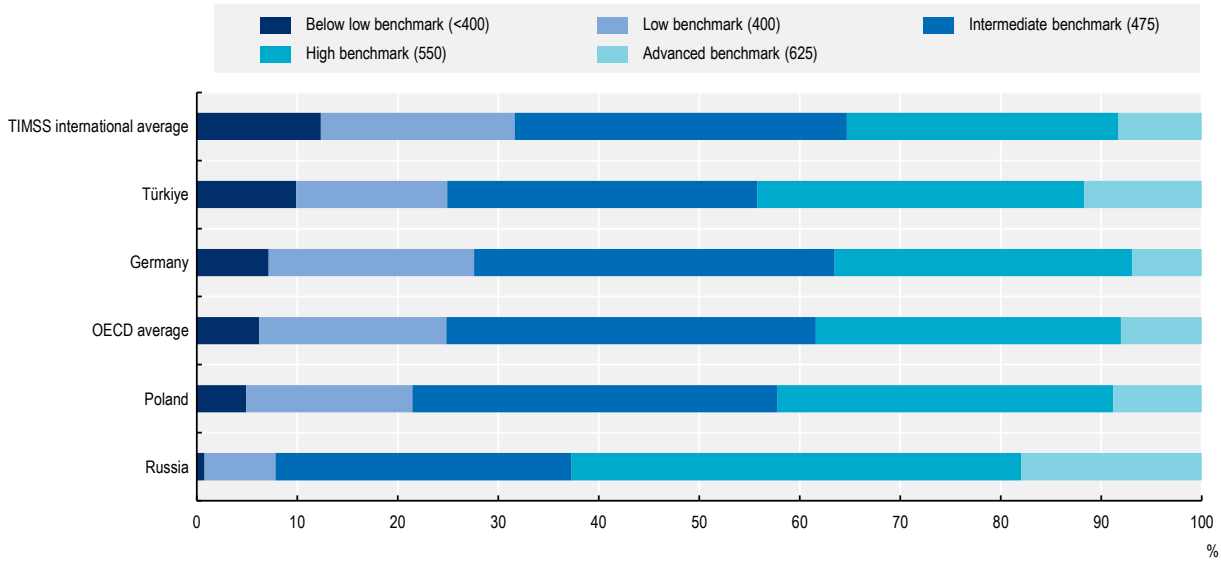
In contrast, 42.5% of students in Türkiye performed at the high and advanced benchmarks. Students at the high benchmark can apply conceptual understanding to solve problems while those at the advanced benchmark can find solutions in a variety of relatively complex situations and explain their reasoning. The share of students performing at the highest levels in Türkiye was greater than both the international and OECD averages.

Students performed particularly well in science, with a high share of top performers

In science, one-fourth of students performed below or at the low benchmark (Figure 2.3). Students below the low benchmark lack basic knowledge and understanding of physical and life sciences, while those at the low benchmark have some basic scientific knowledge. The share of students performing at the lowest two levels in Türkiye was smaller than the international average and similar to the OECD average (24.8%). It was also lower than the share of low performers (i.e. at or below the low benchmark) in mathematics.

In Türkiye, 44% of students reached the high and advanced proficiency benchmarks. At these levels, students are able to apply scientific knowledge in everyday and abstract contexts. The share of students performing at these levels was higher than both the international and OECD averages. In general, students in Türkiye often perform higher in science than in other domains, suggesting it is an area of national strength.

Figure 2.3. Grade 4 students' proficiency levels in science, TIMSS 2019



Note Countries are ranked in ascending order of the percentage of students in Grade 4 who performed below 400 score points in science.
Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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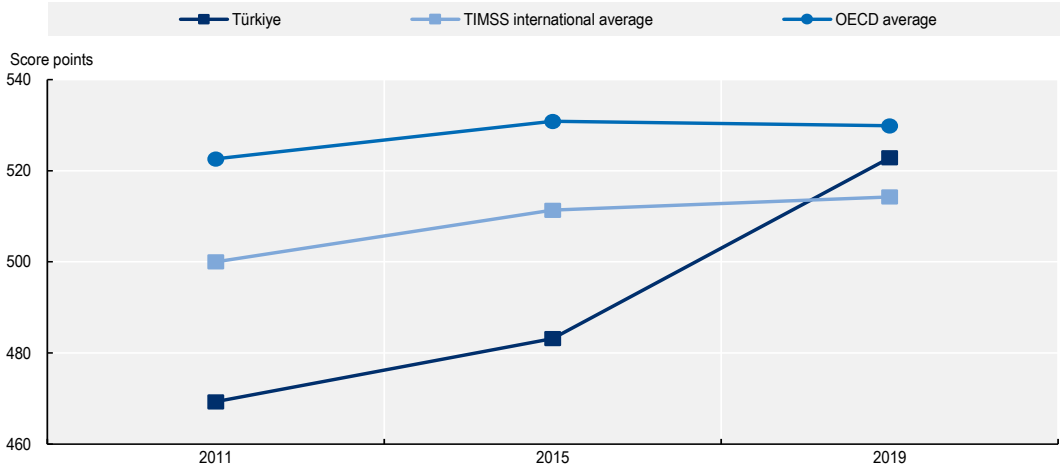
Grade 4 students' performance in mathematics and science show significant improvement over time

Students' performance in mathematics rose considerably by 54 score points between 2011 and 2019

The trend in Türkiye's Grade 4 mathematics scores between 2011 and 2019 shows marked improvement (Figure 2.4). Average performance rose by 14 score points between 2011 and 2015 and a further 40 points between 2015 and 2019, surpassing the international average and bringing Türkiye very close to the OECD average. The improvement in Türkiye's performance was substantial especially in the last cycle (between 2015 and 2019).

In general, in TIMSS, countries that made substantial improvements like Türkiye started from a position below the international average, with few exceptions. This was the case of Poland which experienced the largest rise among all countries between 2011 and 2015, moving from significantly below the international average to significantly above it. In contrast, countries that showed stability or minor declines were those that started near or above the international average (e.g. Germany, whose performance remained stable).

Figure 2.4. Trends in students' mathematics performance in Grade 4



Source: IEA (2012[2]), *About TIMSS 2011*, https://timssandpirls.bc.edu/timss2011/, (accessed on 21 May 2021); IEA (2016[3]), *TIMSS 2015 International Reports*, https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021); IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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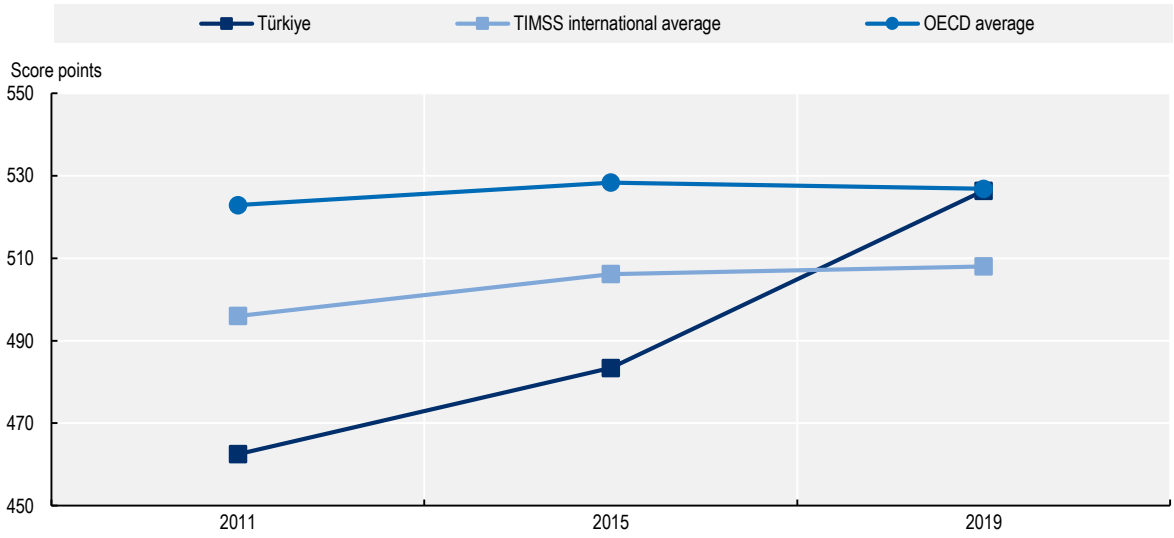
The improvement in science performance was even larger than in mathematics

The performance in science of Grade 4 students also improved with a rise of 20 score points between 2011 and 2015 followed by a substantial rise of 43 score points between 2015 and 2019 (Figure 2.5. Trends in students' science performance in Grade 4). This rise brought Türkiye's average above the international average and closed the gap with the OECD average. Only Poland had a similar improvement over time with a rise of 42 score points between 2011 and 2015. This rise was followed by a drop of 16 score points between 2015 and 2019, while Germany experienced a drop of ten score points between 2011 and 2019.

Improvements have been driven by a major decline in the share of low performers and an increase in the share of high performers

In mathematics, between the two TIMSS cycles of 2011 and 2019, the share of students performing at or below the low benchmark declined substantially (Figure 2.6). In 2011, half (49%) of the students performed at or below the low benchmark. By 2019, just less than a third of students performed at the two lowest levels (i.e. below and at the low benchmark) and the share of students performing below the low benchmark almost halved. In contrast, the share of students performing at high and advanced levels doubled over the same period. A similar pattern was observed in Poland between 2011 and 2015. Over that period, Poland's results were marked by a substantial rise in the number of students in the high and advanced benchmarks of about 27 percentage points and an equivalent decline in the proportion of low achievers (at or below the low benchmark).

Figure 2.5. Trends in students' science performance in Grade 4



Source: IEA (2012[2]), *About TIMSS 2011*, https://timssandpirls.bc.edu/timss2011/, (accessed on 21 May 2021); IEA (2016[3]), *TIMSS 2015 International Reports*, https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021); IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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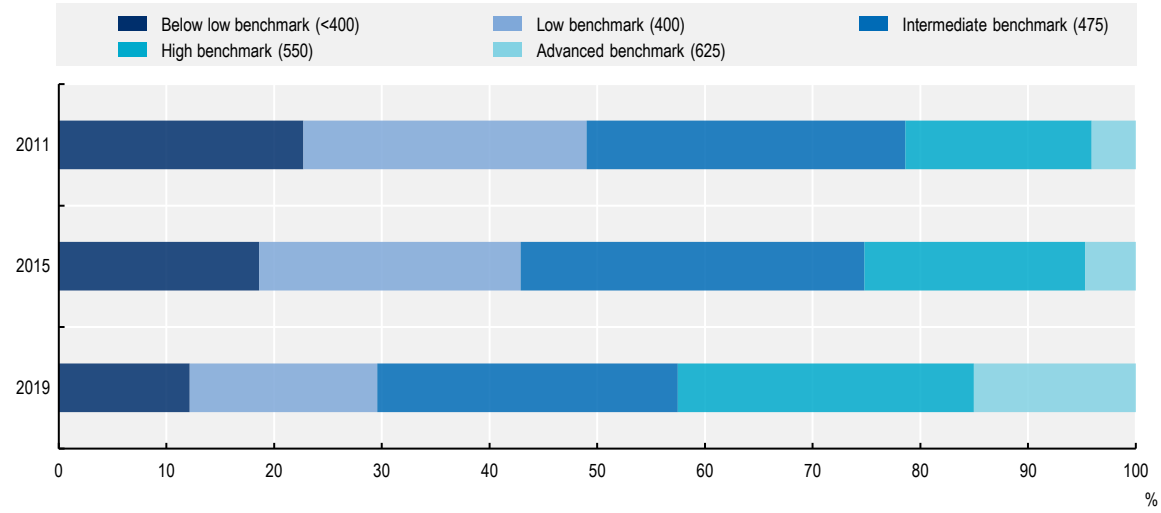
Figure 2.6. Grade 4 students' proficiency in mathematics over time



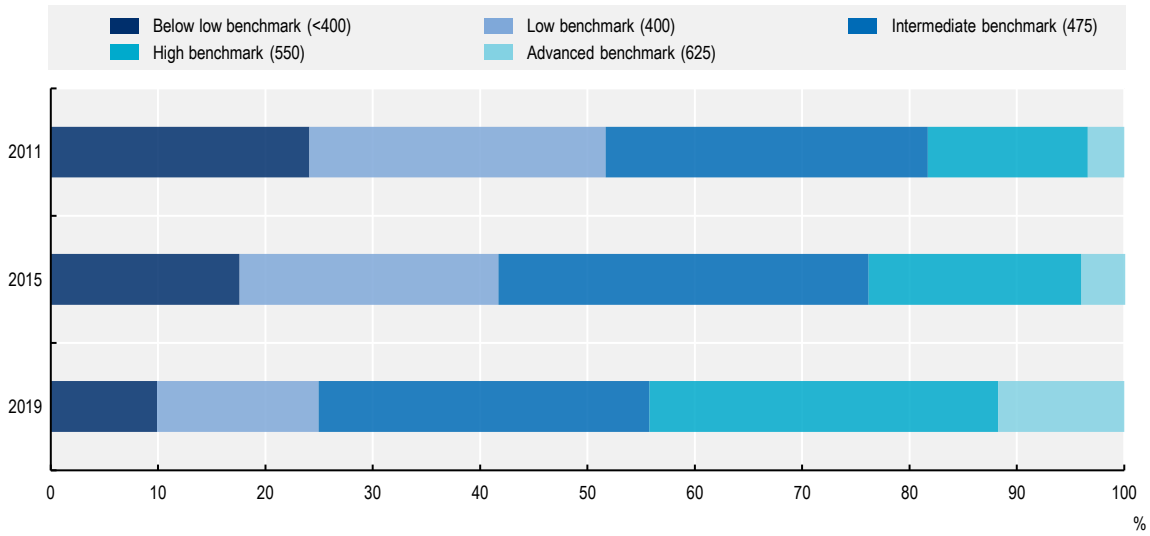
Source: IEA (2012[2]), *About TIMSS 2011*, https://timssandpirls.bc.edu/timss2011/, (accessed on 21 May 2021); IEA (2016[3]), *TIMSS 2015 International Reports*, https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021); IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/x2z3hc

The evolution of proficiency in science over time was similar (Figure 2.7). Between 2011 and 2019, there was a clear drop in the share of students scoring below the low benchmark (decline of 14 percentage points) and the share of students in the low benchmark (decline of 13 percentage points combined with a rise in the high (18 percentage points)) and advanced proficiency benchmark (8 percentage points).

Comparatively, a similar trend was observed in Poland with the share of students below the low, low and intermediate benchmarks declining and the share of students in the high and advanced benchmarks rising by 14 percentage points.

Figure 2.7. Grade 4 students' proficiency in science over time



Source: IEA (2012[2]), *About TIMSS 2011*, https://timssandpirls.bc.edu/timss2011/, (accessed on 21 May 2021); IEA (2016[3]), *TIMSS 2015 International Reports*, https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021); IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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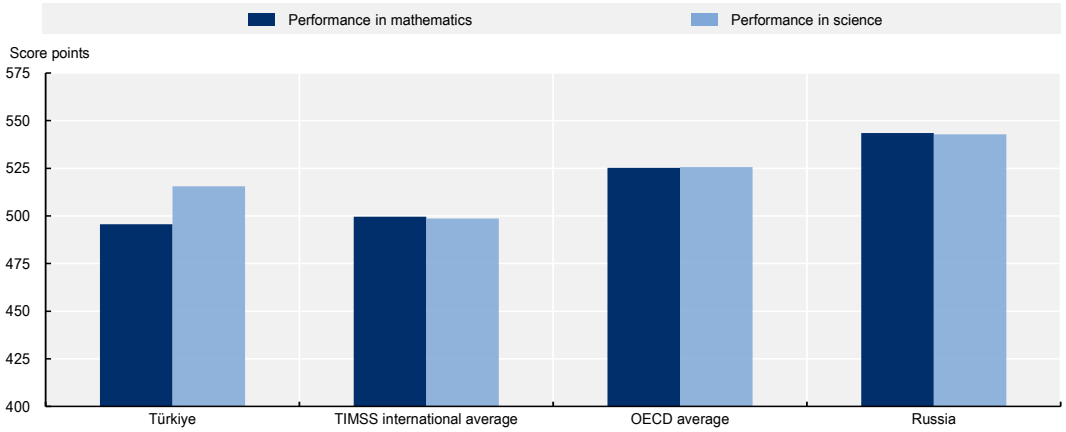
Students' performance in mathematics and science in TIMSS Grade 8

In 2019, students performed at the international average in mathematics and above it in science

In mathematics in 2019, Grade 8 students in Türkiye had an average performance that was similar to the international average of TIMSS countries but below the average of OECD countries (Figure 2.8). Statistically, the performance of students in Türkiye in mathematics was similar to that of students in Italy, Norway and Sweden, while in science it was similar to that of students in England (United Kingdom) and Israel.

Figure 2.8. Grade 8 students' performance in mathematics and science, TIMSS 2019



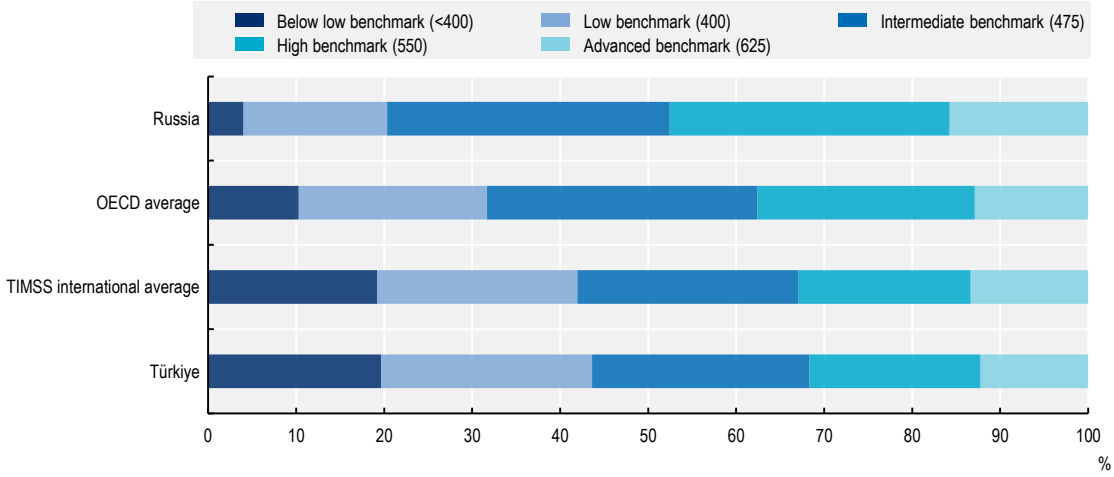
Note: Countries are ranked in ascending order of the average performance score in mathematics.
Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/6tc1vd

In 2019, the share of students performing at lower levels was higher in mathematics than science

About 20% of Grade 8 students scored below the low proficiency benchmark in mathematics (Figure 2.9). This was similar to the international average of 19% but higher than the OECD average of 10%. Students at this level are unable to perform basic mathematics tasks. In contrast, a larger proportion of students – 32% in mathematics – performed at the high or advanced benchmarks.

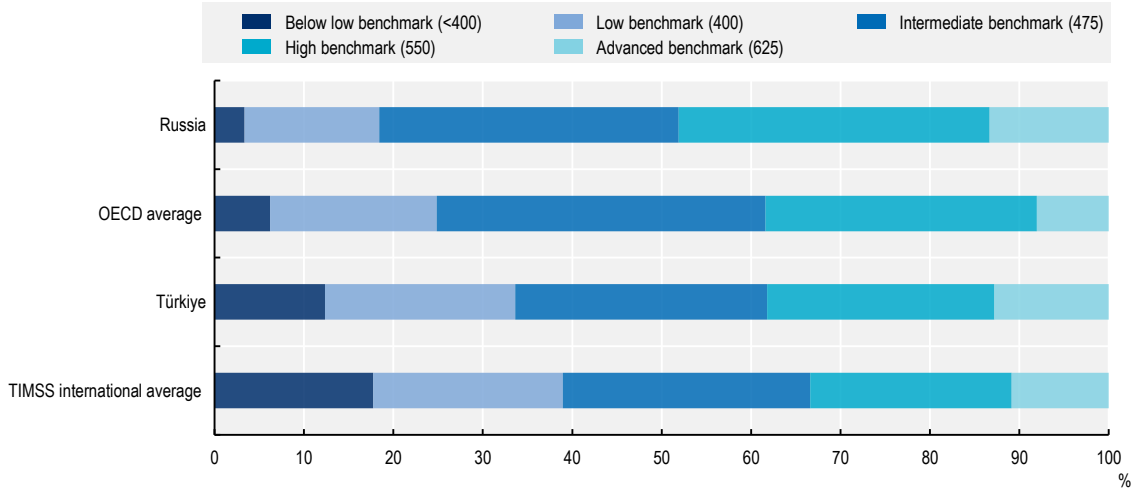
Figure 2.9. Grade 8 students' proficiency levels in mathematics, TIMSS 2019



Note: Countries are ranked in ascending order of the percentage of students in Grade 8 who performed below 400 score points in mathematics.
Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/shpf6z

Figure 2.10. Grade 8 students' proficiency levels in science, TIMSS 2019



Note: Countries are ranked in ascending order of the percentage of students in Grade 8 who performed below 400 score points in science.
Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/3r1pq0

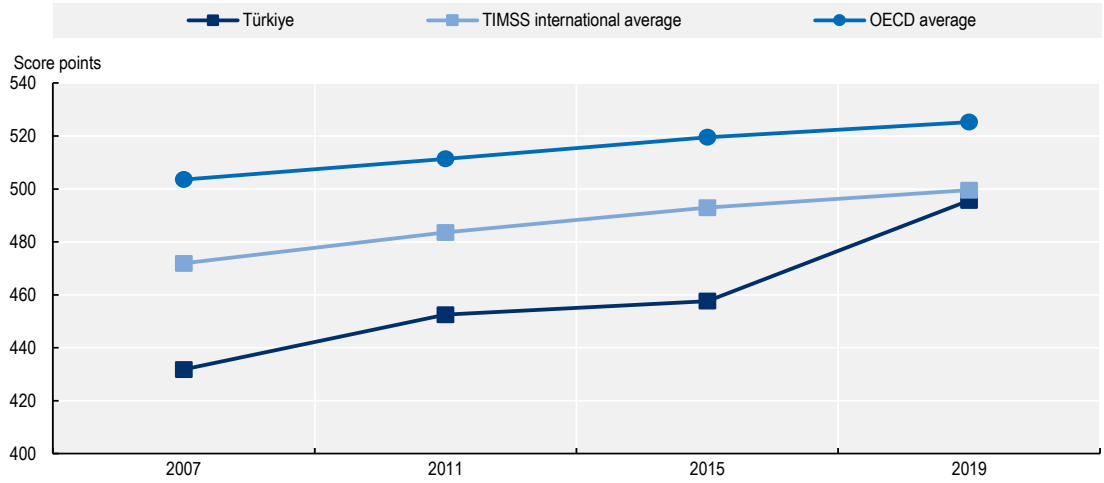
In science, 12% of students did not reach the low benchmark against an international average of 18% (OECD average of 9%). In contrast, a larger proportion (38% of students) performed at the high or advanced benchmarks. Türkiye's comparatively stronger performance in science compared with mathematics reflects the relative strength of the country's performance in this domain.

A positive and significant improvement in Grade 8 mathematics and science performance was observed over time in Türkiye

The improvement in Grade 8 mathematics and science performance was even stronger than in Grade 4

The improvement trend in Grade 4 was mirrored by a similar and even stronger trend (in terms of absolute points) in Grade 8 in both mathematics and science (Figure 2.11). Achievements in mathematics improved over the period of 2007 to 2018 with a rise of 64 score points, bringing Türkiye to the international average and closer to the OECD average. The bulk of this improvement took place between 2015 and 2019 (rise of 38 score points).

Figure 2.11. Trends in students' mathematics performance in Grade 8



Source: IEA (2012[2]), *About TIMSS 2011*, https://timssandpirls.bc.edu/timss2011/, (accessed on 21 May 2021); IEA (2016[3]), *TIMSS 2015 International Reports*, https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021); IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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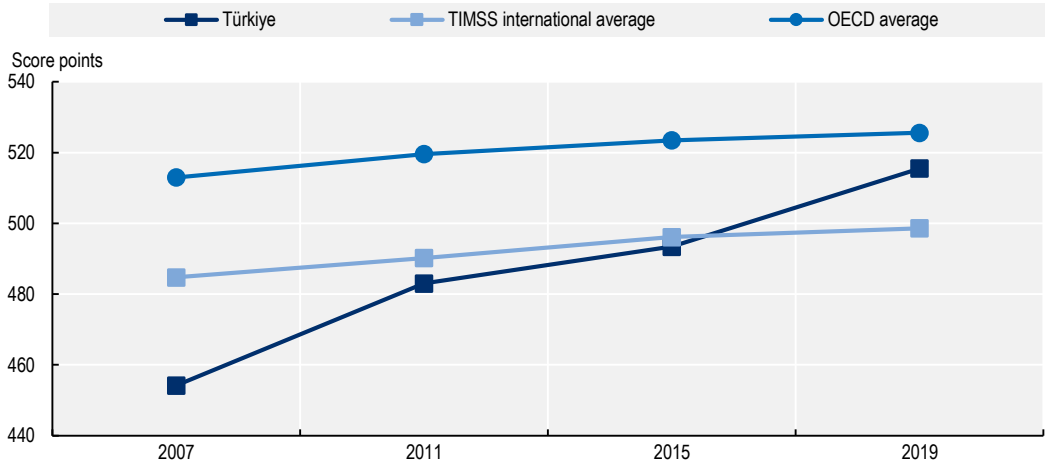
Improvements in science were stronger than in mathematics relative to international averages.

A major improvement in students' science achievements in Grade 8 was observed between 2011 and 2019 (Figure 2.12). Average performance rose by 61 score points with the bulk of improvement happening between 2007 and 2011 (29 score points), and between 2015 and 2019 (22 score points). This rise brought Türkiye's average performance above the international average of 499 (but just below the OECD average of 526) and closed the gap with high performing countries.

Figure 2.12. Trends in students' science performance in Grade 8



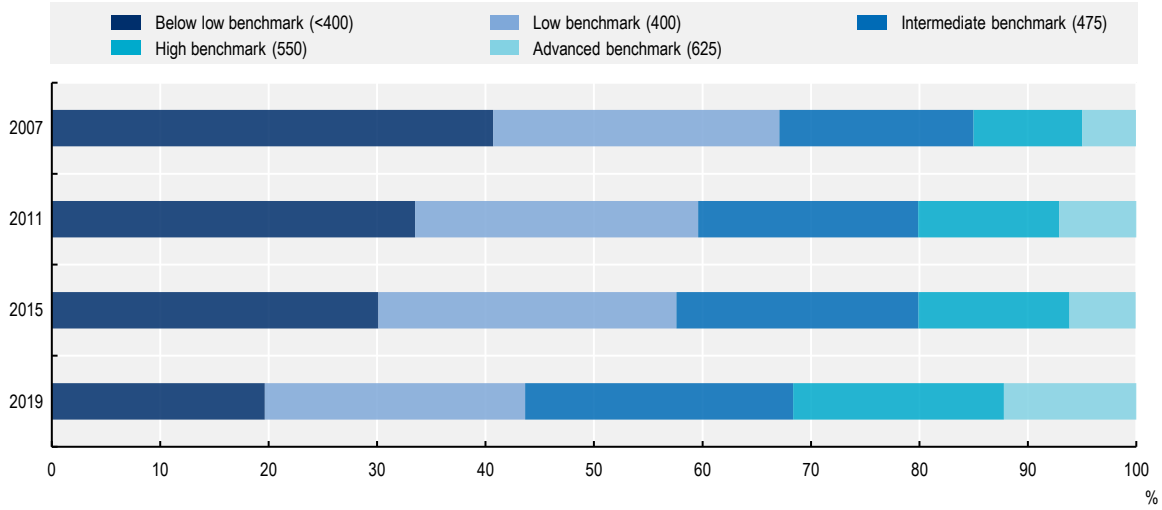
Source: IEA (2012[2]), *About TIMSS 2011*, https://timssandpirls.bc.edu/timss2011/, (accessed on 21 May 2021); IEA (2016[3]), *TIMSS 2015 International Reports*, https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021); IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/imsfk4

This improvement was driven by a decline in the share of students not reaching the low mathematics and science proficiency benchmarks and a rise in the share of students performing in the top three benchmarks

In 2007 in mathematics, more than two-thirds of students (67.1%) performed at or below the low proficiency benchmark. Between 2007 and 2019, there was a major and consistent decline in the share of students performing at those levels with a fall of more than 20 percentage points (Figure 2.13). This drop was accompanied by a rise in the share of students in the intermediate, high and advanced proficiency benchmarks. The largest improvements were observed in the high and advanced benchmarks, with a doubling of the share of students in each benchmark by 2019.

Figure 2.13. Grade 8 students' proficiency in mathematics over time

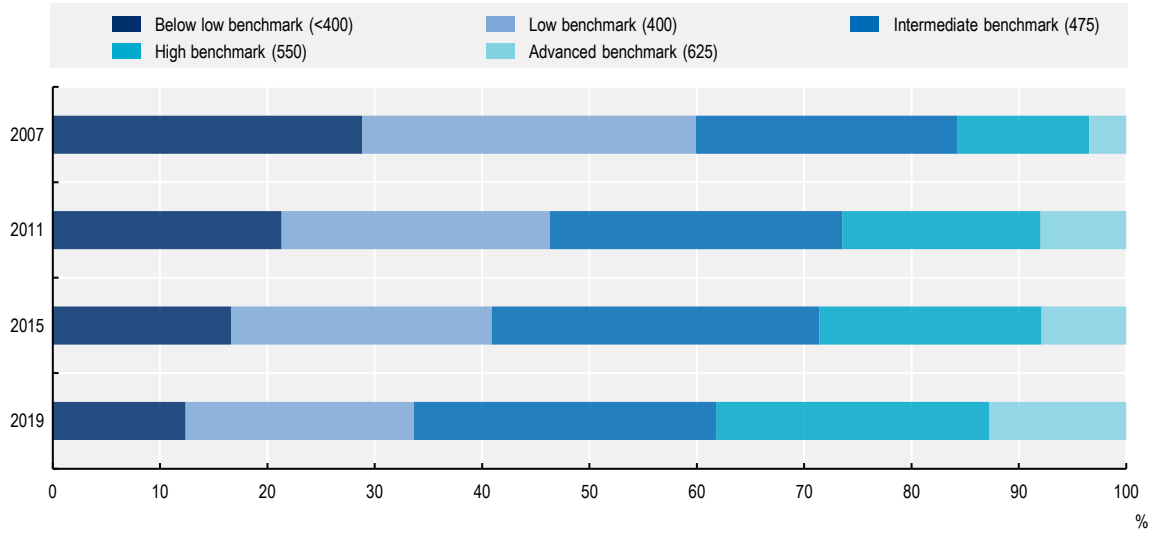


Source: IEA (2012[2]), *About TIMSS 2011*, https://timssandpirls.bc.edu/timss2011/, (accessed on 21 May 2021); IEA (2016[3]), *TIMSS 2015 International Reports*, https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021); IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/wji96m

In science in 2007, almost two-thirds (59.9%) of students performed at or below the low benchmark, falling to just over a third (34%) by 2019 (Figure 2.14). At the other end of the scale, there was an improvement in all other three benchmarks (i.e. intermediate, high and advanced), especially at the high and advanced benchmarks where the share of students in these top benchmarks more than doubled.

Figure 2.14. Grade 8 students' proficiency in science over time



Source: IEA (2012[2]), *About TIMSS 2011*, https://timssandpirls.bc.edu/timss2011/, (accessed on 21 May 2021); IEA (2016[3]), *TIMSS 2015 International Reports*, https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021); IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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How do students' performances across Grades 4 and 8 compare?

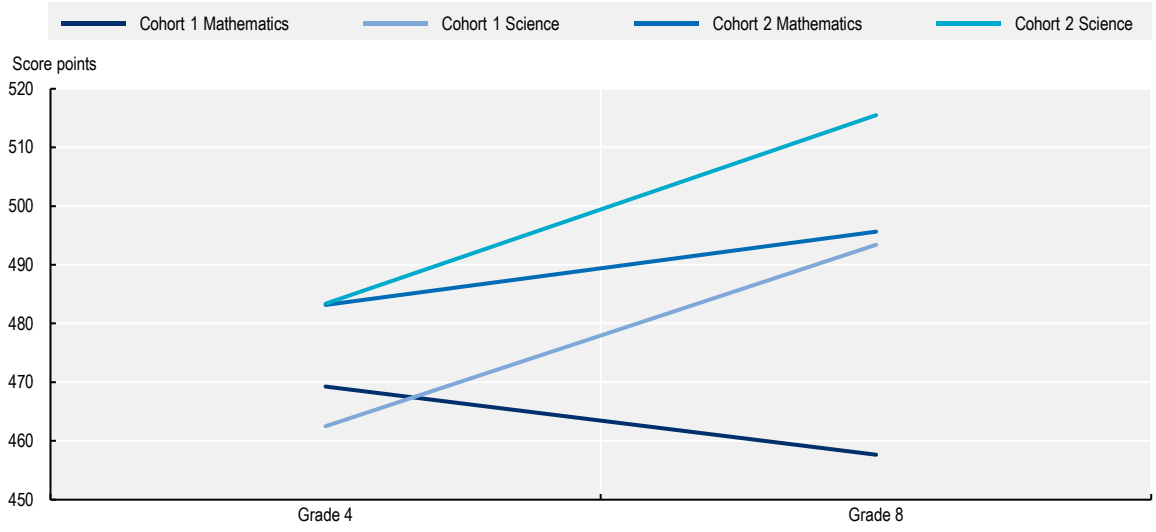
As the target Grade 4 cohort in 2011 is the same as the one in Grade 8 in 2015, and the one in Grade 4 in 2015 is the same as the one in Grade 8 in 2019, TIMSS allows for comparison of relative progress achieved by the cohort between these grades. It should, however, be noted that due to the fact that TIMSS is a quasi-longitudinal survey, it is possible to compare the performance of the same cohort at different points in time but not that of individual students. Therefore, what does TIMSS tell us about students' progress in mathematics and science between Grades 4 and 8?

Most cohorts showed an improvement in score points between Grades 4 and 8

The first cohort that was assessed in Grade 4 in 2011 and then in Grade 8 in 2015 ("Cohort 1") showed a decline in mathematics performance and an improvement in science performance between Grades 4 and 8. In mathematics, the average performance of this cohort declined by 11 score points between Grades 4 and 8, while in science, performance improved by 30 score points between the two grades (Figure 2.15).

The second cohort, which was first assessed in Grade 4 in 2015 and then in Grade 8 in 2019 ("Cohort 2") improved in both subjects across grades. In mathematics, performance improved by 13 score points and by 32 score points in science. Another country that had major progress for Cohort 2 in science and mathematics is Bahrain.

Figure 2.15. Students' progress between Grades 4 and 8 in TIMSS



Note: Cohort 1: 2011-15; Cohort 2: 2015-19.
Source: IEA (2012[2]), *About TIMSS 2011*, https://timssandpirls.bc.edu/timss2011/, (accessed on 21 May 2021); IEA (2016[3]), *TIMSS 2015 International Reports*, https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021); IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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There was a fall in the share of low performers and rise in the share of high performers across both cohorts

Moreover, between Grades 4 and 8, the proportion of students not reaching the low proficiency benchmark in science declined by about five percentage points. This decline was mirrored by a rise in the proportion of students reaching the high and advanced benchmarks. In mathematics, the proportion of students not reaching the low proficiency benchmark rose by one percentage point between 2015 (Grade 4) and 2019 (Grade 8).

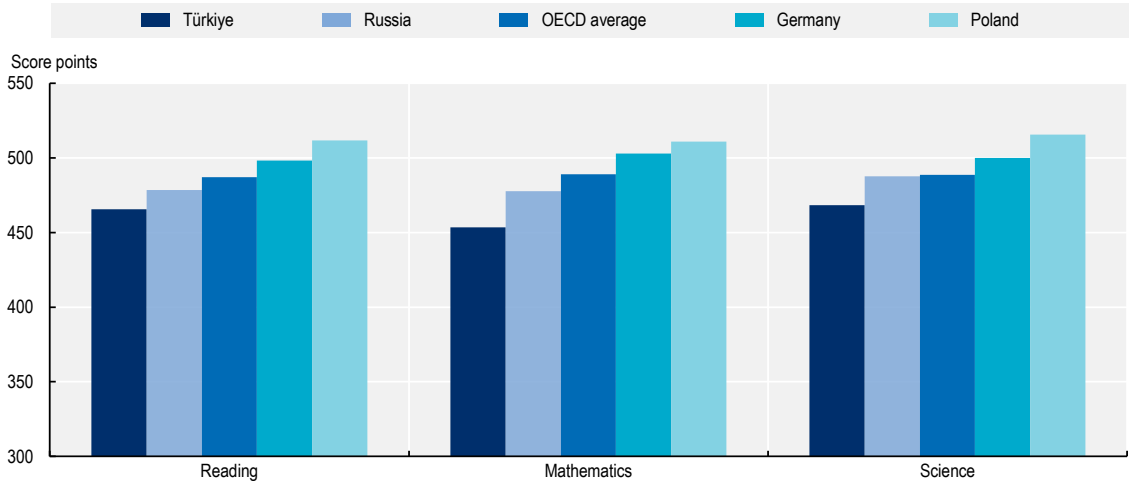
Students' performance in upper secondary education

Performance on the PISA assessment can be reported in a variety of ways. In this section, average performance on the PISA test for Türkiye and benchmark countries is presented, in addition to proficiency in the three domains of assessment: mathematics, science and reading. When considering Türkiye's PISA results, it is important to bear in mind that performance improved at the same time as the rapid expansion of the education system (see Chapter 1 and below).

In Türkiye in 2018, students performed below the OECD average in all three PISA domains

In 2018, 15-year-old students in Türkiye scored below the OECD average in all domains of assessment: reading, mathematics and science; however, the gap between Türkiye's performance and the OECD average was smaller in science than in mathematics (Figure 2.16). Statistically, performance in reading was similar to that of Greece, Israel, Luxembourg and Ukraine, science was similar to that of Belarus, Croatia, Israel, Italy, Slovak Republic and Ukraine, and mathematics was similar to that of Cyprus, Greece, Serbia and Ukraine.

Figure 2.16. Students' performance in reading, mathematics and science, PISA 2018



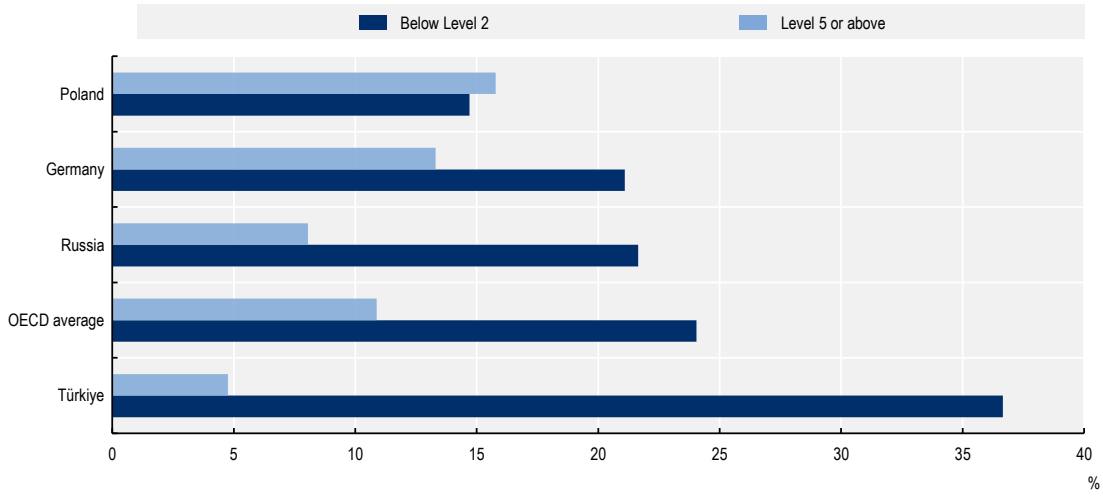
Note: Countries are ranked in ascending order of the average performance score in each subject.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/s56ifr

There was both a higher share of low and high performers in mathematics in comparison with other domains of assessment

Across the three domains assessed by PISA in 2018, mathematics was the domain where there was the greatest share (37%) of students who did not attain the baseline level of proficiency at which students are considered to have the basic skills and knowledge they will need for success in life and work (i.e. Level 2) (see Chapter 1 for further information about proficiency levels). The share of low achievers (i.e. performing below Level 2) in science was more than ten percentage points lower (25.5%) and much closer to the OECD average (22%). In reading, the share of low performers was also closer to the OECD average (Figure 2.17).

Figure 2.17. Percentage of low and high achievers in mathematics, PISA 2018

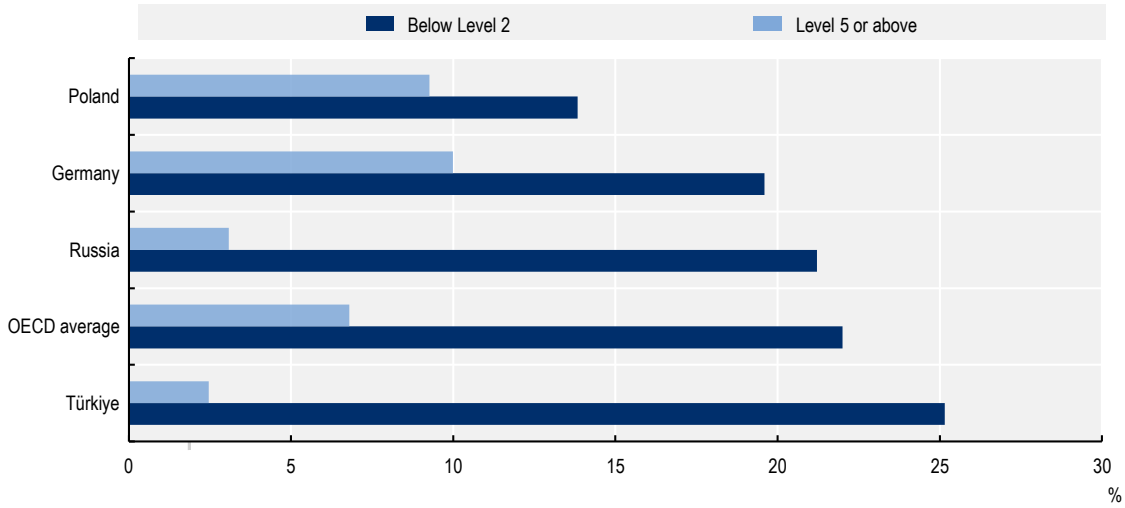


Note: Countries are ranked in ascending order of the percentage of students who perform below Level 2 in mathematics.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/3or7nu

In contrast, the share of high performers (i.e. Level 5 or above) was the greatest in mathematics (4.8%) and the closest to the OECD average (10.8%). In contrast, the share of high performers in science (2.5%) and reading (3.3%) was lower and further away from the OECD average.

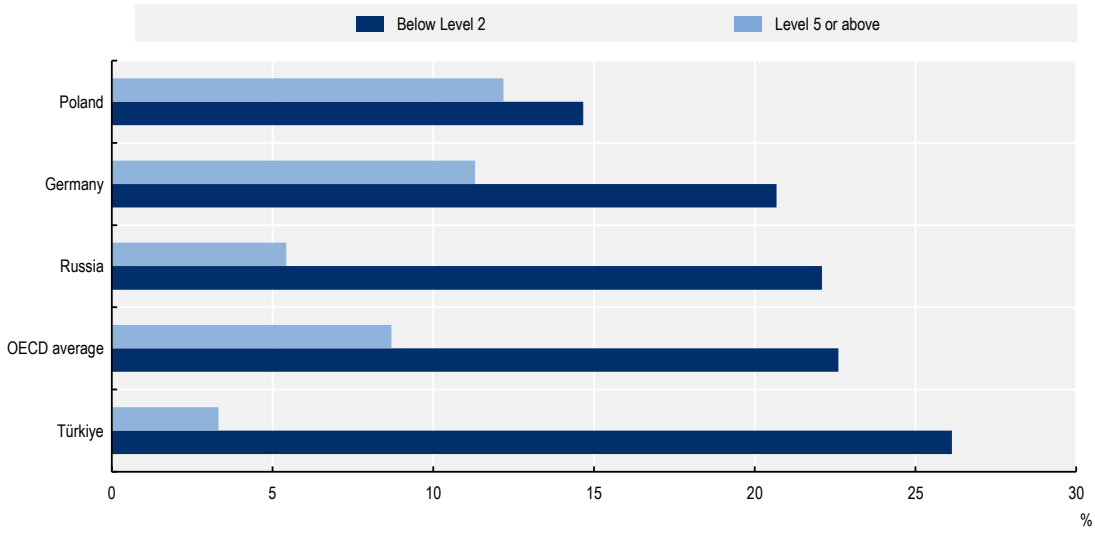
Figure 2.18. Percentage of low and high achievers in science, PISA 2018



Note: Countries are ranked in ascending order of the percentage of students who perform below Level 2 in science.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/0p3gts

Figure 2.19. Percentage of low and high achievers in reading, PISA 2018



Note: Countries are ranked in ascending order of the percentage of students who perform below Level 2 in reading.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

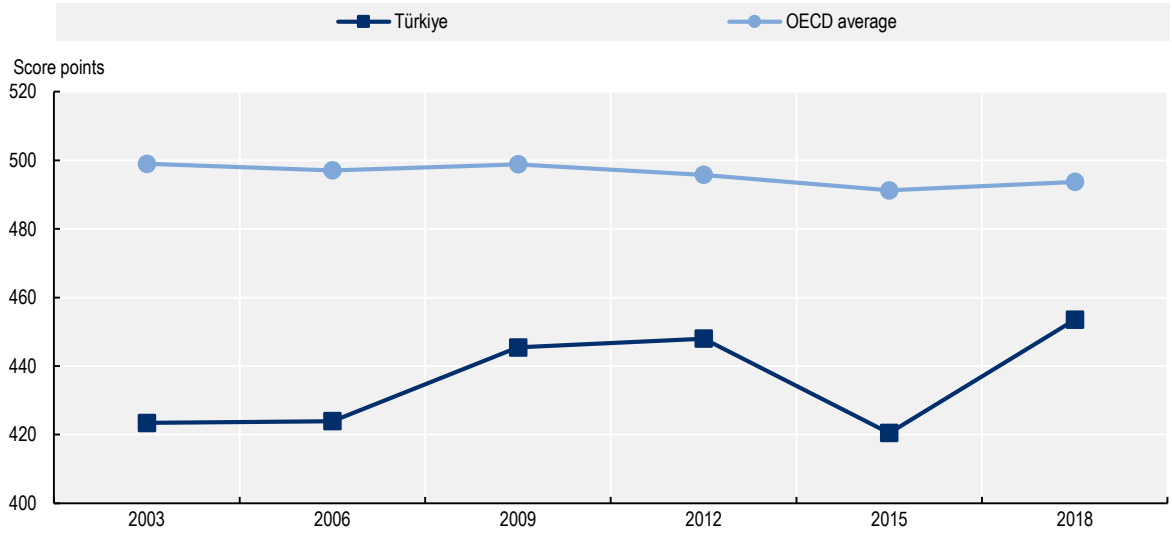
StatLink https://stat.link/7jo8rq

A positive and significant improvement in the performance of 15-year-old students was observed in Türkiye since 2003

The PISA data show that both the participation and performance of 15-year-olds in Türkiye has improved over time. While there has been a general trend of improvement, average scores in all domains dropped

unexpectedly in 2015. Box 2.2 discusses possible reasons for this decline. Since 2003, in mathematics, average performance has risen by 30 score points with a substantial increase between 2006 and 2009 and later between 2015 and 2018 (Figure 2.20). Türkiye's improving performance was the largest among all three benchmark countries. In general, countries that did well on the PISA test in earlier cycles tended to have stable performances or more modest improvements than countries like Türkiye that started from a lower position with greater room for growth. The two other countries that experienced major improvements between 2003 and 2018 are Poland and Portugal.

Figure 2.20. Trend in PISA mean mathematics performance, 2003 through 2018

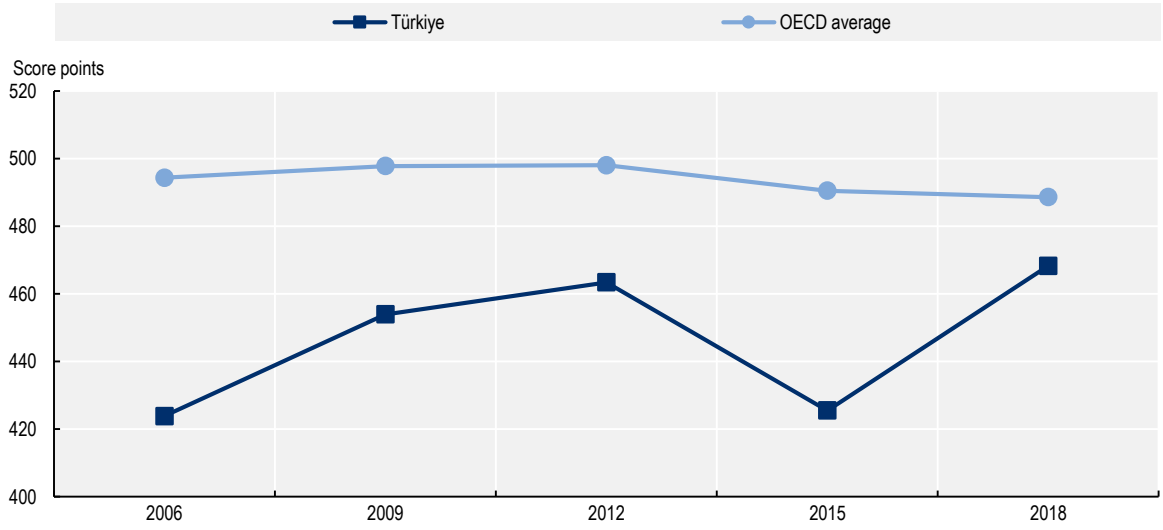


Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/n7354j

Türkiye's average performance in science improved by more than 40 score points between 2006 (the first year when science was the main domain of assessment) and 2018 with an unexpected drop in 2015 (Figure 2.21). This rise brought Türkiye's performance closer to the OECD average and reduced the gap by more than a half (the gap shrunk from 40 score points to 20). In all three benchmark countries, performances were either stable (Poland and Russia) or declined over that period (Germany). The only country to experience a greater improvement in science between 2006 and 2018 was Qatar (increase of 70 score points).

Figure 2.21. Trend in PISA mean science performance, 2006 through 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

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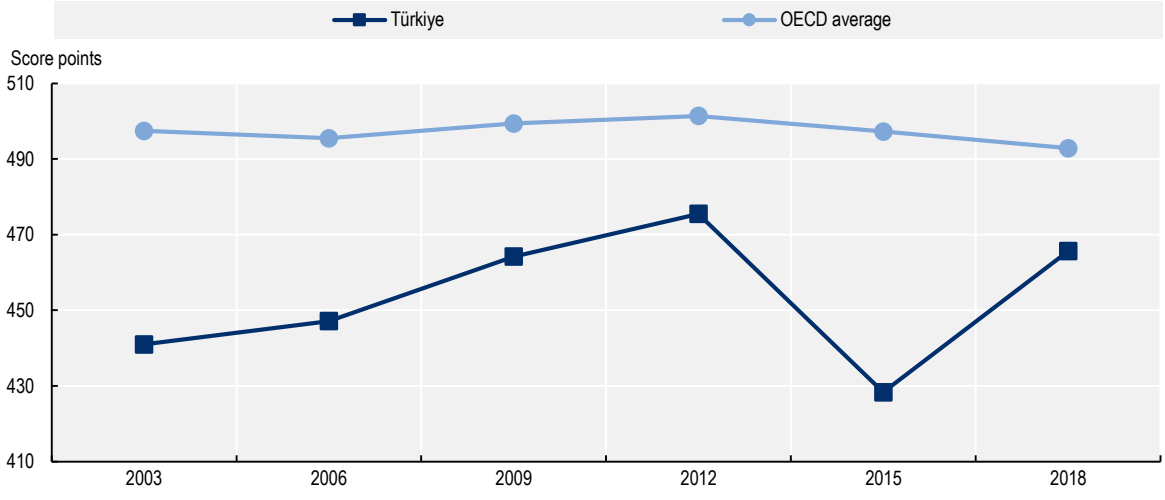
In reading, the average performance of students in Türkiye rose by 25 score points between 2003 and 2018, reaching its highest level in 2012 (Figure 2.22). Mexico was one of the only countries to experience a substantial rise in reading performance over the same period.

Figure 2.22. Trend in PISA mean reading performance, 2000 through 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

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Box 2.2. Possible explanations for the sudden drop in Türkiye's performance in PISA 2015

In PISA 2015, Türkiye experienced a sudden drop in the performance of its students across all domains. In PISA 2018, student performance returned to its previous trajectory. Even though conclusive reasons are difficult to identify, there are some possible scenarios. Such a sudden and significant fall in average performance followed by a swift return to previous levels is unlikely to be explained by changes in student performance alone. Although TIMSS does not assess the students of the same age or according to the same assessment framework, one would expect to see a similar pattern in Türkiye's performance in TIMSS across 2015 and 2019 if the drop in performance was related to systemic, school-wide factors, which is not the case.

National sources suggest that one possible explanation for the drop in performance is the shift from paper-based assessment in 2012 to computer-based assessment in 2015. Low levels of digital awareness and limited familiarity with the computer-based setting may have impacted student performance.

Another possible explanation is changes in Türkiye's PISA sampling procedures related to changing distribution of students across schools.

Starting in 2015, Türkiye embarked on a major school building campaign reaching a total of 67 835 classrooms made available to students. These new schools have provided additional places and helped reduce class size, especially in urban areas. The expansion of the number of schools also meant that new schools were eligible for sampling in the PISA assessment (see Chapters 4 and 11 in the PISA 2018 technical report). The largest type of high school to expand between 2015 and 2018 were Anatolian High Schools (with a rise of eight percentage points in the nationally representative Turkish PISA sample) and Science High Schools (rise of 1.5 percentage points over this period). This was mirrored by a decline in the share of vocational and technical Anatolian High Schools (drop of 4.8 percentage points) and Multi-Programme Anatolian High Schools (decline of 1.8 percentage points). The two types of schools that witnessed an expansion were on average better performing than the two types that witnessed a decline in the PISA sample. This expansion of the number of schools combined with a change in the composition of those schools is a plausible explanation for the recovery between 2015 and 2018.

At the end of Grade 8, since students in Türkiye are placed in different types of high schools with different levels of performance, changes in student numbers and school size impacted PISA performance but not TIMSS. In Grades 4 and 8, most students attend the same primary and lower secondary schools.

It is important to note that this is just one possible explanation, which is speculative. Forensic examination of the sampling procedure would be necessary to confirm if this explanation is correct. Moreover, changes to the assessment methods such as the move to computer-based testing in 2015 and the treatment of missing data (i.e. unanswered test questions) should be taken into account.

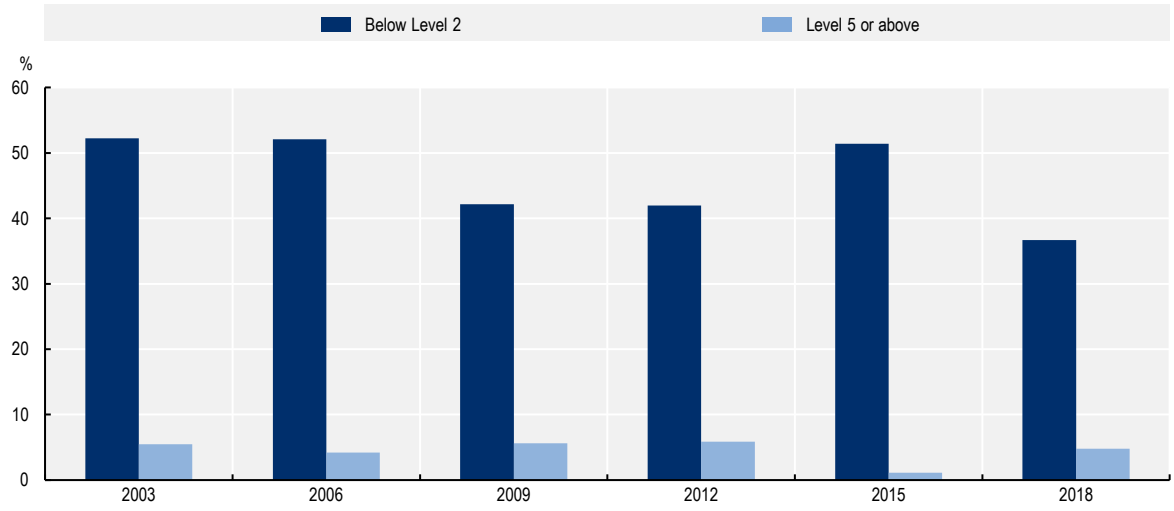
Note: In Türkiye, as well as following either vocational or academic pathways in upper secondary education, students also attend different types of upper secondary schools: Anatolian; Science; Social Sciences; Anatolian Imam and Preacher; Sports/Arts; Multi-Programme; and Vocational and Technical Anatolian High Schools. Codes to identify the different types of high schools in PISA 2015 data was shared with the OECD by the Ministry of National Education in Türkiye as part of the OECD Review of Evaluation and Assessment in Education: Student Assessment in Türkiye (Kitchen et al., 2019[5]).

Source: World Bank (2017[6]), "World Bank administers School Construction Projects under the Facility for Refugees in Türkiye", https://www.worldbank.org/en/news/press-release/2017/01/30/world-bank-administers-school-construction-projects-under-the-facility-for-refugees-in-Türkiye (accessed on 6 December 2021).

The improvements in average performance were driven by a decline in the proportion of low achievers in all three subjects

In mathematics in 2018, the proportion of low achievers (students performing below Level 2) declined by about 15 percentage points in comparison with previous cycles of PISA (i.e. 2003 and 2015) while the proportion of top achievers (students performing at Level 5 or above) slightly increased. On average across OECD countries, the proportion of high and low achievers did not change. This result is particularly encouraging because it shows that the improving trends in mathematics were driven by a rise in the performance of low achievers. It is particularly notable that the performance of low performers improved at the same time as previously out-of-school students remained in school longer (see following section on improving performance and rising participation among 15-year-olds). Among the three benchmark countries, Poland had similar trends over time with a decline in the proportion of low achievers.

Figure 2.23. Percentage of low and high achievers in mathematics, 2003 through 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/vjbawo

In science, between 2006 and 2018, the proportion of low achievers declined by 20 percentage points while the share of high achievers rose by two percentage points (across all OECD countries, the proportions were stable). Most of the improvement in performance took place among the intermediate achievers. No other country, including the three benchmarks, had a similar decline in the share of low achievers over that period with the exception of Qatar (drop of 31 percentage points).

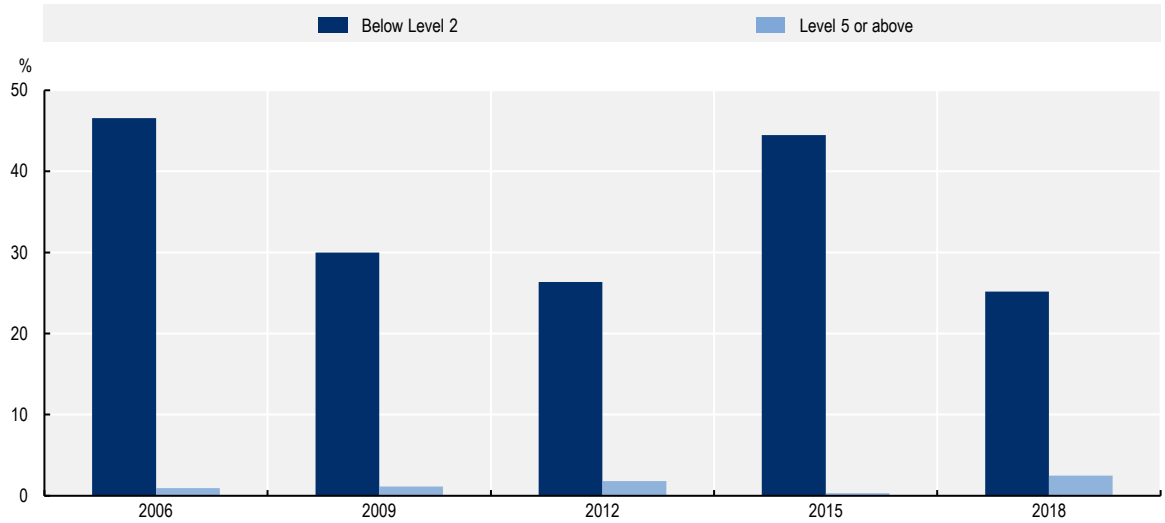
In reading, the proportion of low and high achievers was stable over the period of 2009 to 2015. However, between 2015 and 2018, the share of low achievers (performing below Level 2) declined by 14 percentage points while the share of high achievers (performing at Level 5 or above) increased by three percentage points. No changes were observed on average across OECD countries. Only North Macedonia had a similar decline in the proportion of low achievers over the same period of time as Türkiye.

Improving performance and rising participation among 15-year-olds

Over the period of 2003 to 2018, the average performance in reading of students in Türkiye improved by 25 score points. This improvement was accompanied by a rise in enrolment among 15-year-olds and a rise in the PISA sample coverage (see Chapter 1). School enrolment increased progressively between

2003 and 2012 with the largest rise taking place in 2012 when education became compulsory for this age group. Similarly, coverage of the PISA sample of the 15-year-old population improved over time (with the coverage index rising from 36% to 73%) as more students became eligible for sampling.[5]

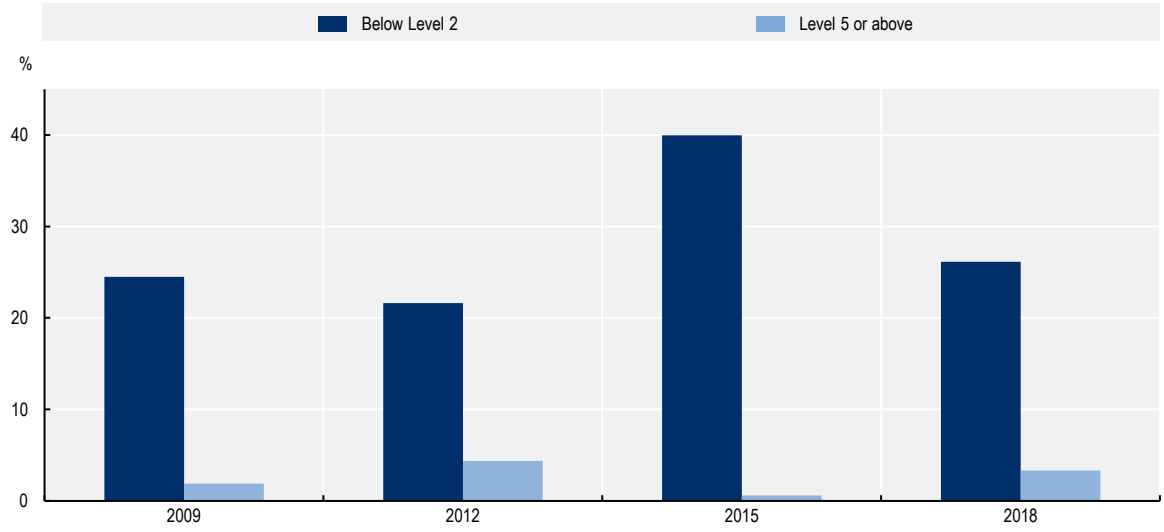
Figure 2.24. Percentage of low and high achievers in science, 2006 through 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/4q2deb

Figure 2.25. Percentage of low and high achievers in reading, 2009 through 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

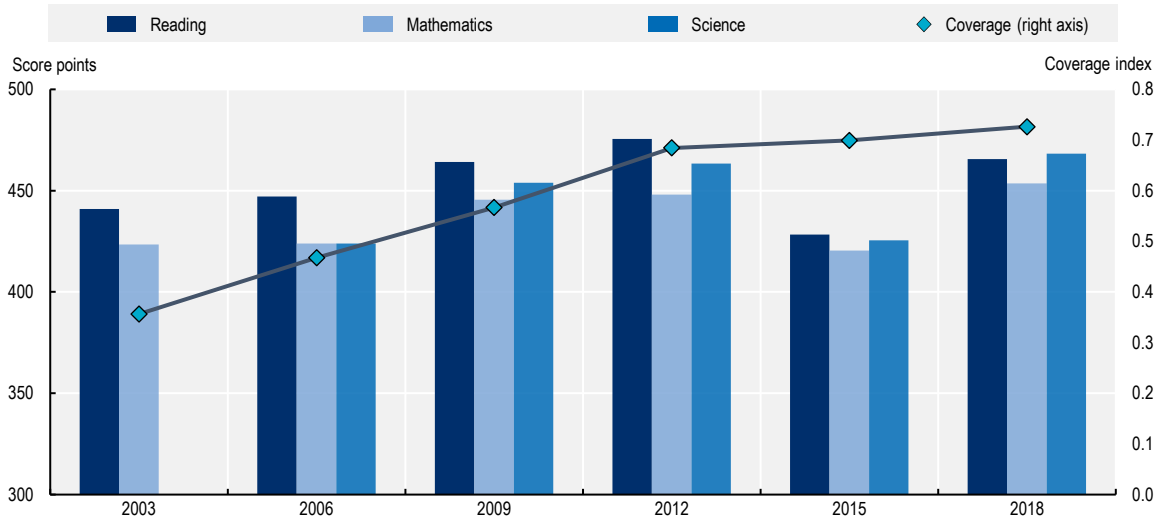
StatLink https://stat.link/vnmy71

Assessment of out-of-school 15-year-olds in five countries by the OECD shows that they perform lower than those that are in school (Ward, 2020[7]). One might therefore expect that as an education system

expands and participation increases, with previously out-of-school children starting to attend school, that average performance might decline. However, Türkiye's PISA results show that the country has been able to both increase participation and performance at the same time. Comparing the performance of the highest and lowest performing students over time shows that Türkiye has been able to improve the performance of both high and low performing students while participation has increased. The score of students at the 75th percentile of performance – who are most likely not to have been impacted by changes in enrolment – increased by 27 points in reading between 2003 and 2018. At the same time, the score of students at the 25th percentile of performance – the group of performers most likely affected by increasing enrolment – also increased by 27 score points. This suggests that Türkiye has been able to bring previously out-of-school young people into school and still improve performance for most of the student population including the newcomers (see Chapters 1 and 3).

Policies and initiatives undertaken by the Ministry of National Education and other actors over the last decade have contributed to improvements in both participation and quality at the same time. These include improvements in the school infrastructure, for example by increasing the number of classrooms, increasing teacher numbers and expanding access to a wider share of students, for example by providing transportation services for students living in remote areas may also have contributed to improvements in quality and access. In particular, the expansion of access among girls has been a major achievement in Türkiye. While girls were under-represented in PISA 2003, representing 45% of the PISA sample, more girls progressively joined the system to reach parity with boys by 2018 (in 2018, girls represented 49.6% of the PISA sample). Since girls score higher than boys on average in two out of three PISA domains (reading and science), the increase in girls' participation, relative to boys, may have helped to increase Türkiye's average score in PISA over time. It is also possible that in Türkiye, the rise in participation was achieved among the easier to reach population since only one-third of 15-year-olds were eligible to participate in PISA in 2003.

Figure 2.26. Participation and performance in Türkiye over time, PISA



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

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Conclusions

This chapter paints a very positive picture of student performance in Türkiye. Average performance in Grades 4 and 8 and at age 15 has improved progressively over time and the gap between Türkiye's performance and the OECD average and that of TIMSS-participating countries has shrunk substantially. These improvements have been driven by a rise in the share of high performers and a decline in the share of low performers in all grades and across the two assessments (PISA and TIMSS). The improvements in PISA are particularly notable since they were accompanied by a rise in participation among 15-year-olds. However, it is important to note that since the 2018 PISA assessment only covered 73% of 15-year-olds, the data do not provide a full picture of the performance of all 15-year-olds in Türkiye.

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IEA (2016), *TIMSS 2015 International Reports*, TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College, and International Association for the Evaluation of Educational Achievement, http://timssandpirls.bc.edu/timss2015/international-results/ (accessed on 21 May 2021). [3]

IEA (2012), *About TIMSS 2011*, TIMSS & PIRLS International Study Center, Boston College, International Association for the Evaluation of Educational Achievement, https://timssandpirls.bc.edu/timss2011/ (accessed on 21 May 2021). [2]

Kitchen, H. et al. (2019), *OECD Reviews of Evaluation and Assessment in Education: Student Assessment in Turkey*, OECD Reviews of Evaluation and Assessment in Education, OECD Publishing, Paris, https://doi.org/10.1787/5edc0abe-en. [5]

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Notes

[1] In this report, the terminology of “TIMSS Grade 4” is used throughout since this is the official name of the assessment. However, the data refer to Grade 5 students in lower secondary education in Türkiye.

[2] While the PISA sample coverage has more than doubled since 2003, there remains one-fifth of 15-year-olds who were not covered by the assessment in 2018. Therefore, the results do not represent the performance of the entire population of 15-year-olds in Türkiye.

[3] Refers to the average of OECD countries participating in TIMSS.

[4] For consistency across the PISA analysis and in line with the OECD’s standard practice for comparative analysis, an average of TIMSS-participating countries (“TIMSS international average”) and OECD countries that participate in TIMSS (“OECD average”) are used throughout this report.

[5] See Chapter 1 for a discussion on the difference between the PISA coverage index and national enrolment rates.

3 Exploring associations between student background and performance

This chapter uses background information about students collected by the International Association for the Evaluation of Educational Achievement (IEA) Trends in International Mathematics and Science Study (TIMSS) and the OECD Programme for International Student Assessment (PISA) assessments to explore how factors associated with a student's background might be associated with their performance in Grades 4, 8 and at 15 years of age in Türkiye. Background factors analysed include a student's socio-economic background, the language they speak at home, their gender and participation in early childhood education and care (ECEC).

This chapter explores associations between students' individual characteristics, such as their socio-economic background and gender, and Türkiye's performance on the international assessments, IEA TIMSS and OECD PISA.

Box 3.1. What the data tell us

- There is great heterogeneity in students' socio-economic background in Türkiye. The variation in students' socio-economic background in Türkiye across both PISA and TIMSS are among the highest of all OECD- and TIMSS-participating countries.
- According to TIMSS 2019, over a quarter (26.3%) of children in Grade 4 and over a third of students in Grade 8 (31.8%) and, according to PISA 2018, a third of 15-year-olds (34.0%) are from disadvantaged backgrounds. This makes achieving high and equitable outcomes an inherently greater challenge than in countries where students come from more advantaged socio-economic backgrounds and there is less variation in socio-economic background on average.
- In TIMSS Grade 4,[1] the differences in performance between students of high and low socio-economic backgrounds is the highest of all OECD-participating countries (174.62 points in mathematics). This difference falls by just over 10 score points by Grade 8. Differences in performance related to not speaking Turkish at home also decline through schooling.
- Türkiye has been able to bring previously out-of-school students into school – many of whom were likely from disadvantaged backgrounds – while raising the average performance of disadvantaged students overall. In Türkiye, the average performance among disadvantaged 15-year-olds in mathematics increased by 32 points between 2003 and 2012.
- Participation in ECEC in Türkiye has increased in recent decades but the data from PISA and TIMSS, which provide information about ECEC participation five years ago (TIMSS 2019) and ten years ago (PISA 2018), show that at these times, participation was strongly related to the socio-economic background of students. Advantaged students tended to participate more and for longer compared to disadvantaged students: according to TIMSS 2019, almost 60% of children with many resources attended ECEC for 2 or 3 years compared to less than 5% of children with few resources.
- While ECEC attendance was positively associated with students' performance later in life, in Türkiye, as in all countries, this association becomes weaker after students' socio-economic background has been accounted for. In Türkiye, ECEC attendance was positively associated with reading performance only when children attended ECEC for one year in PISA 2018 and one and two years in TIMSS 2019.

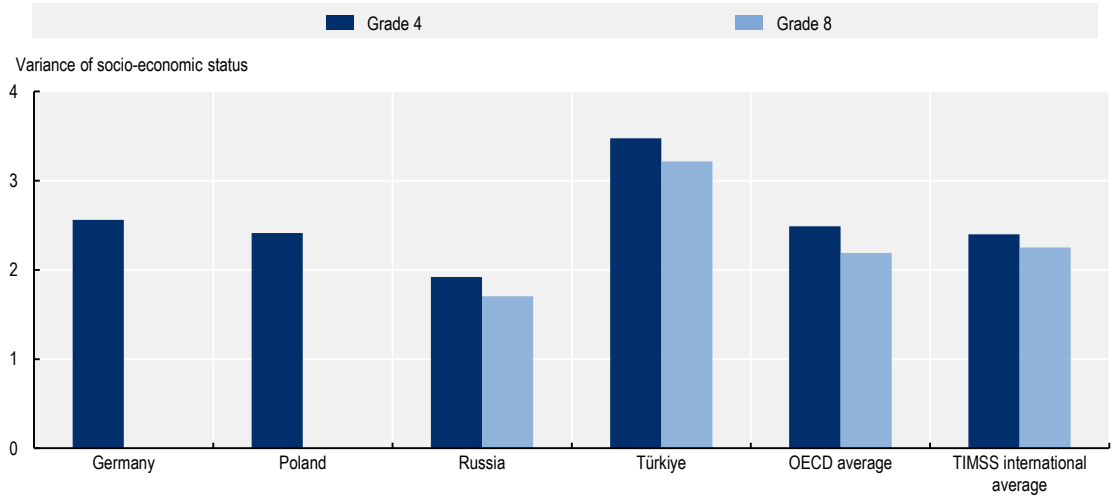
Socio-economic status

Socio-economic status of students in Türkiye

Evidence shows that, across all countries, students' socio-economic background is positively associated with learning and educational outcomes (OECD, 2019[1]). This means that an understanding of the socio-economic status of students in Türkiye is important when looking at the country's results. Both PISA and TIMSS collect information about the degree of variation in students' socio-economic background within countries. In countries where variation in socio-economic background is higher, this means that there is more heterogeneity in students' backgrounds. According to PISA and TIMSS, the variation in students' socio-economic background in Türkiye is among the highest of all PISA- and TIMSS-participating countries

(Figures 3.1 and 3.2). Having a student population with very heterogeneous backgrounds makes achieving equitable outcomes an inherently greater challenge than in countries where student background is more homogenous. Inequities across the full cohort of 15-year-olds in Türkiye might be even higher than the PISA data suggest since, in 2018, the assessment only covered 73% of the cohort (OECD, 2019[2]).

Figure 3.1. Variation in socio-economic background, TIMSS 2019



Source: IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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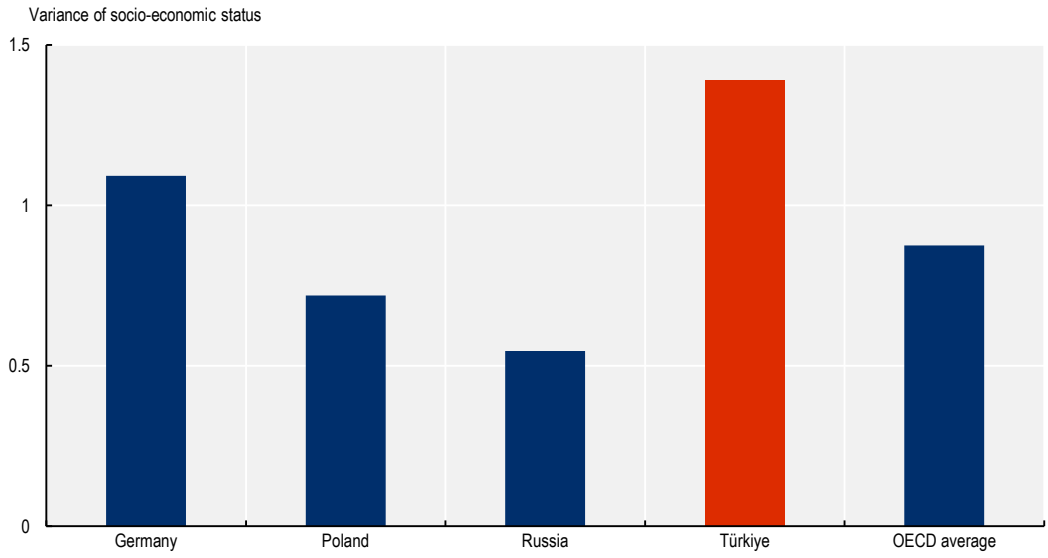
Figure 3.2. Variation in socio-economic background, PISA 2018

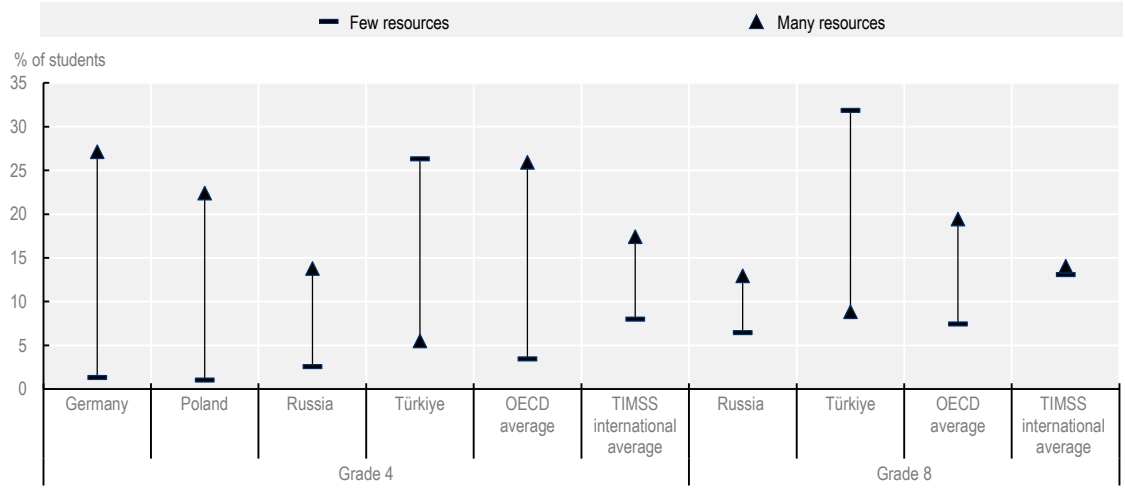


Note: The figure refers to the total variation in student PISA index of economic, social and cultural status (ESCS) which is equal to the square of the standard deviation of ESCS within each country/economy.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLi https://stat.link/cqowk6

According to the TIMSS scales of home resources (Box 3.2), in Grade 4, the share of students in Türkiye with "few resources" at home is over 7 times greater than the average of OECD-participating countries and over 4 times greater in Grade 8 (Figure 3.3). According to the PISA index of ESCS (Box 3.2), the share of 15-year-olds in Türkiye from the bottom international decile of the ESCS index is six times greater than the OECD average (Figure 3.4).

Figure 3.3. Share of students with "few" and "many" resources in Grades 4 and 8, TIMSS 2019



Source: IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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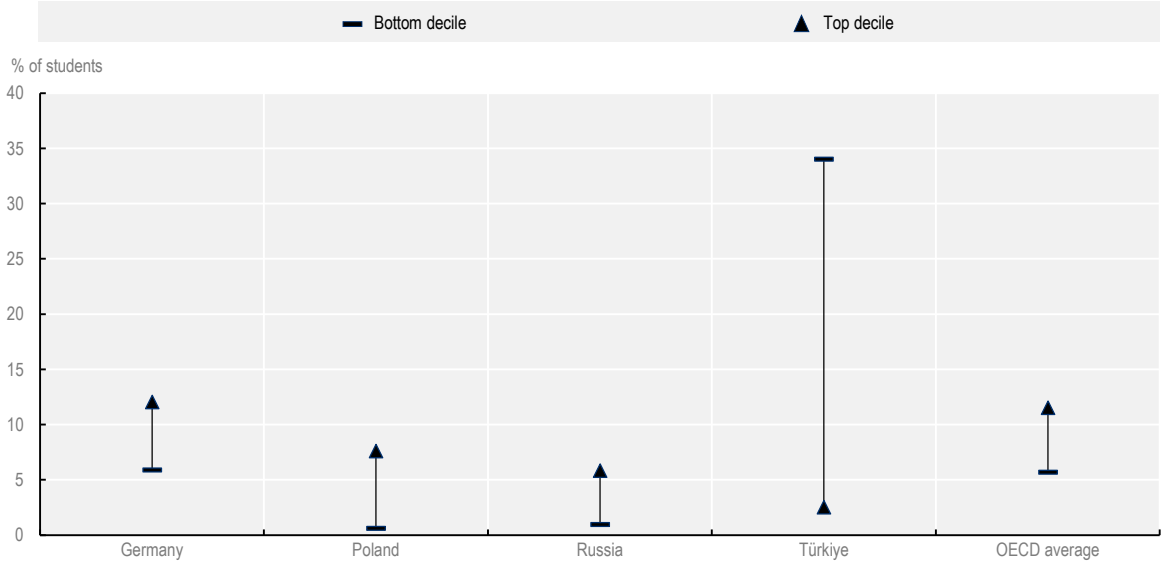
Figure 3.4. Share of students by international decile of socio-economic status, PISA 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/rvwujt

Since socio-economic background is positively associated with performance across PISA and TIMSS, the higher share of disadvantaged students makes it more challenging to achieve high levels of average student performance in Türkiye than in countries where socio-economic background is higher overall, and heterogeneity in terms of socio-economic background across the student population is smaller.

Box 3.2. Measuring students' socio-economic background in PISA and TIMSS

The PISA and TIMSS assessments have both developed indices that draw on multiple sources of information about student background to provide a measure of socio-economic background. Since there are differences across the scales, they are not directly comparable.

PISA index of economic, social and cultural status

In PISA, a student's socio-economic status is estimated by the PISA index of ESCS, a composite measure that combines into a single score the financial, social, cultural and human-capital resources available to students. It is based on several variables related to students' family background – parents' education, parents' occupations and an index summarising a number of home possessions that can be taken as proxies for material wealth or cultural capital, such as possession of a car, the existence of a quiet room to work, access to the Internet, the number of books, having a computer or a tablet, having a study desk and other educational resources available in the home (OECD, 2019[1]).

TIMSS index of home resources

TIMSS 2019 developed a new scale about home resources to provide further insights into the relationship between students' socio-economic environment and their educational achievement. The scale draws on information from both students and parents and is slightly different in Grades 4 and 8:

- **Home Resources for Learning scale, Grade 4** – Students are scored according to their own and their parents' reports regarding the availability of five resources: number of books at home; number of children's books at home; home study supports (e.g. Internet connection, computer, study desk and own room); parent education; and parent occupation.
- **Home Education Resources scale, Grade 8** – Students are scored according to their reports regarding the availability of three resources: number of books at home; home study supports (e.g. Internet connection, computer, study desk and own room); and parent education.

In both grades, the scale is divided into three categories: students with many resources, students with some resources and students with few resources (Mullis et al., 2020[5]).

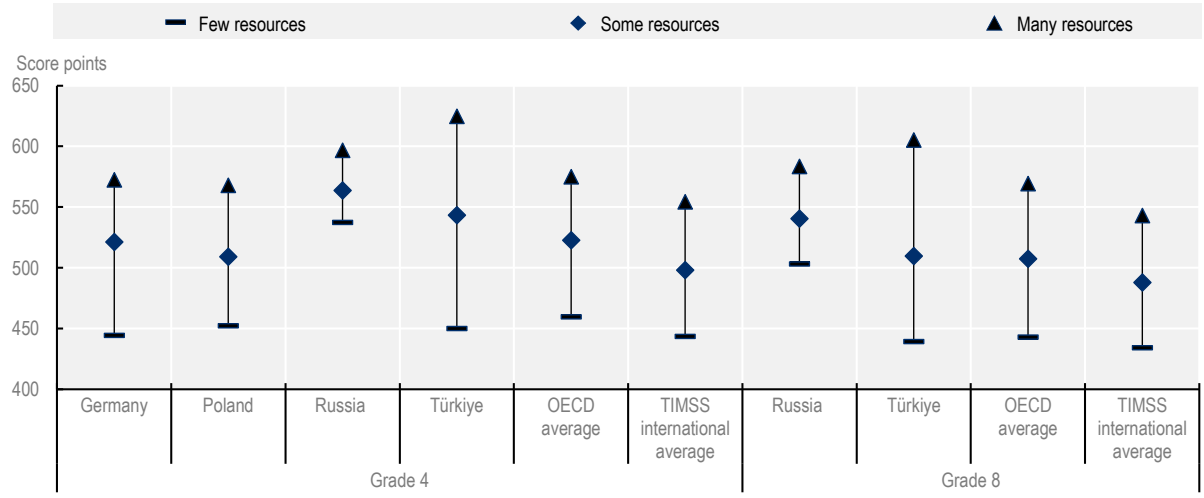
Source: Mullis, I. et al. (2020[5]), *Highlights - TIMSS 2019 International Results in Mathematics and Science*, https://timss2019.org/reports/ (accessed on 24 July 2021); OECD (2019[1]), *PISA 2018 Results (Volume II): Where All Students Can Succeed*, PISA, OECD Publishing, Paris, https://dx.doi.org/10.1787/b5fd1b8f-en.

Comparing the performance of students from similar socio-economic backgrounds internationally

Given the significant differences in the socio-economic status across countries – and particularly in Türkiye compared with other OECD countries – it is important to account for these variations when comparing the performance of students across countries (Özer and Suna, 2021[6]). By looking at the performance of students from the same socio-economic background, one can compare how students with similar backgrounds perform across countries.

In Grades 4 and 8 according to TIMSS, students in Türkiye with the least resources at home perform at similar levels as students with the same background in other OECD and TIMSS-participating countries[2]. In contrast, students with some or many resources at home perform significantly above students from similar backgrounds (Figure 3.5). Equally, according to the PISA data, students from all socio-economic backgrounds perform above the OECD average for 15-year-olds from similar backgrounds (Figure 3.6). Students from the lowest socio-economic group perform particularly well, with the highest score across all OECD countries. Only in some of the highest performing PISA countries – Macao (China), Hong Kong (China) and Beijing, Shanghai, Jiangsu and Zhejiang (China) – do students from this group perform higher (OECD, 2019[1]).

Figure 3.5. Average performance by level of resources in mathematics in Grades 4 and 8, TIMSS 2019



Source: IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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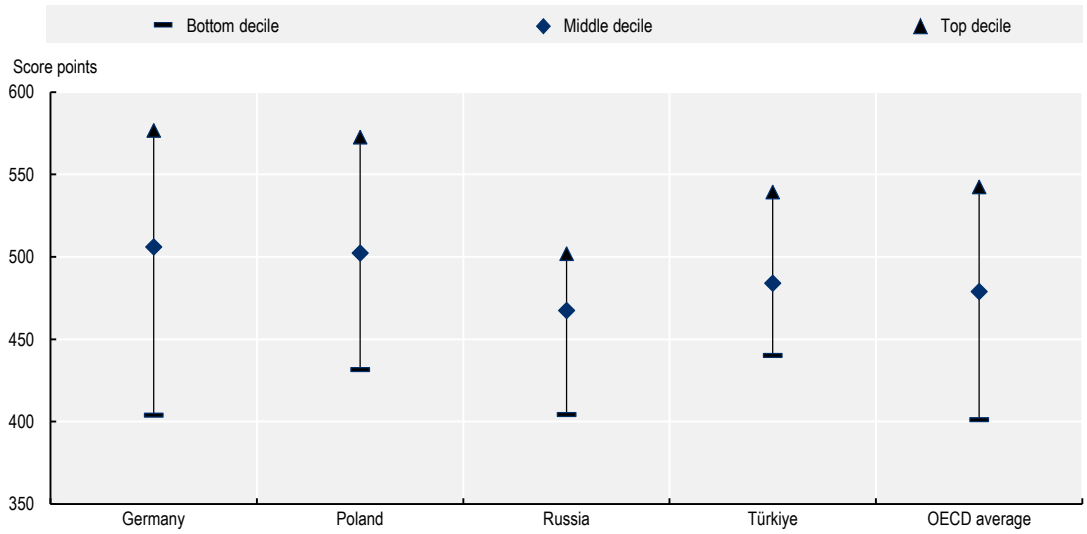
It is important to note that the data in Figure 3.6 do not take into account the actual distribution of students. Since Türkiye has a large share of students from more disadvantaged backgrounds (Figures 3.3 and 3.4), the country's actual average performance on PISA and TIMSS is lower than the average of OECD countries (see Chapter 2). Also, the international deciles of socio-economic status may not be sufficiently subtle to detect the different levels of status at the bottom of the index in Türkiye. The bottom decile of the international index may group together students from different backgrounds domestically.

Nevertheless, one interpretation of these data may be that Türkiye's education system is effective at educating students from lower socio-economic groups. This is reflected in the high share of resilient students (resilient students are students from disadvantaged backgrounds that perform in the top quarter of the country's performers) in Türkiye. Türkiye has the highest share (11.3%) of resilient students across OECD countries, after Estonia (OECD, 2019[1]).

However, at this level of education, it is also important to take into account Türkiye's coverage index in PISA. The coverage index measures the proportion of the national population of 15-year-olds who are represented by the PISA sample (and should not be confused with national enrolment in upper secondary education, see Chapter 1).[3] Türkiye has a coverage index of 0.73, which is the lowest among OECD countries with the exceptions of Colombia, Costa Rica and Mexico (OECD, 2019[1]). The relatively low coverage index in Türkiye is likely related to students who are excluded from the PISA assessment, remain

out-of-school or attend open high schools, which are not covered by the PISA assessment since they do not attend physical schools (see Chapter 1). It might be the case that 15-year-olds with higher performance are more likely to remain in physical schools (since one of the reasons that a student might attend an open high school is failing to pass two school years)[4] and therefore would be covered by PISA (OECD, 2019[1]).

Figure 3.6. Average performance in reading by international decile of socio-economic status, PISA 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/svepuf

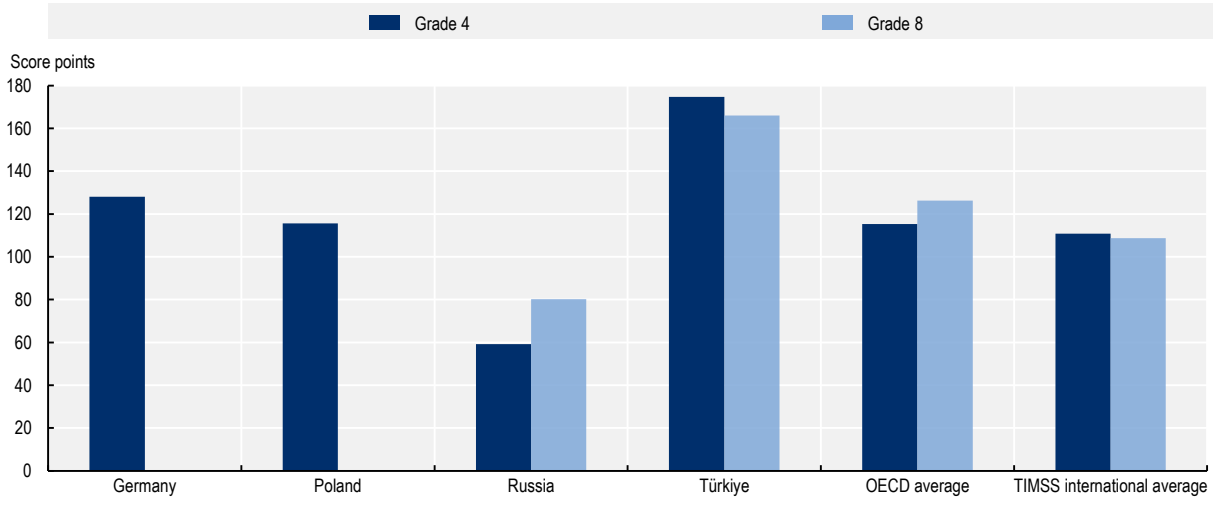
Comparing the difference in performance between advantaged and disadvantaged students

According to the data in Figures 3.7, 3.8 and 3.9, the performance difference between advantaged and disadvantaged students appears to fall as children progress through school, perhaps suggesting that school has an equalising effect and is a driver of equity in Türkiye. According to data from TIMSS, the performance difference between advantaged and disadvantaged students in mathematics and science in Grade 4 in Türkiye is the highest across all OECD-participating countries. However, the performance difference falls by 10 points in mathematics and 12 points in science between Grades 4 and 8 in Türkiye, while the difference increases on average across OECD countries (Figures 3.7 and 3.8). By Grade 8, three OECD countries – Hungary, New Zealand and Sweden – also have greater performance differences between advantaged and disadvantaged students than Türkiye. According to the PISA data in Figure 3.9, this trend appears to continue into upper secondary school. At 15 years of age, the difference in performance in reading across advantaged and disadvantaged 15-year-olds in Türkiye is slightly below the OECD average (Figure 3.9).

There are a number of reasons why the performance difference related to socio-economic background might fall as students move through school in Türkiye. One is the high level of variation in socio-economic background in Grade 4 students which might be associated with high variations in performance. Another is that the Turkish school system is driving more equitable outcomes since once children are in school, access to learning opportunities becomes more equitable (see Chapter 4). As noted above, a greater understanding of the characteristics and performance of students not covered by the PISA assessment at

15 years of age is important to understand the associations between student background and performance in Türkiye in upper secondary school.[5]

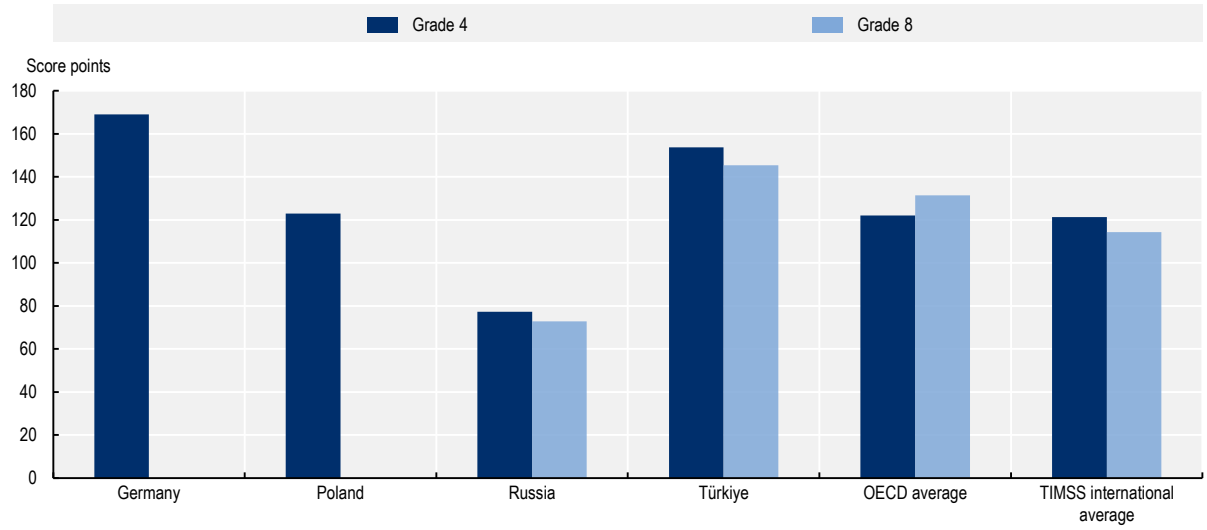
Figure 3.7. Difference in performance between students with "many" and "few" resources in mathematics in Grades 4 and 8, TIMSS 2019



Note: The bar for each country shows the score point difference between students with "many" resources and those with "few resources".
Source: IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/khz0uv

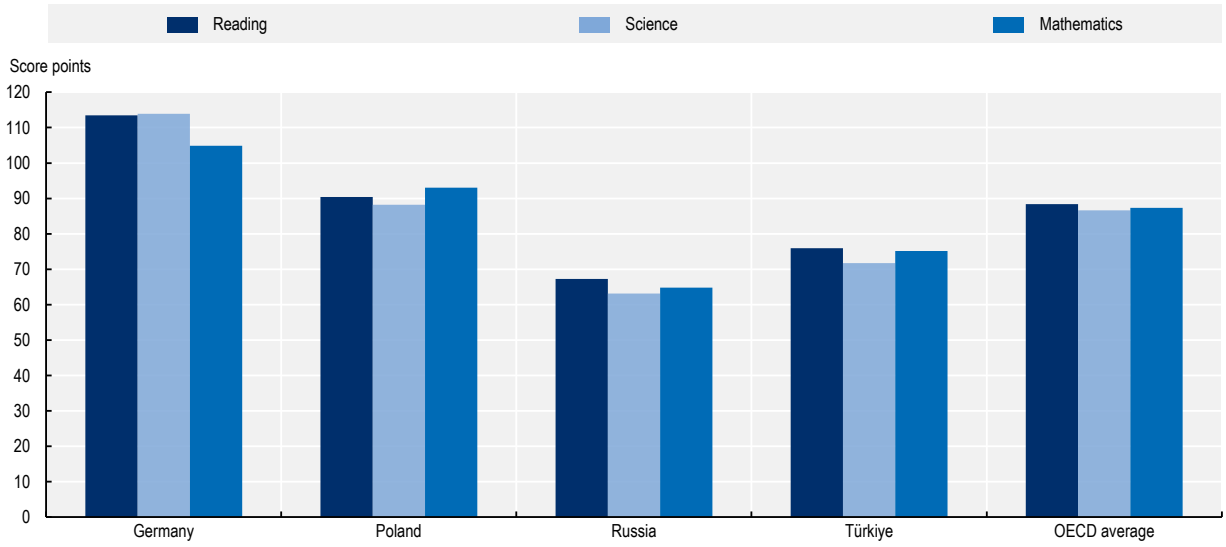
Figure 3.8. Difference in performance between students with "many" and "few" resources in science in Grades 4 and 8, TIMSS 2019



Note: The bar for each country shows the score point difference between students with "many" resources and those with "few resources".
Source: IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/0lb259

Figure 3.9. Difference in performance between top and bottom socio-economic groups in reading, science and maths, science, PISA 2018



Note: The bar for each country shows the score point difference between students at the top and bottom socio-economic groups.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/k4iuvh

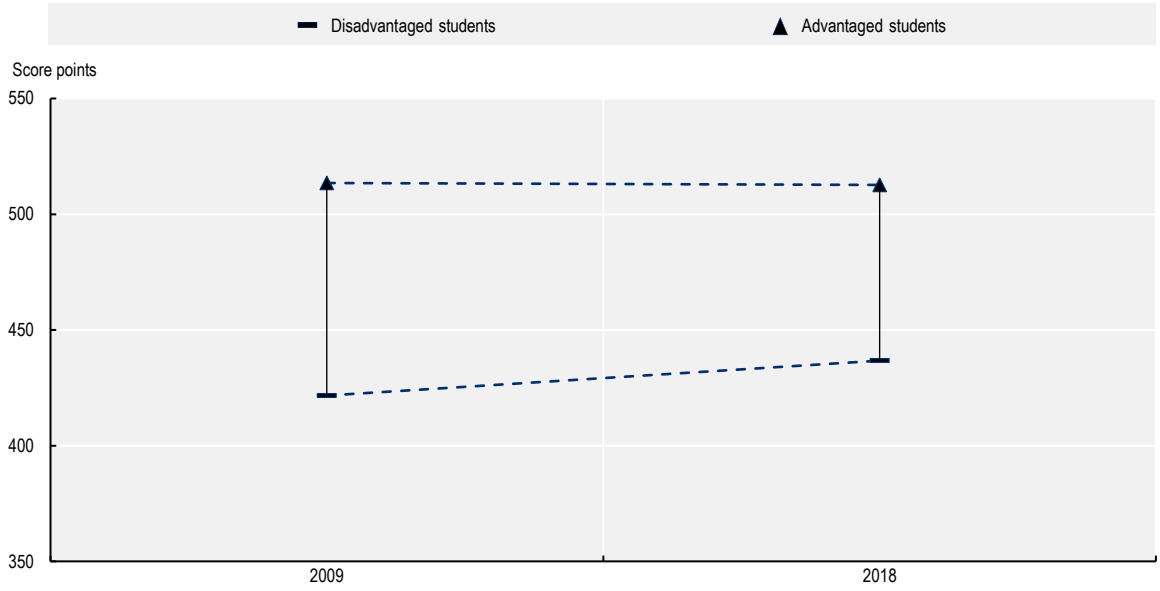
Expanding participation and socio-economic background

In most countries, out-of-school students tend to be from more disadvantaged backgrounds (UIS/UNICEF, n.d.[7]). As education systems expand, with previously out-of-school students moving into the school system, average results in a country may be affected since the incoming students are likely to have lower levels of performance (Ward, 2020[8]). However, in Türkiye, as Chapter 2 shows, the average score of students in Türkiye has not fallen as the coverage index has increased.

As well as assuming that the new students who entered the system as coverage expanded were lower performing, it is also a plausible assumption that they were from more disadvantaged backgrounds – especially relative to the other students already in the system. Looking at the average performance of disadvantaged and advantaged students over PISA cycles, there has been a significant increase in the scores for disadvantaged students by 15 points between 2009 and 2018 and an even greater increase of 32 points in mathematics between 2003 and 2012 (Figures 3.10 and 3.11). In contrast, the performance of the advantaged students as remained relatively stable. This suggests that not only has Türkiye been able to rapidly expand its education system over the past two decades but it has also been able to significantly improve the learning outcomes of the previously out-of-school students who now remain in school longer.

Part of the explanation for how this was achieved may relate to the profile of the 15-year-olds who joined the system. The Ministry has enacted a series of policies and initiatives to expand access to education, notably among girls and students from more disadvantaged backgrounds (Suna and Özer, 2022[9]) (Özer, 2022[10]). The share of the girls in the system increased (girls represented 45% of the 15-year-olds in PISA in 2003 and 49.6% in 2018) and girls in Türkiye outperformed boys in 2 out of 3 PISA domains (reading and science) (OECD, 2019[11]). Equally, while it tends to be the most disadvantaged adolescents who are out of school, in 2003, the share of in-school 15-year-olds was so low – with only around a third of students eligible for the PISA assessment – that some of the new students who have since joined the system must have come from middle socio-economic backgrounds. Other polices to such as increasing the number of classrooms, increasing teacher numbers and transportation services for students living in remote areas may also have contributed to improvements in quality and access.

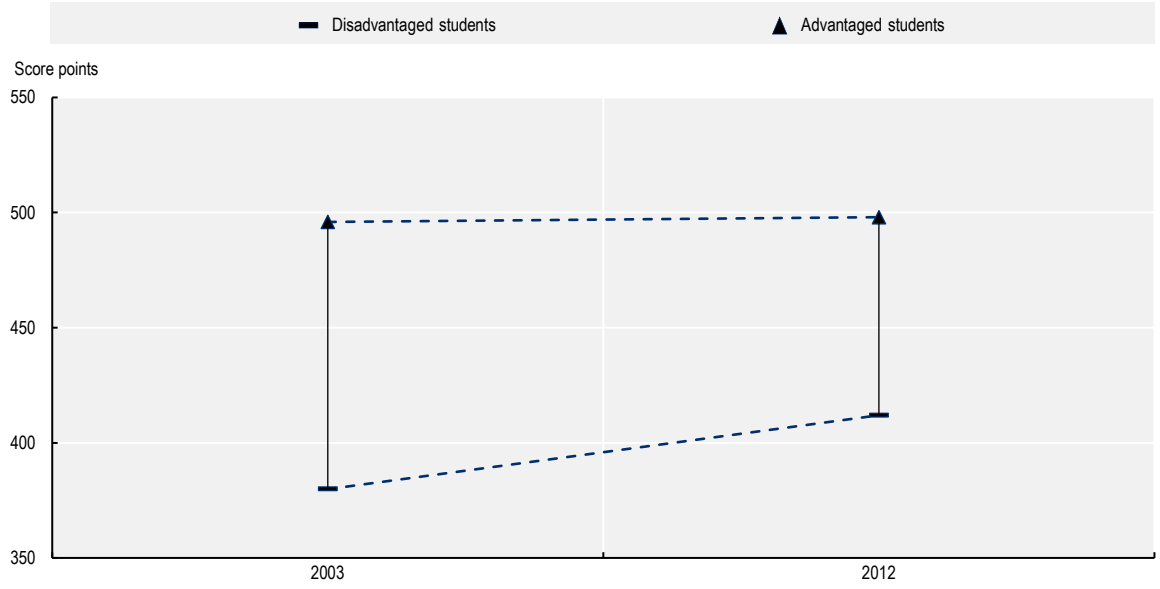
Figure 3.10. Average performance in reading of top and bottom socio-economic groups, PISA 2009 and 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/q9im1l

Figure 3.11. Average performance in mathematics of top and bottom socio-economic groups, PISA 2003 and 2012



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/r4yt12

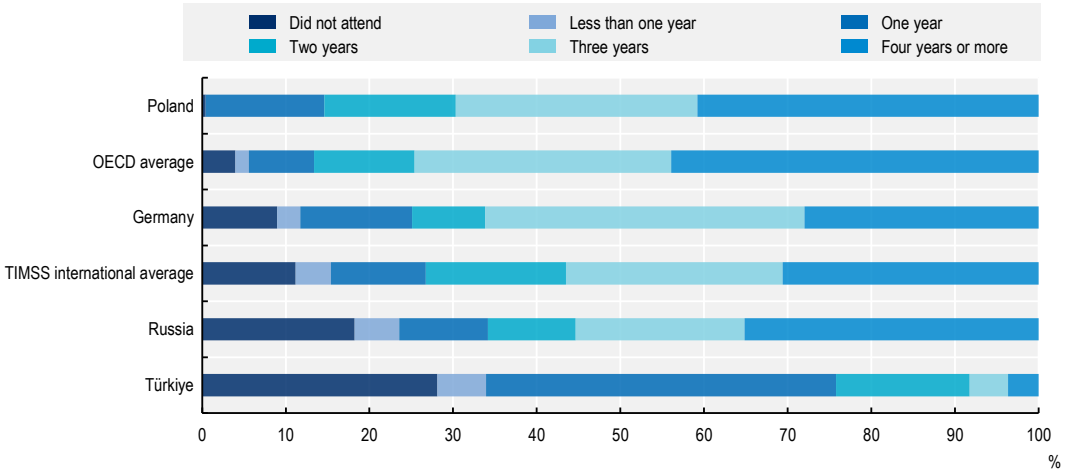
Early childhood education and care (ECEC) participation

Participation in ECEC

This section presents data from PISA and TIMSS about ECEC. It should be noted that both PISA and TIMSS measure participation in ECEC retrospectively. In the case of TIMSS, this means approximately 5 years prior to the 2019 assessment when the cohort of Grade 4 students were of ECEC age and in the case of PISA, approximately 10 years prior to the 2018 assessment, when the current cohort of 15-year-olds were of ECEC age.

In Türkiye, children start primary school at 5.5 years. ECEC (ISCED 0) covers the period before school begins.[6] According to TIMSS and PISA historic data, in the past, children in Türkiye were less likely to participate in ECEC than in many OECD countries and when children in Türkiye did participate in ECEC, it tended to be for less time. TIMSS 2019 data showed that 34% of children in Grade 4 in Türkiye did not attend ECEC or attended for less than 1 year, compared to only 6% of children on average across OECD countries (Figure 3.12). Evidence shows that the longer ECEC participation is, the greater the positive impact on students' performance (up to three to four years of participation) (OECD, 2021[12]). In Türkiye, among those who attended ECEC, only 8% attended for 3 years or more compared to 56% on average across OECD countries (Figure 3.12). According to the PISA data, a slightly higher share of students (37%) did not participate in ECEC or participated for less than 1 year (Figure 3.13).

Figure 3.12. ECEC attendance Grade 4, TIMSS 2019



Notes: For the purpose of this report, responses to the PISA and TIMSS questionnaires were harmonised to have the same categories of participation.
Source: IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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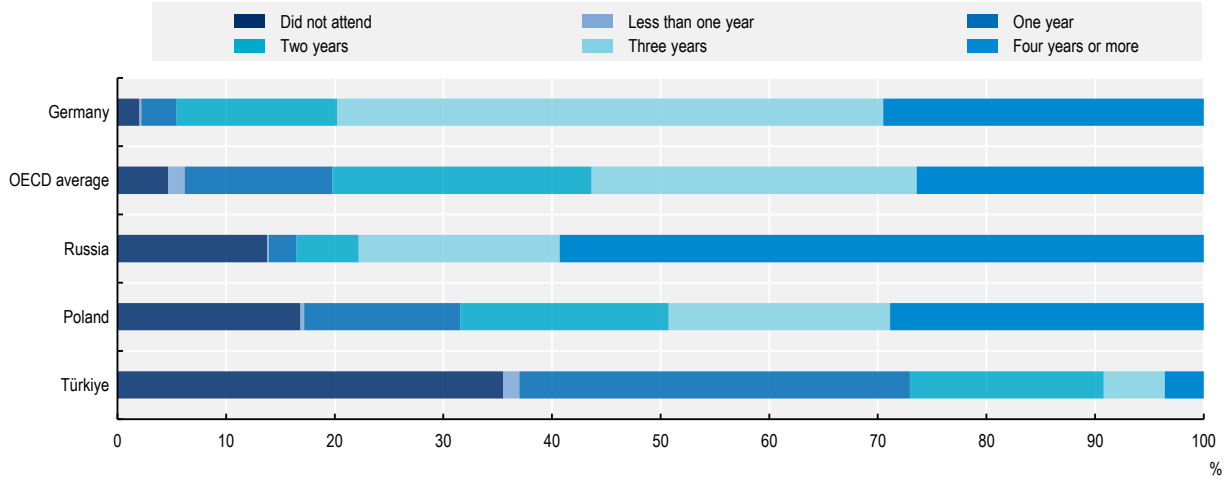
The difference in ECEC attendance across the PISA and TIMSS data is likely explained by the age difference of the students taking each assessment. While the students taking the Grade 4 TIMSS assessment were aged around 10 years old and therefore participated in ECEC around 4-5 years ago, the 15-year-olds in the PISA sample participated in ECEC around a decade ago. The difference across the assessments is likely driven by an increase in participation over time. This is also reflected by international data on ECEC participation in Türkiye (OECD, 2020[13]). While the increase in ECEC attendance in Türkiye over time has been significant, the increase in ECEC attendance in Poland was even bigger, going from

17% of children not attending ECEC or attending for less than 1 year in PISA 2018 to less than 1% in TIMSS 2019. This is also reflected in international enrolment rates of 3-5 year-olds (OECD, 2020[13]).

In line with TIMSS results, PISA shows that children in Türkiye tended to participate in ECEC for fewer years than in other countries – only 6% of 15-year-olds attended ECEC for at least 3 years compared to 30% on average among OECD countries (Figure 3.13).

Figure 3.13. ECEC attendance, PISA 2018



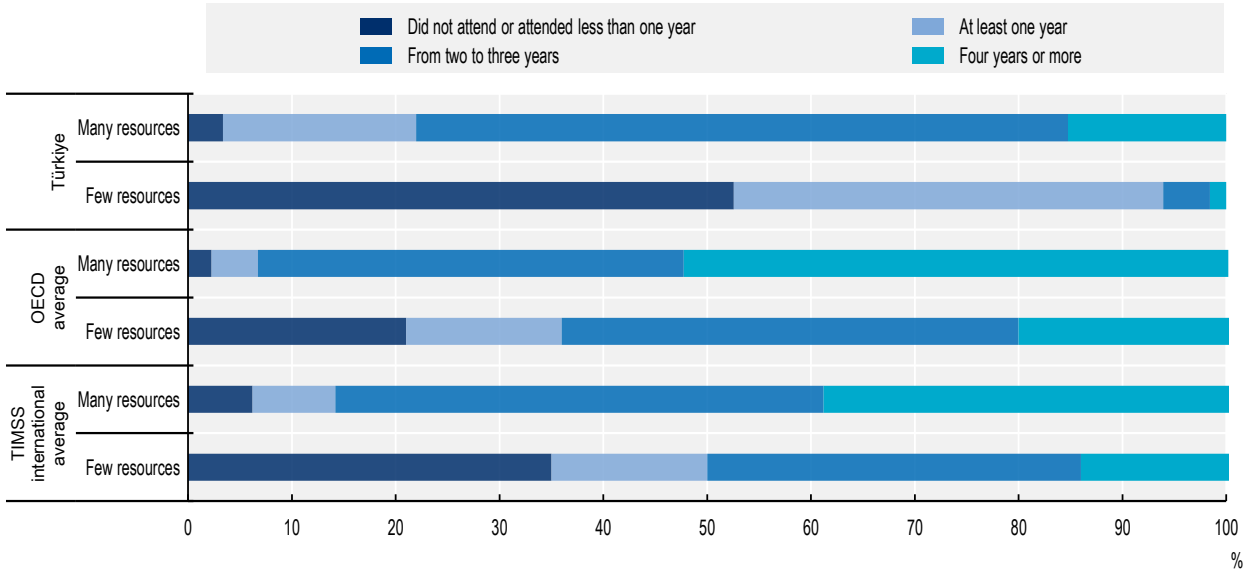
Notes: For the purpose of this report, responses to the PISA and TIMSS questionnaires were harmonised to have the same categories of participation.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/cdt9po

ECEC attendance and socio-economic status

Research has shown that the benefits of ECEC attendance tend to be greater for socio-economically disadvantaged children (Suziedelyte and Zhu, 2015[14]). The data from PISA and TIMSS suggest that in the past in Türkiye, there was a strong association between a student's socio-economic background and their participation in ECEC (Suna and Özer, 2022[9]). Data from both PISA 2018 and TIMSS 2019 show that, in Türkiye, students from disadvantaged backgrounds were far less likely to attend ECEC. According to TIMSS, more than 50% of students with few resources did not participate in ECEC or attended for less than 1 year compared to less than 4% of students with many resources. Students' socio-economic background was also associated with the duration of participation in ECEC. In TIMSS 2019, almost 60% of children with many resources attended ECEC for 2 or 3 years compared to less than 5% of children with few resources (Figure 3.14). In line with TIMSS, PISA data showed that, in Türkiye, 54% of disadvantaged students had not participated in ECEC or attended for less than 1 year compared to only 14% of advantaged students. Moreover, 40% of advantaged students attended ECEC for 2 or 3 years compared to 14% of disadvantaged students (Figure 3.15).

Figure 3.14. Duration of ECEC by socio-economic status, TIMSS 2019



Notes: Shares of students in each category of ECEC attendance are provided in Figure 3.12 and Figure 3.13.
Source: IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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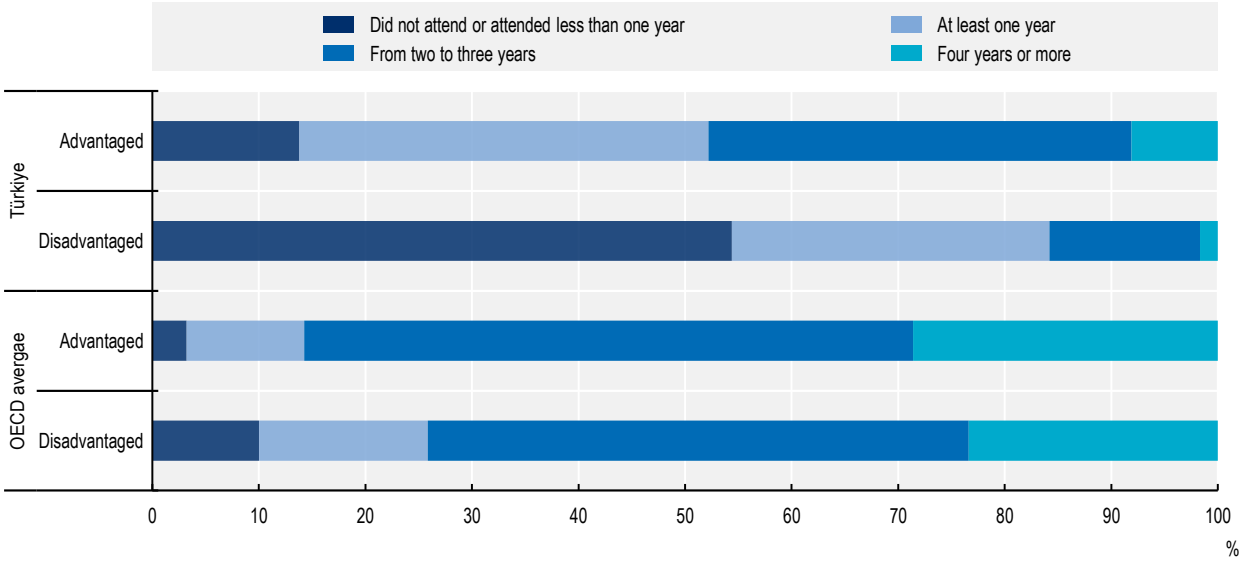
Figure 3.15. Duration of ECEC by socio-economic background, PISA 2018



Notes: Shares of students in each category of ECEC attendance are provided in Figure 3.12 and Figure 3.13.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/lej0fw

ECEC attendance and performance

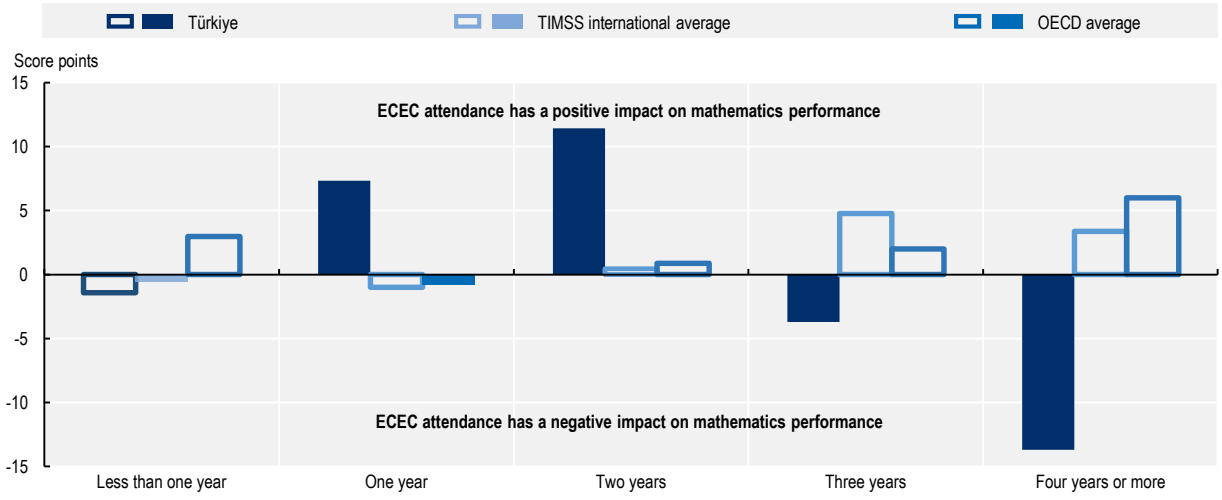
The benefits of ECEC extend well beyond cognitive development into social and emotional skills and labour market participation for mothers (OECD, 2020[15]). Equally, academic performance is influenced by a wide range of factors, of which prior experience of ECEC might only be one. Looking at the associations between ECEC attendance and school performance, therefore, only provides one aspect of a very large and complex picture on children's development. However, the data from international assessments do provide some insights on how ECEC experiences might be associated with later school performance.

Internationally, attending ECEC is positively associated with performance and this is the case in Türkiye (OECD, 2020[16]). However, since in many countries, students from advantaged backgrounds are more likely to attend ECEC and for longer periods, part of the positive impact of ECEC is associated with students' socio-economic background (OECD, 2021[12]). Across all OECD countries, accounting for students' socio-economic status results in the benefits in performance associated with ECEC attendance falling (Balladares and Kankaraš, 2015[17]). However, data from PISA and TIMSS show that in Türkiye in the past, after accounting for students' and schools' socio-economic status, ECEC was positively associated with reading performance only when children attended ECEC for one year in PISA and one and two years in TIMSS (Figures 3.16 and 3.17).

The PISA and TIMSS data do not provide insights as to why ECEC appeared to have a negative impact on performance once socio-economic status is accounted for in the past. However, one possible explanation is the quality of ECEC programmes in Türkiye, although neither the PISA nor TIMSS data can provide any information about ECEC quality. The fact that ECEC programmes appear to have a positive impact for longer in the more recent TIMSS data (Figure 3.16) might suggest that quality is improving. Evidence suggests that the long-term positive effect of ECEC attendance on cognitive skills is strongly dependent not only on the duration of attendance but also on the quality of the programme (OECD, 2021[12]).

Figure 3.16. ECEC attendance and performance in mathematics after accounting for socio-economic status, TIMSS 2019

Change in mathematics performance for every extra year of ECEC attendance (compared to not attending ECEC) after accounting for students' and schools' socio-economic status



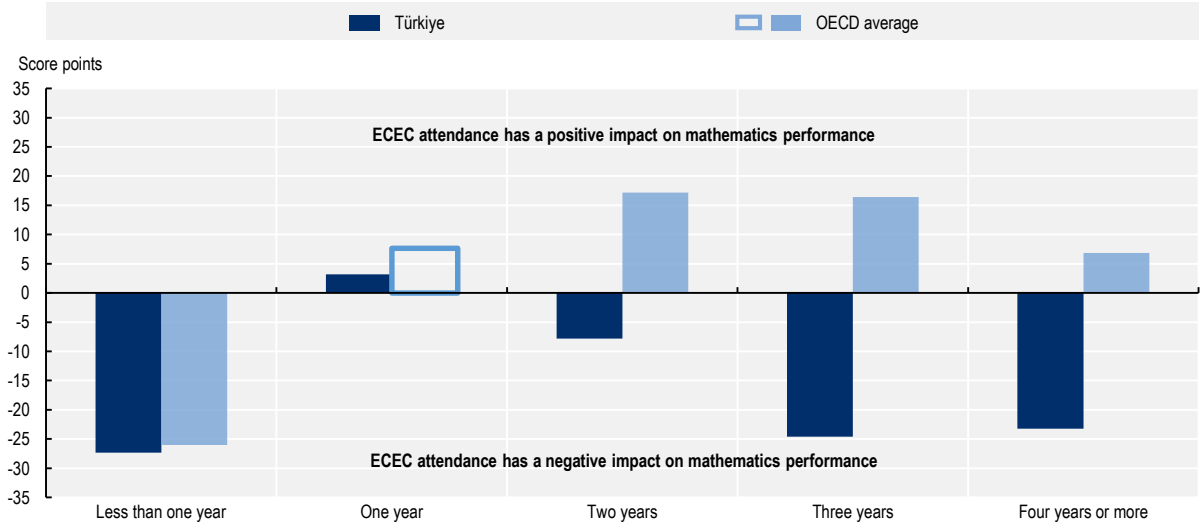
Note: The regression controls for students' and schools' socio-economic status to avoid an upward bias since this is positively correlated to both ECEC attendance and students' performance. Fully coloured bars represent results that are statistically significant at 95% level of significance while bars with a coloured border represent results that were not found to be statistically significant. Shares of students in each category of ECEC attendance are provided in Figure 3.12 and Figure 3.13.

Source: IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/wmo532

Figure 3.17. ECEC attendance and performance in reading after accounting for socio-economic status, PISA 2018

Change in reading performance for every extra year of ECEC attendance (compared to not attending ECEC) after accounting for students' and schools' socio-economic status



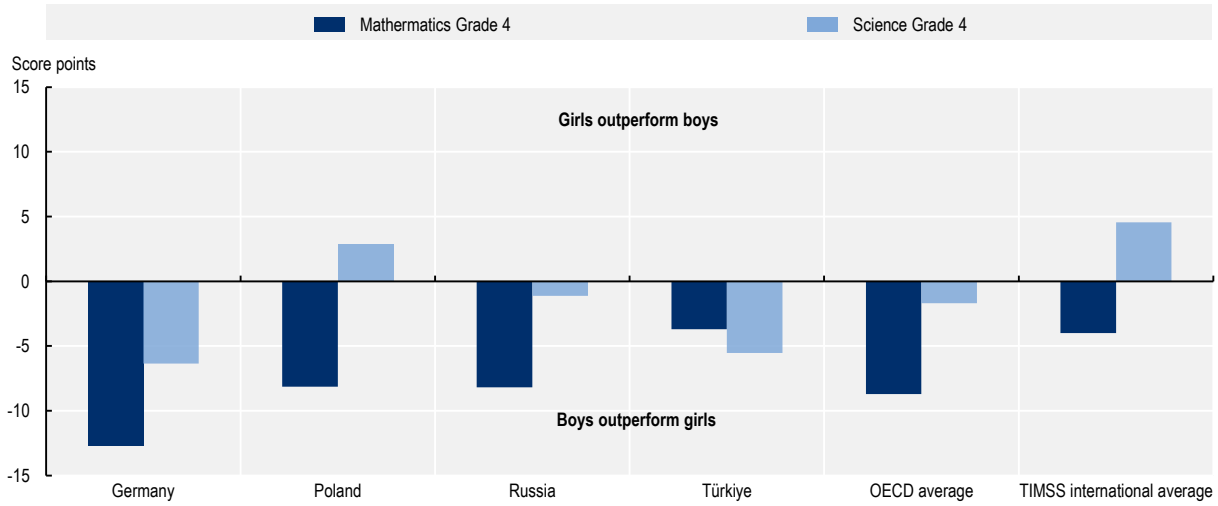
Note: The regression controls for students' and schools' socio-economic status to avoid an upward bias since this is positively correlated to both ECEC attendance and students' performance. Fully coloured bars represent results that are statistically significant at 95% level of significance while bars with a coloured border represent results that were not found to be statistically significant. Shares of students in each category of ECEC attendance are provided in Figure 3.12 and Figure 3.13.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/9irz3f

Gender

According to TIMSS, in Grade 4, boys outperform girls in Türkiye in both mathematics and science (Figure 3.18). There is a similar pattern of performance in many OECD and some TIMSS countries suggesting that the reasons young girls have lower performance than boys in these subjects might not be specific to Türkiye. By Grade 8, girls in Türkiye outperform boys in mathematics and science (Figure 3.19). While the gender gap narrows in most countries as children move through school, the improvement in girls' performance in Türkiye is particularly marked by Grade 8.

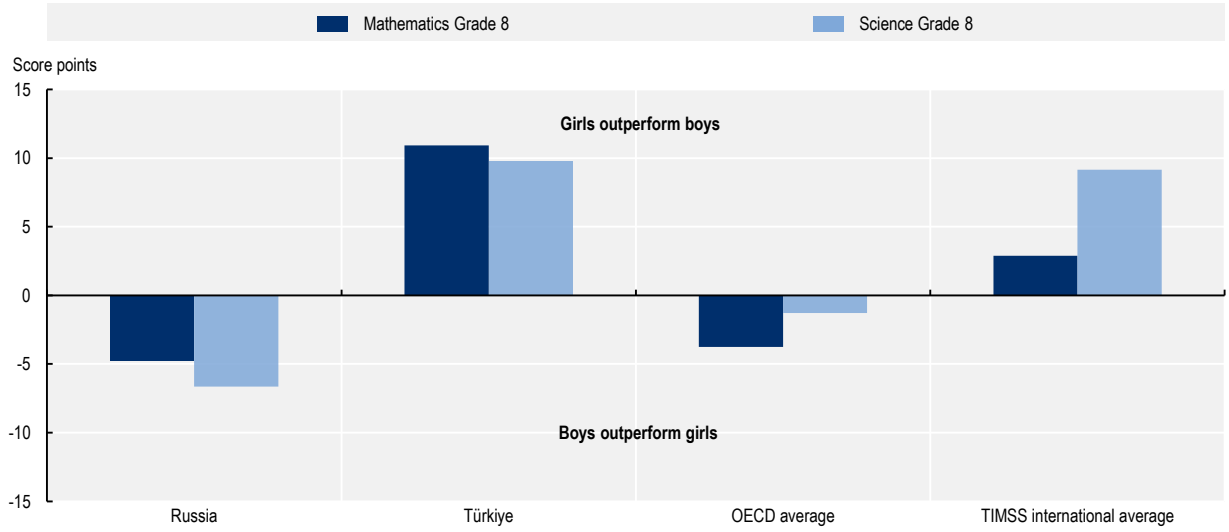
Figure 3.18. Performance by gender in Grade 4, TIMSS 2019



Source: IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/dh84y5

Figure 3.19. Performance by gender in Grade 8, TIMSS 2019



Source: IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

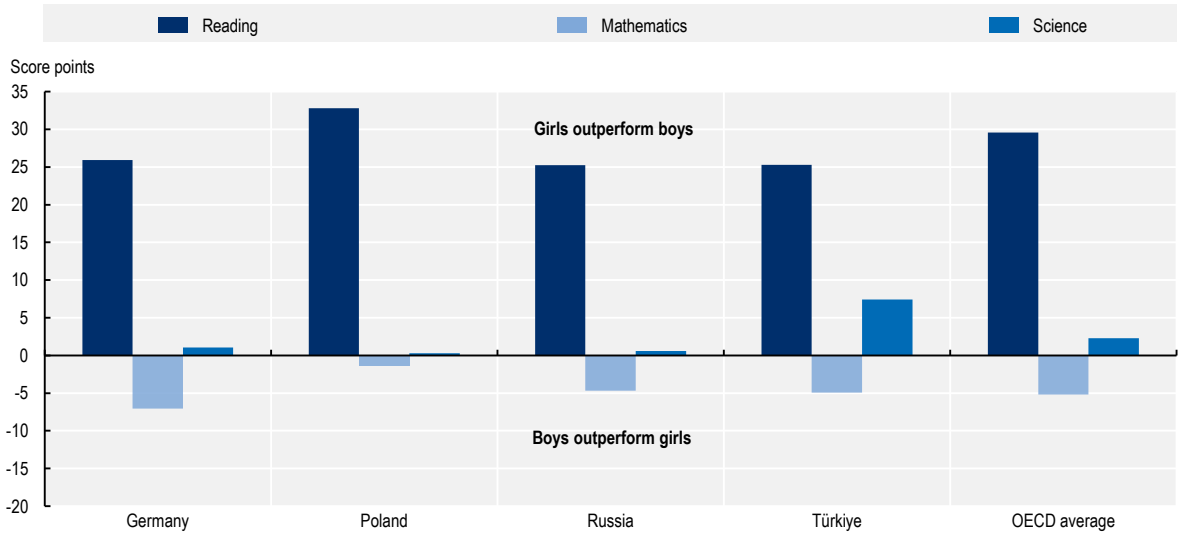
StatLink https://stat.link/tyhbmk

At 15-years-old, according to PISA, girls in Türkiye outperform boys in reading while boys slightly outperform girls in mathematics with patterns of performance very similar to the OECD average. An exception is science, where the higher performance of girls in Türkiye is more pronounced (Figure 3.20).

The gender distribution of in-school and out-of-school students may also be impacting student performance in Türkiye. The first time that Türkiye participated in PISA in 2003, girls were underrepresented, presenting only 45% of the PISA sample (which is designed to be representative of the overall in-school student

population). The share of 15-year-old girls has progressively increased over PISA cycles, to reach 49.6% in PISA 2018 (OECD, 2019[2]). Since girls in Türkiye outperform boys in reading and science at 15 years of age (and in mathematics and science in Grade 8), this partly explains the rise in both participation and performance in Türkiye in recent decades.

Figure 3.20. Performance by gender at 15 years of age, PISA 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/08luir

Student language

TIMSS and PISA provide data on the share and performance of students who speak the language of the test at home, which is Turkish in the case of Türkiye. The vast majority of students in Türkiye throughout schooling always or almost always speak Turkish at home (Table 3.1). The share of students who do not speak Turkish at home declines throughout schooling to just 7% for 15-year-olds, as measured by PISA.

Table 3.1. Share of students who speak the language of test at home, TIMSS 2019 and PISA 2018

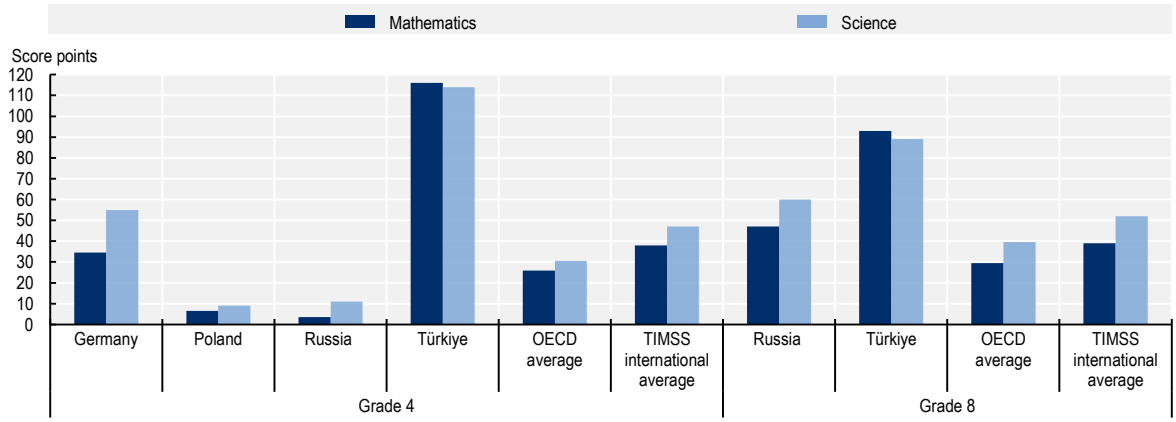
		Always or almost always speak the language of the test at home* (%)	Sometimes or never speak the language of the test at home (%)
Grade 4, TIMSS	Türkiye	86	14
	OECD average	85	15
	TIMSS international average	77	23
Grade 8, TIMSS	Türkiye	88	12
	OECD average	93	7
	TIMSS international average	81	19
15-year-olds, PISA	Türkiye	93	7
	OECD average	88	12

Note: * The four categories were merged into two to make interpretation easier. TIMSS asks students in both Grade 4 and 8 how often they speak the language of the test at home. The variable includes the following categories: "always," "almost always," "sometimes," or "never" speak the language of the TIMSS test at home.
Source IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021); OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

While the vast majority of students regularly speak Turkish at home, those who do not have far lower performance in Grades 4 and 8 (Figure 3.21). However, the performance difference declines as children move through school, which perhaps reflects the equalising impact of school in Türkiye, with school attendance particularly benefitting those students who have fewer opportunities to regularly speak Turkish at home.

Figure 3.21. Performance difference by language spoken at home, TIMSS 2019

Performance difference in score points between students who always or almost always speak the language of the test at home and those who sometimes or never speak the language of the test at home



Note: The bar for each country shows the score point difference between students who speak the language of the test at home and those who sometimes or never speak the language of the test at home.
Source: IEA (2020[3]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

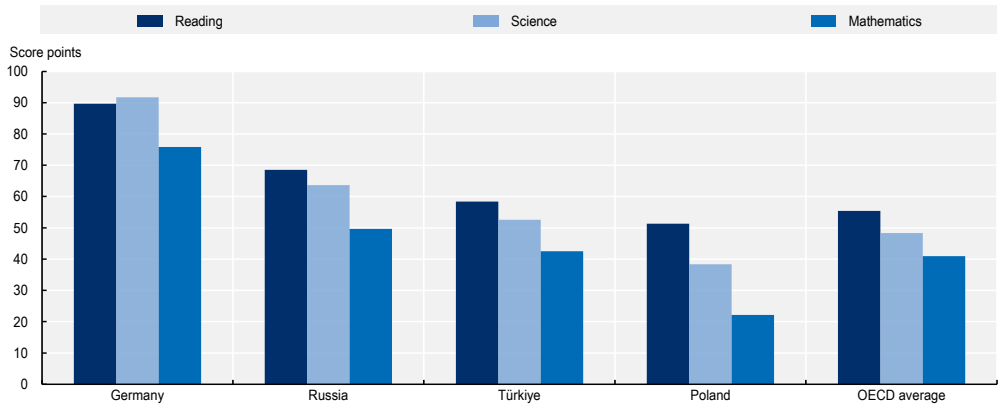
StatLink https://stat.link/x3yg60

At 15-years-old, the difference between students who speak Turkish at home and those who do not is similar to the OECD average (Figure 3.22). One possible explanation for the apparent decline in the impact

of not speaking Turkish at home is that school continues to have an equalising effect. It is also possible that some of these students may move into groups of students that are not sampled by PISA.

Figure 3.22. Performance difference by language spoken at home, PISA 2018

Performance difference in score points between students who always or almost always speak the language of the test at home and those who sometimes or never speak the language of the test at home



Note: The bar for each country shows the score point difference between students who speak the language of the test at home and those who sometimes or never speak the language of the test at home.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/brzp5a

Conclusions

In Türkiye, the data from TIMSS show that there are wide inequities across children in Grade 4 and that many children (over 26%) come from disadvantaged backgrounds (i.e. home backgrounds where there are few resources) (Mullis et al., 2020[5]). While participation in ECEC has increased in recent years, in the past, it has also seemed to play a limited role in driving equity before children start school (Figures 3.16 and 3.17). This might be because mainly advantaged children tended to benefit from ECEC and the impact from ECEC on learning outcomes was limited, once students' socio-economic background is accounted for (Figures 3.16 and 3.17). However, once children are in school, some indicators of equity improve, perhaps suggesting that performance becomes more equitably distributed across different groups of students – by socio-economic background (Figures 3.5 and 3.6) and the language spoken at home (Figures 3.21 and 3.22) – as students move through school. Equity in terms of gender has also improved in Türkiye. The increase in the participation of 15-year-olds has particularly benefitted girls who are no longer underrepresented in the school population. In PISA 2003, girls represented were 45% of the PISA sample (compared to 49.6% in PISA 2018 (OECD, 2019[11])). The increase in girls as a share of the 15-year-old population, given their higher performance on reading and science in Türkiye, may also be part of the explanation for the rise in both performance and participation at the same time. Other policies and initiatives undertaken over this period, such as expanding access to school for all students and improving school infrastructure also likely contributed to these improvements.

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Notes

[1] In this report, the terminology of “TIMSS Grade 4” is used throughout since this is the official name of the assessment. However, the data refer to Grade 5 students in lower secondary education in Türkiye.

[2] For consistency across the PISA analysis and in line with the OECD’s standard practice for comparative analysis, an average of TIMSS-participating countries (“TIMSS international average”) and OECD countries that participate in TIMSS (“OECD average”) are used throughout this report.

[3] The PISA coverage index is the proportion of 15-year-olds in a country or economy that were covered by the PISA sample (OECD, 2019[2]). The difference between the PISA coverage index for Türkiye (73% in 2018) and the enrolment rate for 15-year-olds in 2018 (92%) in Türkiye is because of a number of factors including excluded students (5.66%) and students attending open high schools.

[4] Reasons for attending an open high school include: being over 18 years which means that students can no longer enrol in physical high schools; students who are required to repeat a grade more than once; students who are suspended from physical high schools; and married students.

[5] The PISA coverage index is the proportion of 15-year-olds in a country or economy that were covered by the PISA sample (OECD, 2019[2]). The difference between the PISA coverage index for Türkiye (73% in 2018) and the enrolment rate for 15-year-olds in 2018 (92%) in Türkiye is because of a number of factors including excluded students (5.66%) and students attending open high schools.

[6] Early childhood education and care (International Standard Classification of Education [ISCED] 01) in Türkiye covers children between 0 and 68 months old. Families seeking care services can send their children to nurseries and day-care centres functioning under the Ministry of Family and Social Services, all of which are private. Early childhood education or pre-school education (ISCED 02) covers children between 36 and 68 months old. Children in this age group go to public and private formal education establishments affiliated to the Ministry of National Education or institutions affiliated to the Ministry of Family and Social Services.

4 Exploring associations between schools and student performance

This chapter explores associations between the characteristics of schools in Türkiye and student performance. Specific characteristics that are explored include the socio-economic composition of school and the national types of upper secondary school that students attend, of which there are eight in the OECD Programme for International Student Assessment (PISA) sample. The chapter also explores how different types of upper secondary schools in Türkiye differ in terms of student gender, school location, school resources, provision of study help and extracurricular activities. The chapter also looks at the performance and composition of private schools in Türkiye.

This chapter explores associations between the characteristics of schools in Türkiye – such as the socio-economic composition, location and type of upper secondary school (high school) – and performance in the International Association for the Evaluation of Educational Achievement (IEA) Trends in International Mathematics and Science Study (TIMSS) and OECD PISA international assessments. It identifies if specific school-level factors are associated with lower-than-average performance.

Box 4.1. What the data tell us

- Schools in Türkiye are highly segregated by performance and students' socio-economic background in the TIMSS Grade 4 assessment.[1]
- Differences in performance between schools decline by Grade 8 according to TIMSS data. This might be driven by school attendance having an equalising effect on learning outcomes in Türkiye.
- According to PISA data, there are very wide performance differences across different types of upper secondary schools. Top-performing Science High Schools score 190 points more than Multi-Programme High Schools at the bottom.
- Students from an advantaged background are more likely to attend the higher-performing upper secondary schools and students from a disadvantaged background are more likely to attend the lower-performing upper secondary schools.
- According to both the PISA and TIMSS data, the difference in performance between schools in cities and less-populated towns or rural areas is one of the highest across the OECD.
- Across both PISA and TIMSS, advantaged schools[2] have lower student-teacher ratios, report fewer shortages in school resources and provide more study help to their students.
- Private school attendance has expanded rapidly in recent decades. The PISA data show that while private schools have more socio-economically students from an advantaged background and more resources, students in private schools perform below those in public schools, on average.

Performance and socio-economic status across schools

TIMSS Grade 4

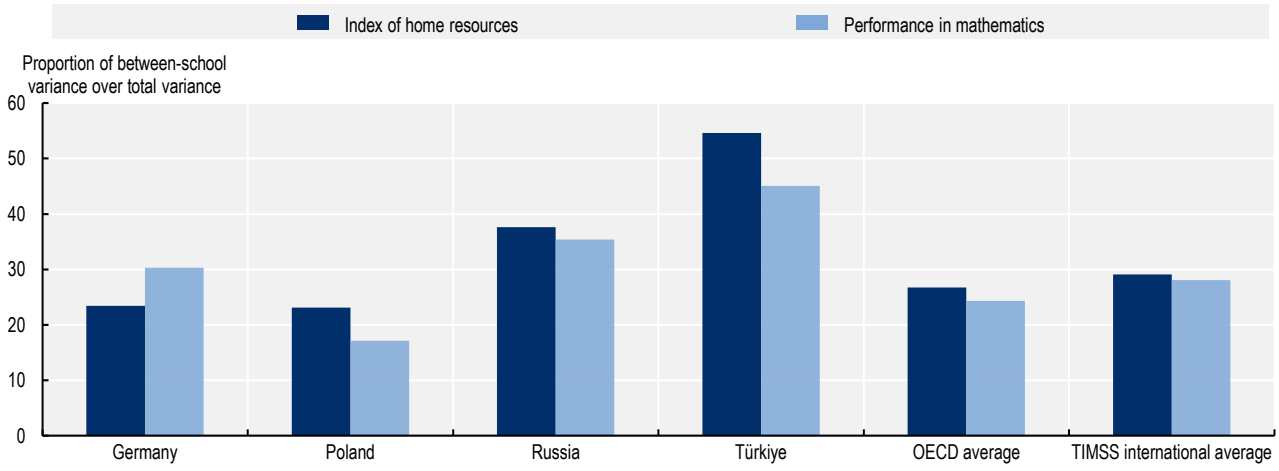
The data from TIMSS Grade 4[3] suggest that in the first year of lower secondary, schools in Türkiye are segregated along socio-economic and performance lines. In Grade 4, almost half of the variation in students' mathematics and science performance occurs between schools (Figure 4.1). This is 21 percentage points above the OECD average and the highest among all TIMSS-participating countries – in only Pakistan, Saudi Arabia and the United Arab Emirates is the variation in performance between schools higher.

In Türkiye, there is also a high degree of variation in socio-economic status across schools (Figure 4.1). This is also well above the OECD average and is the highest among all participating countries except Bulgaria. This means that lower secondary schools in Türkiye frequently group together either lower-performing and disadvantaged children or higher-performing and advantaged children in separate schools.

Since private schooling is relatively low and there are no selection criteria to enter lower secondary schools in Türkiye, the high levels of variation in socio-economic background between different schools might reflect residential segregation in the general population, i.e. families and children from disadvantaged

backgrounds tend to live in the same neighbourhoods and go to the same schools, while those from advantaged backgrounds tend to live in different neighbourhoods and go to different schools.

Figure 4.1. Variation in mathematics performance and home resources between schools, Grade 4 TIMSS 2019



Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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It is important to note that overall variation in socio-economic status across the student body in Türkiye is high (see Chapter 3). However, heterogeneity in socio-economic background across students need not necessarily lead to socially segregated schools. Some countries with overall high levels of variation in students' socio-economic background manage to create more socially mixed primary schools, which leads to less variance in performance between schools such as in Hong Kong (China) and Hungary (Mullis et al., 2020[2]). A greater understanding of residential segregation, school admission policies and educational and resourcing policies to compensate for disadvantage in those countries would help to understand the factors that influence these results.

TIMSS Grade 8

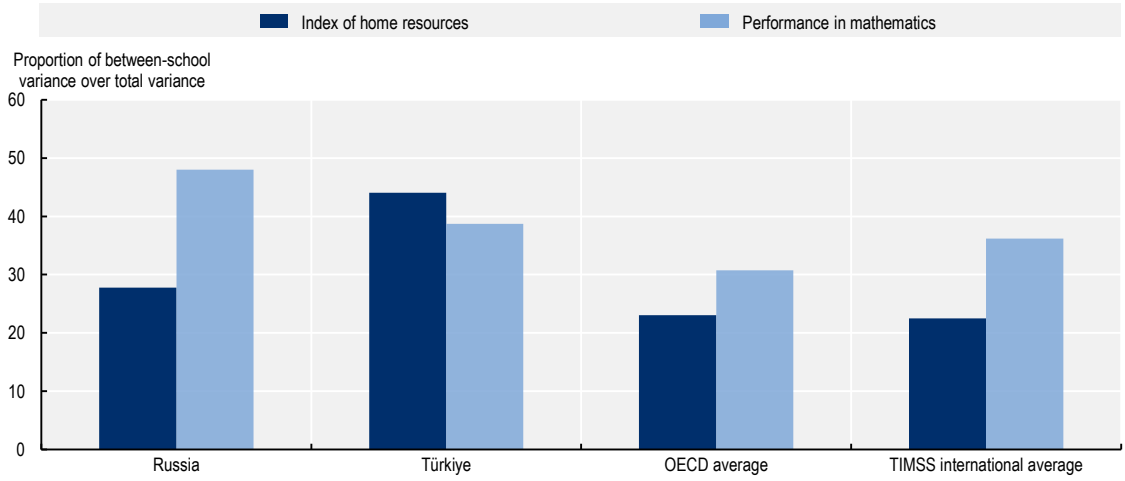
By Grade 8, the variance in performance between schools in Türkiye falls to broadly similar levels as the OECD average (Figure 4.2). One factor contributing to the fall in the performance variance between schools might be the narrowing of the performance gap between students with an advantaged and disadvantaged background(see Chapter 3). As discussed in Chapter 3, data from TIMSS suggest that the education system has an equalising effect on learning outcomes in Türkiye, which results in a fall in the performance gap between students with an advantaged and a disadvantaged background between Grades 4 and 8, and, at the school level, in a narrowing of the difference in performance between schools, even while variation in socio-economic status remains comparatively high.

In Grade 8, the variation in socio-economic background between schools remains far above the OECD average although it does fall slightly – the difference between Türkiye and the OECD average narrows by seven points compared with Grade 4 (Figure 4.2). The slight decline is difficult to explain since in the 2019 TIMSS assessment, students for both the Grade 4 (Grade 5 in Türkiye) and Grade 8 assessment are theoretically all in lower secondary schools and so the decline cannot be explained by changes in the

residential area that schools cover. However, it is possible that student movement across schools may contribute. The TIMSS scale for home resources was constructed differently in Grades 4 and 8 (see Box 3.1 in Chapter 3) which may also impact the results.

Another reason why the variation in performance and socio-economic status between schools in Türkiye falls to similar levels as the OECD average in Grade 8 is that the OECD average itself increases. While schools in Türkiye seem to become slightly less segregated on performance and socio-economic grounds between Grades 4 and 8, the reverse is true in many OECD countries.

Figure 4.2. Variation in mathematics performance and home resources between schools, Grade 8 TIMSS 2019



Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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PISA

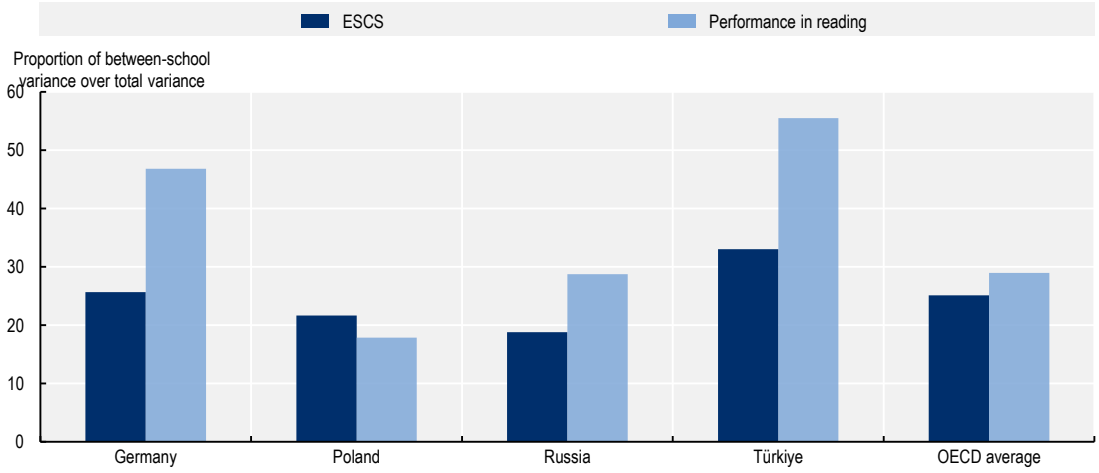
For 15-year-olds, the variation in performance between schools in Türkiye is among the highest across the OECD and is over 26 percentage points greater than the OECD average. It is likely that the selective school admission policies for upper secondary schools in Türkiye at least partially influence the large variance in performance between schools in PISA (Box 4.2). Other countries with selective admission school policies in upper secondary education or earlier, such as Austria, the Czech Republic, Germany, Hungary, the Netherlands and the Slovak Republic, also have similarly high levels of between-school performance variance.

In Türkiye, the high difference in performance between schools unsurprisingly leads to a very high isolation index for high-performing students (i.e. high-performing students are very frequently grouped together) – the highest across the OECD – and a high isolation index for low performing students (i.e. low performing students are very often grouped together) (Figure 4.4). Other countries with selective entrance systems based on ability, such as Germany, Hungary, the Netherlands and the Slovak Republic, also have high indices of isolation for low- and high-performing students.

The variation in socio-economic status between schools in Türkiye is higher than the OECD average and is the sixth-highest across OECD countries (Figure 4.3). This reflects that, to a large extent, students are segregated by socio-economic background across the different types of upper secondary schools (Suna, Tanberkan and Özer, 2020[3]). However, in the most common upper secondary schools – Anatolian High

Schools and Vocational and Technical High Schools – the social segregation is less pronounced (Figure 4.3).

Figure 4.3. Variation in reading performance and ESCS between schools, PISA 2018



Note: ESCS stands for PISA index of economic, social and cultural status
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

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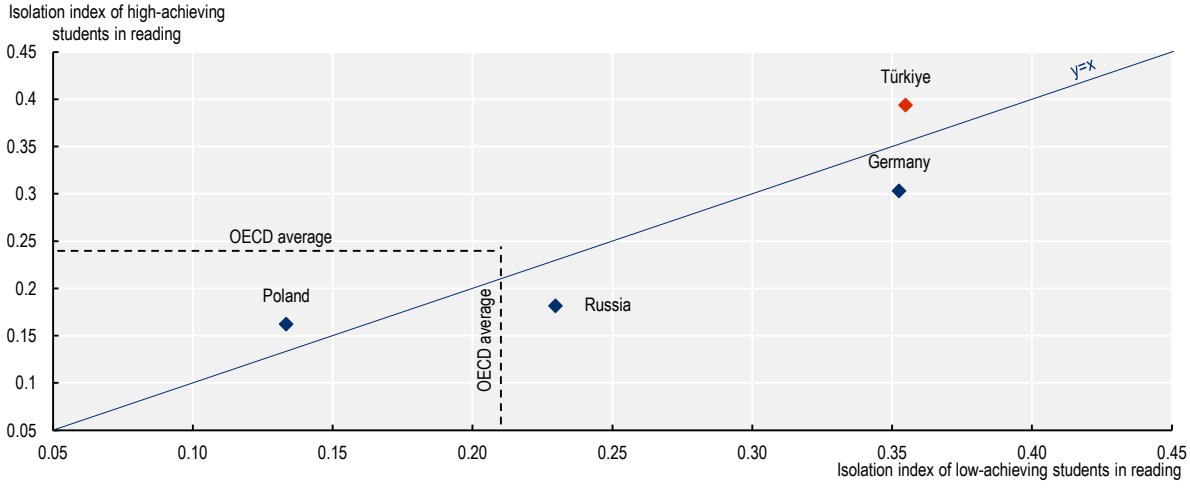
Figure 4.4. Isolation index of low- and high-achieving students in reading, PISA 2018



Note: The analysis is restricted to schools with the modal International Standard Classification of Education (ISCED) level for 15-year-old students. The isolation index measures whether students of type-A are more concentrated in some schools. The index is related to the likelihood of a representative type-A student to be enrolled in schools that enrol students of another type. It ranges from 0 to 1, with 0 corresponding to no segregation and 1 to full segregation (see (OECD, 2021[4]) for a more complete description). Low-achieving students are students who scored amongst the bottom 25% of students within their country or economy on the PISA test. High-achieving students are students who scored amongst the top 25% of students within their country or economy on the PISA test.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

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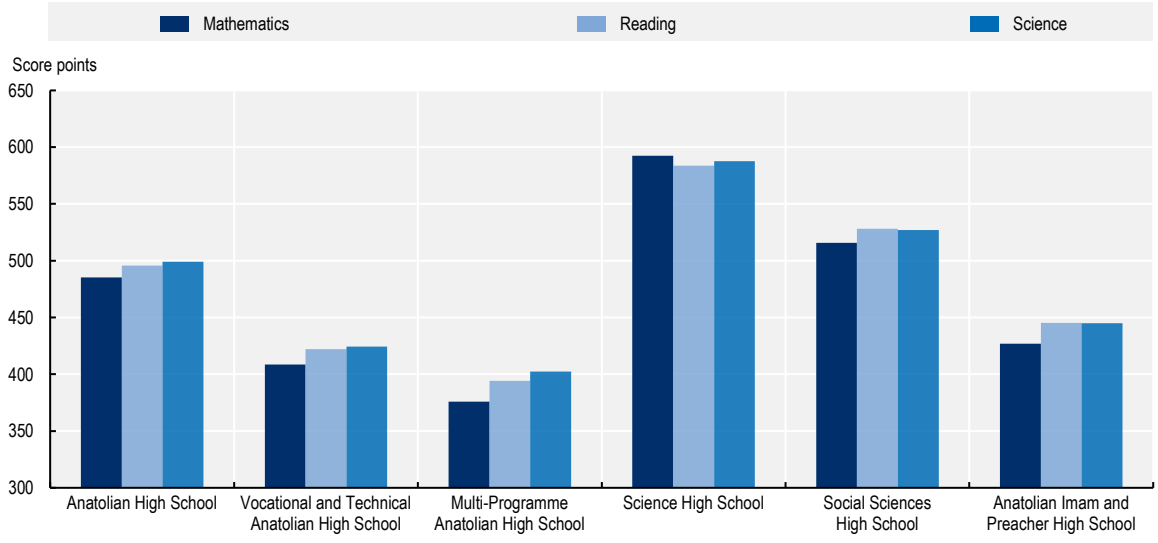
The 2018 changes in Türkiye to upper secondary school entry may help to create more balanced schools in terms of socio-economic status in the future – notably in the Anatolian High Schools and Vocational and Technical High Schools (Box 4.2). However, as the TIMSS data show, social and performance segregation in Türkiye occurs in lower secondary education in the absence of selective school policies. The latter may reflect residential segregation or other factors that are not observable in the international assessment data. In the country's elite schools – the Science and Social Science High Schools – where social segregation is most marked, students will continue to be required to take competitive examinations for entry. The social composition of these schools might not be affected by the recent end to entrance examinations.

Analysis of upper secondary school type

Average performance across upper secondary schools

Average performance differs significantly across the different types of upper secondary schools in Türkiye (Figure 4.5). Between the top and bottom upper secondary school types, there is a 216 score point difference in average performance in mathematics. To help understand the magnitude of the difference in performance across schools one can compare the average performance in upper secondary schools to countries' average performance. At the top, with an average performance of 592 in mathematics, the performance in Science High Schools is higher than all PISA-participating countries' average performance. While at the bottom, with an average performance of 376 in mathematics, performance in Multi-Programme Anatolian High Schools would be among the lowest 10% of all PISA-participating counties, with a performance similar to that of Georgia, Indonesia and Panama (OECD, 2019[5]).

Figure 4.5. Average performance by upper secondary school, PISA 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

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Box 4.2. Upper secondary education in Türkiye

In Türkiye, as well as following either vocational or academic pathways in upper secondary education, students also attend different types of upper secondary schools. Within the PISA sample, while there are eight types of upper secondary schools, the majority of students attend either an Anatolian High School or a Vocational and Technical Anatolian High School (Table 4.1).

Table 4.1. Share of students by upper secondary school type, PISA 2018

Pathway	Type of upper secondary school	Share of students (%)
General	Anatolian High School	46.0
	Science High School	4.0
	Social Sciences High School	1.4
	Anatolian Imam and Preacher High School	12.7
	Sport/Arts High School	0.5
	Lower Secondary School	0.5
General/vocational	Multi-Programme Anatolian High School	3.3
Vocational	Vocational and Technical Anatolian High School	31.5

Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en..

Students are placed in one of the different upper secondary schools at the end of Grade 8, at 13.5 years of age (see Chapter 1). Until 2018, students were placed in upper secondary schools based on their preferences, their results in a centralised national examination – the Transition from Elementary School to Secondary School Examination (*Temel Eğitimden Ortaöğretime Geçiş Sistemi*, TEOG) and the results of their classroom assessments in lower secondary school. In 2018, the TEOG was abolished and entrance to most upper secondary schools based instead on a combination of student choice, catchment areas and overall achievement in lower secondary. Students can still opt to take a national examination for entry to the most sought-after upper secondary school places – including the Science and Social Sciences High Schools (Kitchen et al., 2019[6]). This chapter presents data from PISA 2018, when the students taking the assessment would have entered upper secondary school under the previous TEOG system.

Source: Kitchen, H. et al. (2019[6]), *OECD Reviews of Evaluation and Assessment in Education: Student Assessment in Türkiye*, https://dx.doi.org/10.1787/5edc0abe-en; OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

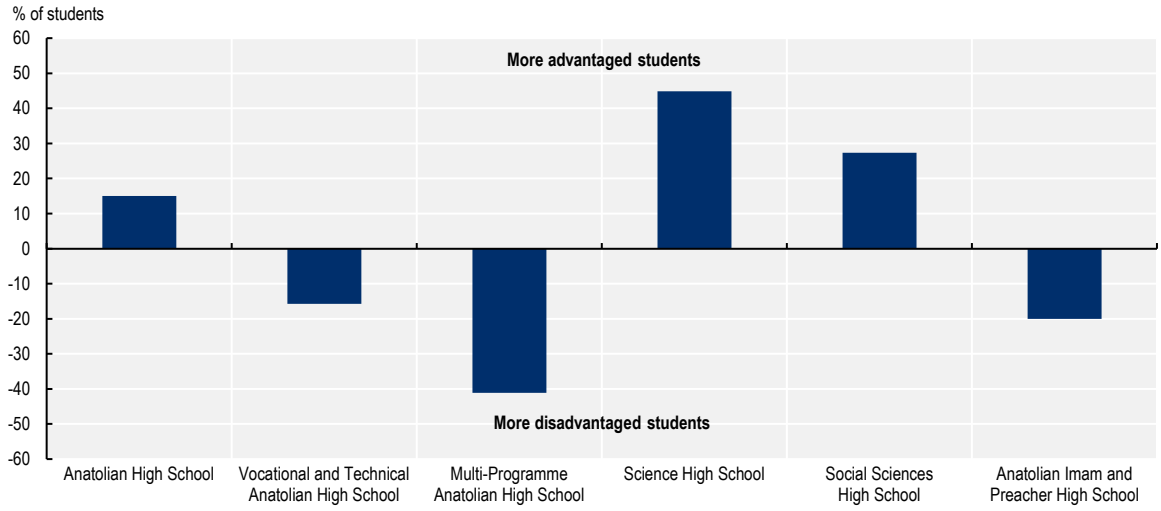
Upper secondary school attendance by students' socio-economic status

The between-school variation in socio-economic background in Türkiye is among the highest across the OECD. In systems that use selective school entrance policies based on ability, effectively selecting students is difficult because background and performance tend to be correlated. In Türkiye, the high levels of variance in both performance and socio-economic background between schools suggests that school selection policies are not always effectively selecting students based on performance alone. Students from an advantaged background are over-represented in all the higher-performing types of upper secondary schools – Anatolian High Schools, Science and Social Sciences High Schools – while, conversely, students with a disadvantaged background are over-represented in all of the lower-performing schools –

Vocational and Technical Anatolian High Schools, Multi-Programme Anatolian High Schools and the Anatolian Imam and Preacher High Schools (Figure 4.6).

After accounting for students' socio-economic background, the general distribution of performance across Türkiye's upper secondary schools remains, i.e. the same schools remain at the top, the middle and the bottom (Figure 4.7). It is notable that in some of the schools that enrol the greatest share of students – Anatolian High Schools and the Anatolian Imam and Preacher High Schools – the average score is impacted only slightly by socio-economic background, suggesting that students of all backgrounds have a fair chance of entering such schools. However, in the highest- (Science High Schools) and lowest-performing (Multi-Programme High Schools) upper secondary schools – where there are the greatest differences by socio-economic status in terms of student enrolment – student background accounts for a far greater share of students' results. This suggests that entrance to these school types may not be shaped by students' performance alone.

Figure 4.6. Share of students with an advantaged and a disadvantaged background by upper secondary school type, PISA 2018

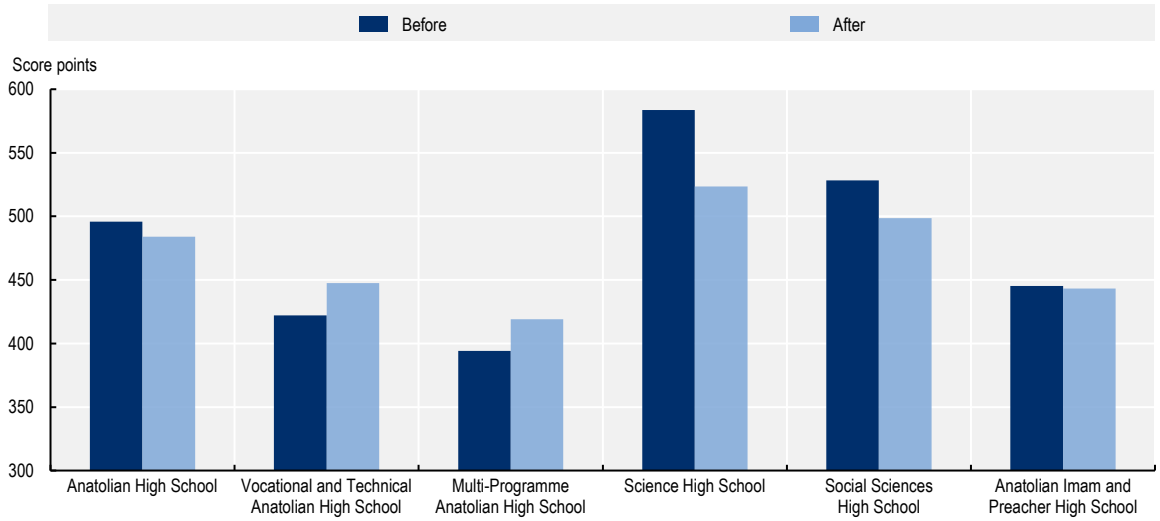


Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/q71cj4

Figure 4.7. Students' performance by school type, PISA 2018

Before and after accounting for student and school socio-economic background



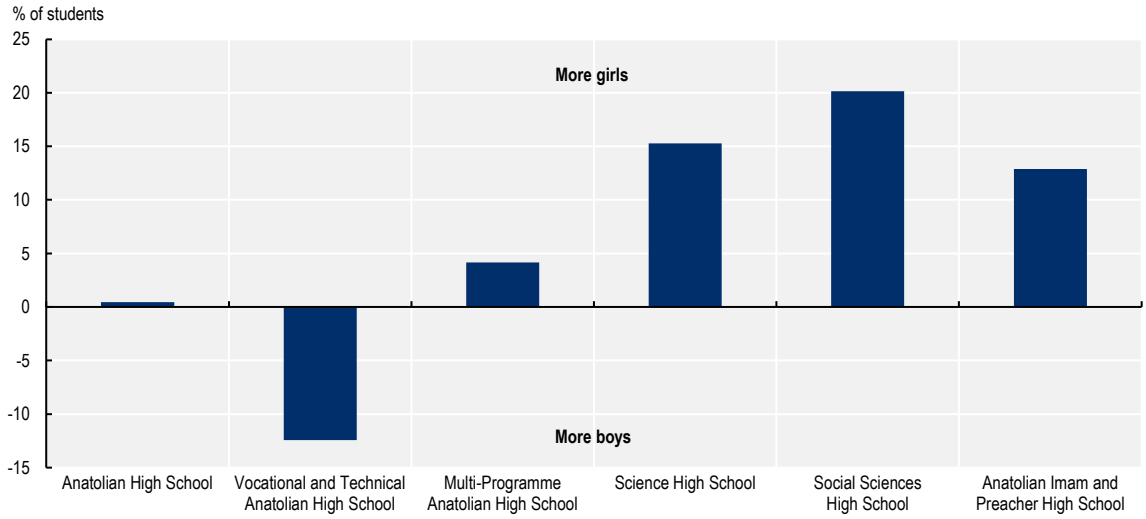
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/wzlief

Upper secondary school attendance by students' gender

As is the case across OECD countries on average, boys in Türkiye are more likely to attend vocational schools– the Vocational and Technical Anatolian Schools in Türkiye – which also tend to be lower-performing (Figure 4.8). Girls in Türkiye are over-represented in the highest performing upper secondary schools: Science and Social Sciences High Schools. This partly reflects the fact that girls outperform boys in mathematics and science in Grade 8 (the year when selective school entrance examinations are taken, see Chapter 3).

Figure 4.8. Upper secondary school attendance by gender, PISA 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/whkfic

School location

In Türkiye, students of all ages tend to attend schools in urban areas more than students in other countries and less than 1% of students attend schools in remote or rural areas (Table 4.2). Internationally, there is a positive association between schools being located in urban areas and performance. In Türkiye, this association is particularly strong at all levels of schooling. While students living in urban areas (cities in PISA and urban, sub-urban and medium-sized cities in TIMSS) perform at similar levels to the OECD average across PISA- and TIMSS-participating countries, both assessments show that students living in smaller areas (i.e. towns and rural or remote areas) perform significantly below their more urban peers (Figure 4.16).

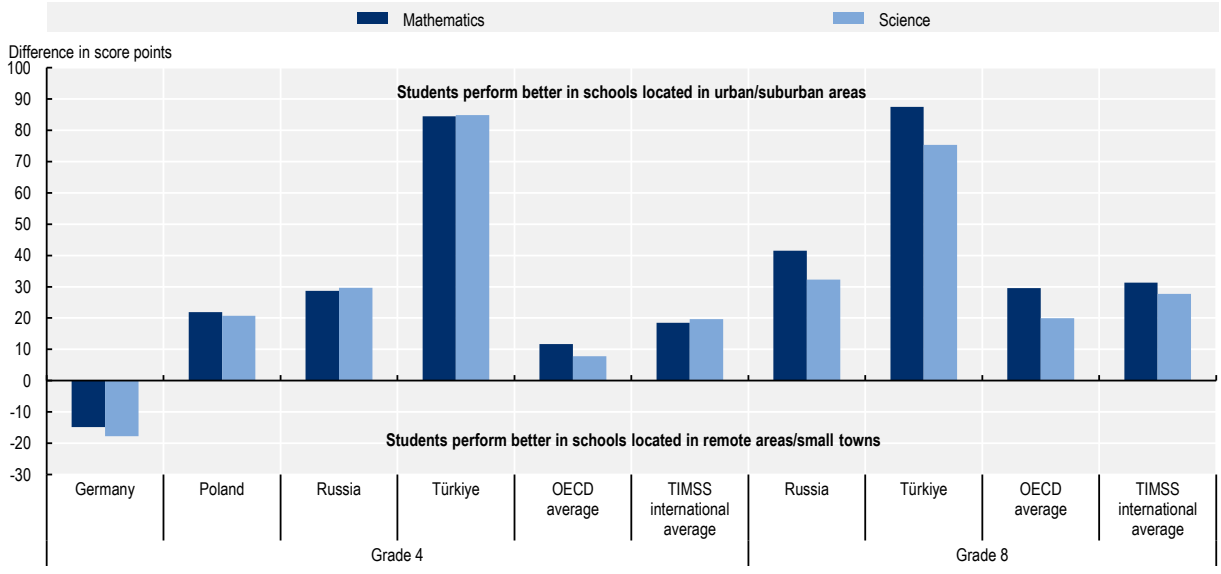
Table 4.2. Share of students by school location in Türkiye, TIMSS 2019 and PISA 2018

			Share of students (%)	
PISA	City	Over 100 000 people	67.1	
	Town	3 000 to 100 000 people	31.9	
	Rural	Fewer than 3 000 people	1	
			Grade 4	Grade 8
TIMSS	Urban	Densely populated	44	46
	Sub-urban	On fringe or outskirts of an urban area	8	8
	Medium-sized city	Medium-sized city or large town	28.9	28
	Small town	Small town or village	19	16
	Remote rural		0	1

Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021); OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

Figure 4.9. Performance by school's location, TIMSS 2019

Difference in performance between urban/suburban areas and remote areas/small towns in Grades 4 and 8



Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

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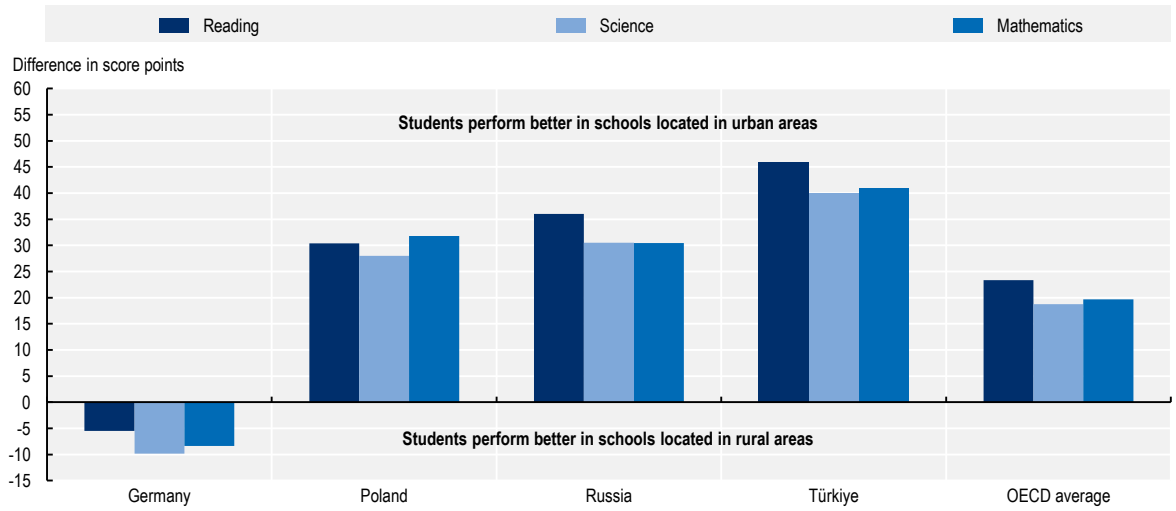
According to the PISA data, most types of upper secondary schools are located slightly more in cities (Figure 4.17). There are two exceptions, however: Anatolian High Schools – which are significantly more frequently located in cities – and Multi-Programme High Schools – of which over 90% are located in towns or rural areas. The latter reflects a government policy to develop multi-programme schools in lower population areas. These Multi-Programme High Schools group together different programmes, vocational and technical schools and other institutions through single administration with the aim of improving

effectiveness and use of resources (OECD, 2007[7]). While these schools may have been developed to serve populations living in more remote areas, they are likely not a very attractive option for many students, given the very low learning outcomes compared with other upper secondary schools in Türkiye (Figure 4.11).

Figure 4.10. Performance by school's location, PISA 2018

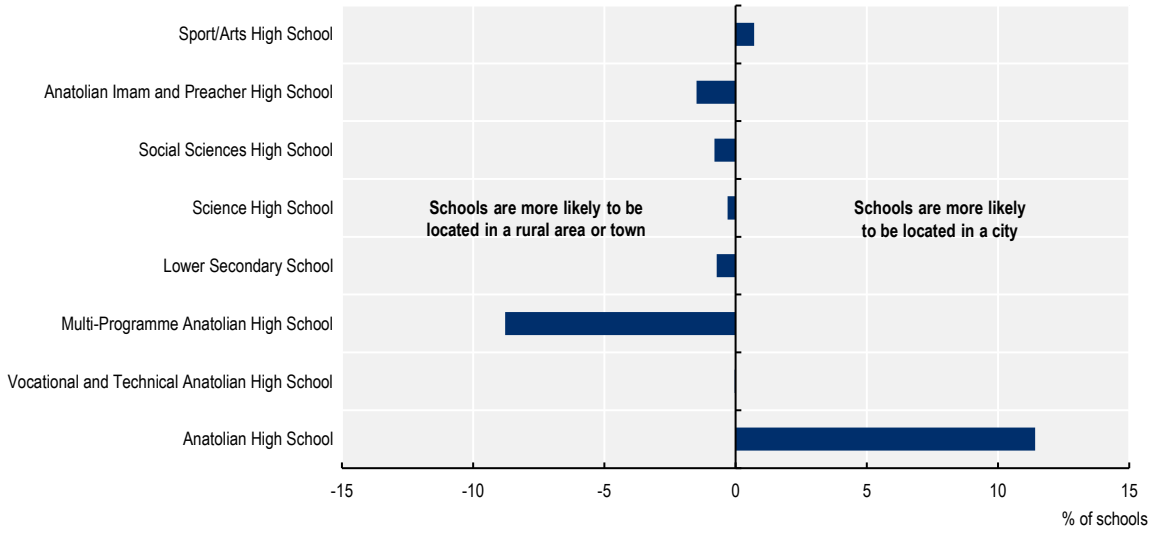
Difference in performance between urban areas and rural areas/small towns



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/0irwhg

Figure 4.11. Upper secondary schools by location, PISA 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/nb0lpk

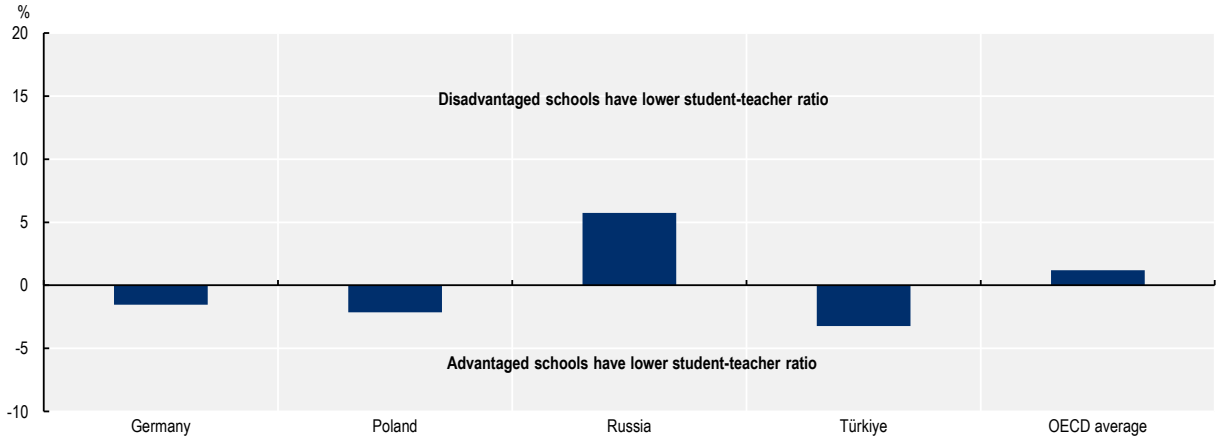
Resources and support at school

This section discusses the resources and support that schools have through a range of indicators on student-teacher ratios, school resources and study help.

Student-teacher ratios

In Türkiye, student-teacher ratios (13.5) are close to the OECD average (13.3). Disadvantaged schools in Türkiye have significantly more students per teacher, compared with more advantaged schools (Figure 4.12). Across OECD member countries, only Colombia has more students per teacher in disadvantaged schools. In contrast, on average across OECD countries, student-teacher ratios are lower in disadvantaged schools. This may reflect a specific policy to have lower student-teacher ratios in disadvantaged schools to provide students in these schools with additional support to rebalance inequities.

Figure 4.12. Difference in student-teacher ratio between advantaged and disadvantaged schools, PISA 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

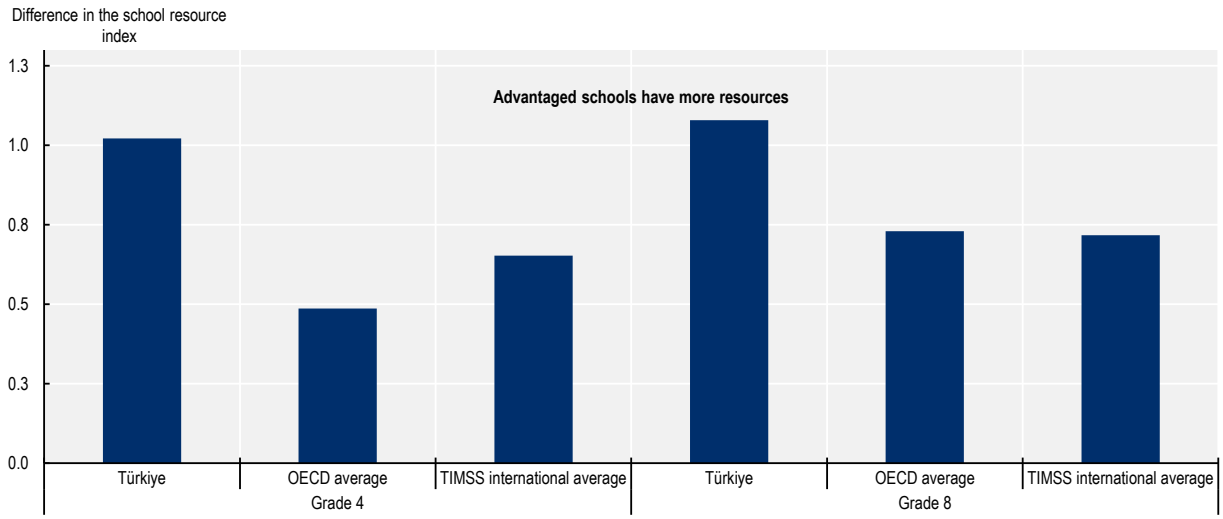
StatLink https://stat.link/j3hset

School resources

Disadvantaged schools in Türkiye tend to report greater shortages in school resources than more advantaged schools. According to the TIMSS data, many children attend lower secondary schools where their instruction is affected by a shortage of resources. In the TIMSS assessment, resource shortage refers to both shortages in general school resources, such as school buildings, infrastructure and digital resources, and shortages in resources for either mathematics (or science) instruction, such as teachers with a specialisation in mathematics and computer software (Mullis et al., 2020[2]). In Türkiye in Grade 4, 95% of children are in schools where their instruction in mathematics and science is affected by resource shortages and 92% in Grade 8 (Mullis et al., 2020[2]).[4] Schools that report greater resource shortages score lower on average in mathematics and science, and more disadvantaged schools are more likely to report resource shortages than more advantaged schools (Figure 4.13).

Figure 4.13. Difference in the shortage of educational resources between advantaged and disadvantaged schools, TIMSS 2019

Difference in instruction affected by shortage of educational resources between advantaged and disadvantaged schools



Note: The lower the index the higher is the shortage of resources. The scales for Grades 4 and 8 differ.
Source: IEA (2020[1]), *TIMSS 2019 International Results in Mathematics and Science*, https://timssandpirls.bc.edu/timss2019/international-results/ (accessed on 21 May 2021).

StatLink https://stat.link/fp2ow9

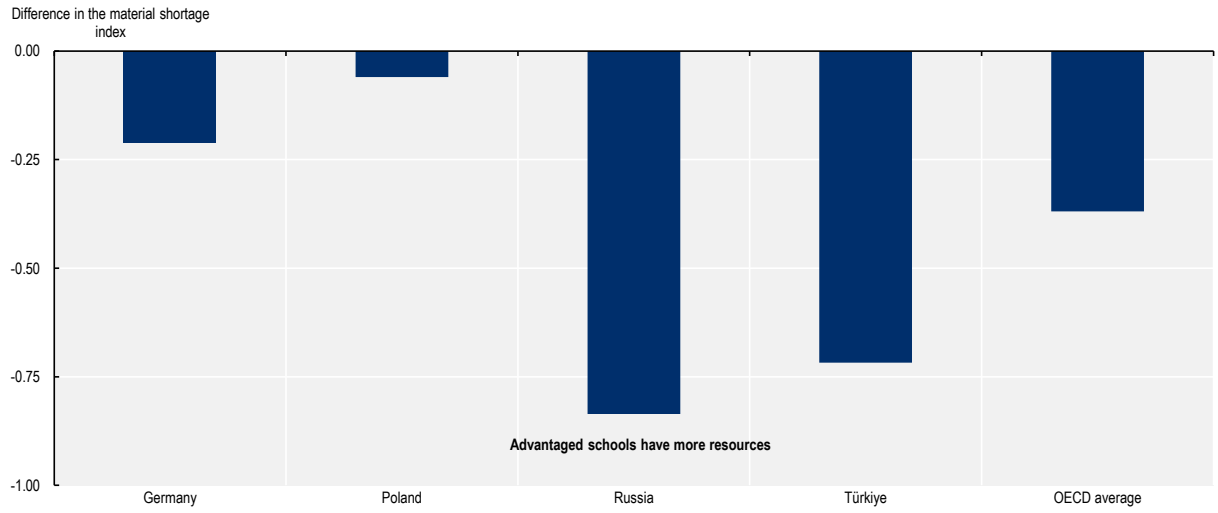
According to the PISA data, on average, schools in Türkiye do not report that a shortage of resources affects instruction. In PISA, resource shortages refer to: a shortage in education materials (i.e. information and communication technology [ICT] equipment, library or laboratory material); inadequate or poor-quality educational materials; a lack of physical infrastructure (i.e. building, grounds, heating/cooling systems, lighting and acoustic systems); or inadequate or poor-quality physical infrastructure (OECD, 2020[8]). However, in schools in Türkiye where there is a shortage in educational resources or resources of poor quality, students score lower in reading, even after accounting for school and student background. Disadvantaged schools are also more likely to report resource shortages than advantaged schools, while this is also the case across the OECD on average, resource shortages in disadvantaged schools in Türkiye are more pronounced (Figure 4.14). Schools in towns are also more likely to report resource shortages compared with those in cities.

Study help

PISA 2018 collected data about the availability of study help that schools make available to students for their homework. In Türkiye, on average, advantaged schools report making more rooms available for students to use for study and more staff available to help students with their homework. While this reflects a similar trend on average across OECD countries, the difference in the availability of such study help in favour of advantaged schools in Türkiye is the highest across the OECD (Figure 4.15). In contrast, in a number of countries, the reverse is true, with more study help being made available for disadvantaged schools.

Figure 4.14. Difference in material shortage between advantaged and disadvantaged schools, PISA 2018

Difference in the average index of principals' views on material shortage, between advantaged and disadvantaged schools

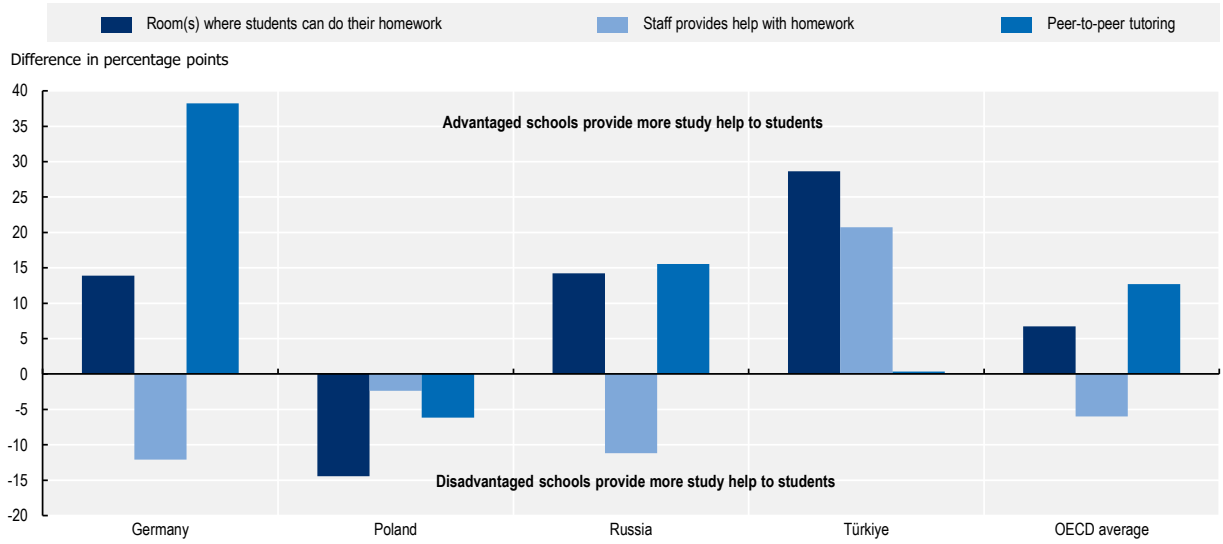


Note: Disadvantaged schools experience material shortage more than advantaged schools.
Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/ywxrdp

Figure 4.15. Schools providing study help by the school's socio-economic status, PISA 2018

Difference in the percentage of students whose principal reported that the school offers study help between advantaged and disadvantaged schools



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

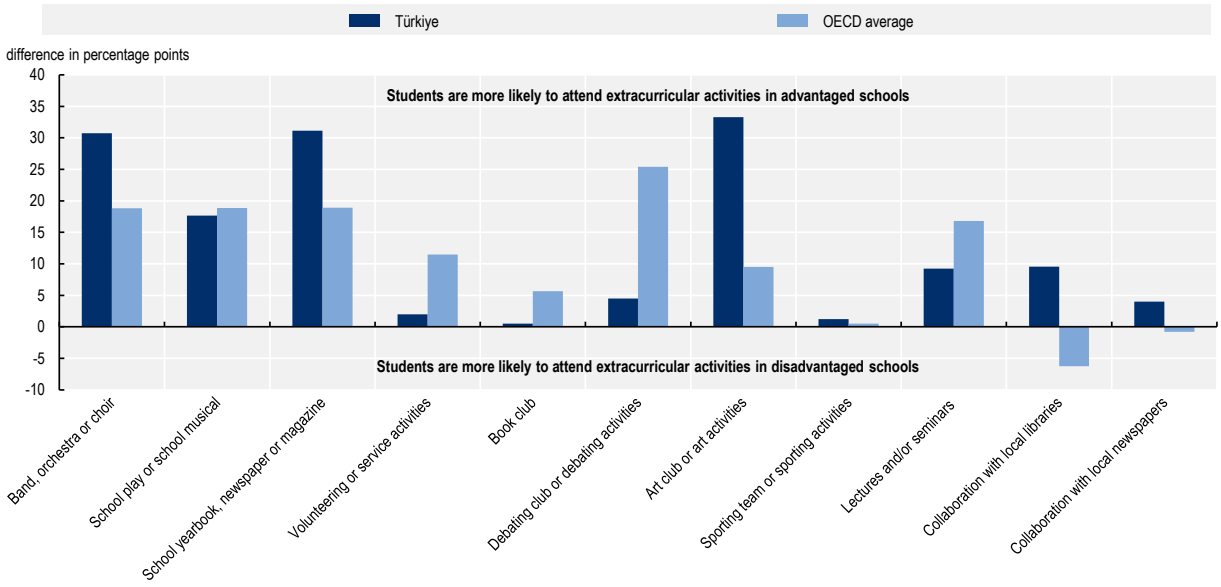
StatLink https://stat.link/7i4xc5

Extracurricular activities

Schools in Türkiye provide a comparatively high level of extracurricular activities, compared with the OECD average. Similar to the situation on average across OECD countries, advantaged schools in Türkiye tend to offer more extracurricular activities than disadvantaged schools (Figure 4.16).

Figure 4.16. Extracurricular activities by socio-economic status, PISA 2018

Difference in the percentage of students whose principal reported that the school offers the following activities to students between advantaged and disadvantaged schools



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/8snybw

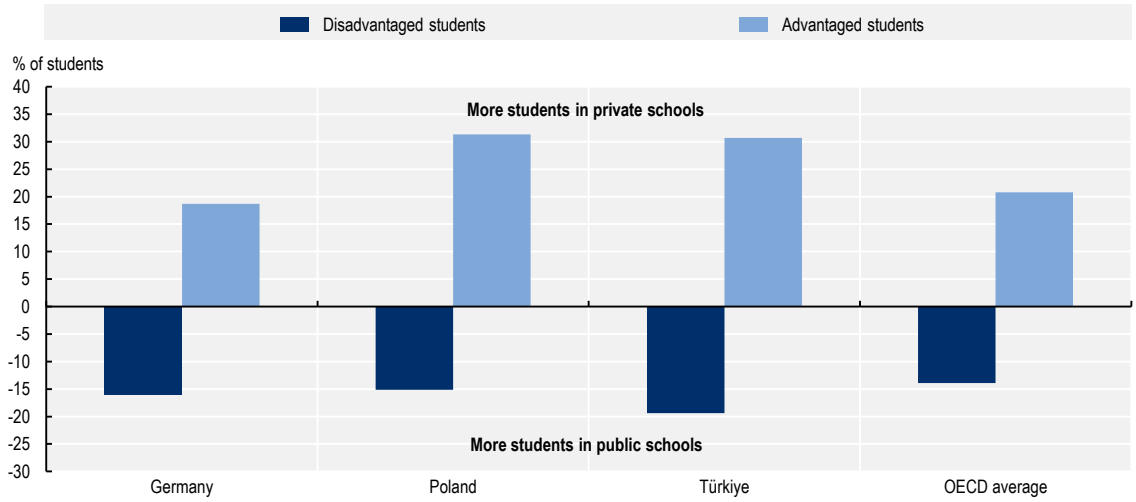
Private schools

In 2018, 12.1% of students in Türkiye attended private schools, slightly lower than the average across the OECD (17.6%). This is a major increase since 2006 when just 0.5% of students attended private schools according to PISA data (OECD, 2008[9]). Since there has been a significant rise in the share of students attending private schools, this section explores their characteristics and the students that attend them.

Like private schools in other countries, private schools in Türkiye tend to have a relatively advantaged position compared with public schools. Private school students have a higher socio-economic background on average compared with students who attend public schools (Figure 4.17). Private schools also report fewer resource shortages and much lower student-teacher ratios (7.6 compared with 13.1 in public schools) (OECD, 2019[10]).

Despite these advantages, private schools performed slightly lower on average (-8 points in reading) than public schools in 2018 in Türkiye. With an average score of 459, private schools in Türkiye perform below the three highest performing upper secondary school types in Türkiye – Science, Social Sciences and Anatolian Science High Schools. This may reflect the strong tradition and prestige of the top-performing public schools in Türkiye, which attract top-performing students.

Figure 4.17. Difference in the share of students with an advantaged and a disadvantaged background by private and public schools, PISA 2018



Source: OECD (2021[4]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/n80rft

Conclusions

This chapter has shown that there are wide variations in average student performance and socio-economic status between different schools in Türkiye. These variations persist throughout all levels of schooling, although there is a decline between Grades 4 and 8, with an increase in performance differences at 15 years of age. While the increase in performance variation across schools at 15 may be linked to selective school entrance policies in upper secondary education, the high degree of variation between schools before upper secondary education suggests that other factors – such as residential segregation and other school admission policies – may also be influencing the differences in performance and socio-economic status between schools. The distribution of resources across schools in Türkiye at present does not seem to counterbalance these differences between schools. In some OECD countries, resource distribution policies aim to compensate for disadvantage, which is a policy Türkiye may consider exploring.

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Kitchen, H. et al. (2019), *OECD Reviews of Evaluation and Assessment in Education: Student Assessment in Turkey*, OECD Reviews of Evaluation and Assessment in Education, OECD Publishing, Paris, https://doi.org/10.1787/5edc0abe-en. [6]

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OECD (2021), "PISA: Programme for International Student Assessment", *OECD Education Statistics (database)*, https://doi.org/10.1787/data-00365-en (accessed on 21 May 2021). [4]

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OECD (2008), *PISA 2006: Volume 2: Data*, PISA, OECD Publishing, Paris, https://doi.org/10.1787/9789264040151-en. [9]

OECD (2007), *Reviews of National Policies for Education: Basic Education in Turkey 2007*, Reviews of National Policies for Education, OECD Publishing, Paris, https://doi.org/10.1787/9789264030206-en. [7]

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Notes

[1] In this report, the terminology of “TIMSS Grade 4” is used throughout since this is the official name of the assessment. However, the data refer to Grade 5 students in lower secondary education in Türkiye.

[2] Advantaged and disadvantaged schools are defined in terms of the socio-economic profile of schools. All schools in each PISA-participating education system are ranked according to their average PISA index of economic, social and cultural status (ESCS) and then divided into four groups with approximately an equal number of students (quarters). Schools in the bottom quarter are referred to as “socio-economically disadvantaged schools” and schools in the top quarter are referred to as “socio-economically advantaged schools”. TIMSS characterises schools in terms of socio-economic composition based on principals’ reports of the percentages of economically disadvantaged and economically affluent students in the school. “More affluent” schools are defined as having more than 25% of students from economically affluent homes and not more than 25% from economically disadvantaged homes, while “more disadvantaged” schools have more than 25% of students from disadvantaged homes and not more than 25% from affluent homes. In this report, the same terminology as PISA was adopted for TIMSS for consistency, so more affluent and more disadvantaged schools are referred as advantaged and disadvantaged schools.

[3] In this report, the terminology of “TIMSS Grade 4” is used throughout since this is the official name of the assessment. However, the data refer to Grade 5 students in lower secondary education in Türkiye.

[4] The four categories used for the questions on school resource shortages were merged into two with “some” and “a lot” combined together to provide continuity with the PISA variables.

5 What are the strengths and weaknesses of students in Türkiye?

This chapter analyses students' performance in Türkiye in different sub-domains and individual test items in Mathematics, Science and Reading in the International Association for the Evaluation of Educational Achievement (IEA) Trends in International Mathematics and Science Study (TIMSS) and the OECD Programme for International Student Assessment (PISA) assessments in Grades 4, 8 and at 15 years of age. It identifies content and cognitive areas of strength and weakness in Türkiye's performance in comparison to the OECD average.

Analyses of student performance in Chapter 2 revealed substantial improvements over time in mathematics and science in International Association for the Evaluation of Educational Achievement (IEA) Trends in International Mathematics and Science Study (TIMSS) Grades 4[1] and 8, and in reading, mathematics and science in the OECD Programme for International Student Assessment (PISA). This improvement was driven by a significant decline in the share of low performers in all grades, subjects and in both assessments. Moreover, this improvement brought Türkiye's performance closer to the OECD average in all subjects of assessment. However, those findings only show the average level of performance and the trends over time. This chapter takes a deeper look, examining student performance in sub-domains of the main subjects of assessment and individual test items.

Box 5.1. What the data tell us

Science

- Physics is an area of strength throughout schooling (except in Grade 8 in 2019).
- Chemistry emerged as a strength in Grade 8 in 2019.
- Life science (Grade 4)/Earth science (Grade 8) are areas of weakness.

Mathematics

- The content sub-domains of number in Grade 4 and algebra in Grade 8 are areas of strength.
- Mathematical reasoning – which refers to solving pure mathematical or real-life problems using logical, systematic thinking – is a weakness in Grade 4 but becomes a strength by Grade 8.
- The sub-domain of applying became a strength in Grade 4 in 2019. In Grade 8, the sub-domain of reasoning is a strength and knowing became a strength in 2019.

Reading

- At age 15, narration and argumentative texts and the cognitive process of evaluating and reflecting are areas of strength, while description texts and the cognitive process of locating information are areas of weakness. Those results might reflect exposure to certain types of texts and activities at school and the coverage of the curriculum.

This chapter relies on an in-depth analysis of performance in different domains and sub-domains of mathematics, science and reading and on success rates on individual test items for those domains and sub-domains. The analysis uses data from TIMSS 2015 and TIMSS 2019 (Grades 4 and 8) (Box 5.2) and from the PISA 2018 international surveys. Note that "domain" and "subject" of assessment are used interchangeably. The domains (and sub-domains) of assessment across TIMSS 2015 Grades 4 and 8 are set out in Table 1.5 and those for TIMSS 2019 in Table 5.2.

Box 5.2. TIMSS 2019 additional analysis

Initially, when the item analysis of this chapter was developed in 2020, only the data from TIMSS 2015 were available. At a later stage, the analysis was expanded using the data from TIMSS 2019 at the request of the Ministry of National Education in Türkiye.

Conducting item analysis of Türkiye's TIMSS 2019 data is of particular interest because, in the 2019 TIMSS assessment, Türkiye chose to assess students in Grade 5 rather than Grade 4 as in previous rounds of TIMSS. TIMSS provides countries with the choice of assessing different grades, if

students do not fall under the minimum average age at the time of testing, to provide the most appropriate match between their curricula and the content of the TIMSS assessments. The change in the assessed year brings Türkiye closer to the age assessed in most countries since students in Türkiye start school slightly earlier than in other countries on average (IEA, 2020[1]). Item analysis of the 2019 data provides a perspective on this change by showing how a student performed in specific areas of the curriculum. A new curriculum was also implemented in Türkiye in 2017/18, so the 2019 analysis may provide a perspective on how the reform is shaping changes in learning.

It is important to note that in 2019 TIMSS started transitioning to computer-based assessment. In 2019, countries were offered the choice between the paper assessment or the new eTIMSS assessment TIMSS 2019 took steps to ensure as much comparability as possible between paper- and computer-based assessments (IEA, 2020[1]). However, it is not possible to establish exactly how the change in assessment mode affected the country's performance in 2019. The TIMSS 2019 Item Equivalence Study found that the mode effect may be stronger in some countries than others (Fishbein et al., 2018[2]).

Source: IEA (2017[3]), *TIMSS 2019 Assessment Frameworks*, https://timssandpirls.bc.edu/timss2019/frameworks/framework-chapters/mathematics-framework/; IEA (2020[1]), *Methods and Procedures: TIMSS 2019 Technical Report*, https://timssandpirls.bc.edu/timss2019/methods/ (accessed on 6 December 2021); Fishbein, B. et al. (2018[2]), "The TIMSS 2019 Item Equivalence Study: Examining mode effects for computer-based assessment and implications for measuring trends", https://doi.org/10.1186/s40536-018-0064-z.

Table 5.1. Sub-domains assessed by TIMSS, 2015

	Maths		Science	
	Grade 4	Grade 8	Grade 4	Grade 8
Content domains	Number (50%)	Number (30%)	Life science (45%)	Biology (35%)
	Geometric shapes and measures (35%)	Algebra (30%)	Physical science (35%)	Chemistry (20%)
	Data display (15%)	Geometry (20%)	Earth science (20%)	Physics (25%)
		Data and chance (20%)		Earth science (20%)
Cognitive domains	Knowing (40%) Applying (40%) Reasoning (20%)	Knowing (35%) Applying (40%) Reasoning (25%)	Knowing (40%) Applying (40%) Reasoning (20%)	Knowing (35%) Applying (35%) Reasoning (30%)

Source: Mullis, I. et al. (2016[4]), *Student Achievement*, http://timssandpirls.bc.edu/timss2015/international-results/timss-2015/mathematics/student-achievement/ (accessed on 5 March 2018); Martin, M. et al. (2016[5]), *TIMSS 2015 International Results in Science*, TIMSS & PIRLS International Study Center, Boston.

Table 5.2. Sub-domains assessed by TIMSS, 2019

	Maths		Science	
	Grade 4	Grade 8	Grade 4	Grade 8
Content domains	Number (50%)	Number (30%)	Life science (45%)	Biology (35%)
	Measurement and geometry (30%)	Algebra (30%)	Physical science (35%)	Chemistry (20%)
	Data (20%)	Geometry (20%)	Earth science (20%)	Physics (25%)
		Data and probability (20%)		Earth science (20%)

	Maths		Science	
	Grade 4	Grade 8	Grade 4	Grade 8
Cognitive domains	Knowing (40%) Applying (40%) Reasoning (20%)	Knowing (40%) Applying (40%) Reasoning (20%)	Knowing (35%) Applying (40%) Reasoning (25%)	Knowing (35%) Applying (35%) Reasoning (30%)

Note: Some of the domain names changed between 2015 and 2019 but the content has remained largely the same:
- In Grade 4 mathematics: Geometric shapes and measures have changed in Measurement and Geometry and Data display has changed in Data.
- In Grade 8 mathematics: Data and chance have changed in Data and Probability.

Also, the shares of each content domain covered in the assessment slightly changed between 2015 and 2019, to better reflect the curricula, standards and frameworks of the participating countries. For further information about the topics covered within the sub-domains, please see IEA (2013[6]) and (2017[3]).
Source: Mullis, I. et al. (2016[4]), *Student Achievement*, http://timssandpirls.bc.edu/timss2015/international-results/timss-2015/mathematics/student-achievement/ (accessed on 5 March 2018); Martin, M. et al. (2016[5]), *TIMSS 2015 International Results in Science*, TIMSS & PIRLS International Study Center, Boston.

In PISA, the analysis in this chapter focuses primarily on reading, since this was the major domain in 2018 (see Chapter 1). The PISA 2018 reading framework is based on the processes of locating information, understanding and evaluating and reflecting across single or multiple-source texts (Table 5.3). For further information about each of these processes, please see *PISA 2018 Results (Volume 1): What Students Know and Can Do* (OECD, 2019[7]).

Table 5.3. Reading processes assessed by PISA across text source, 2018

Reading processes	Single source text (65%)	Multiple-source text (35%)
Locating information (25%)	Scanning and locating (15%)	Searching for and selecting relevant text (10%)
Understanding (45%)	Representing literal meaning (15%) Integrating and generating inferences (15%)	Integrating and generating inferences (15%)
Evaluating and reflecting (30%)	Assessing quality and credibility, and Reflecting on content and form (20%)	Corroborating and handling conflict (10%)

Note: Percentages in parenthesis show the share of items by process and text source.
Source: OECD (2019[7]), *PISA 2018 Results (Volume I): What Students Know and Can Do*, https://dx.doi.org/10.1787/5f07c754-en.

An explanation of the analyses of performance in sub-domains and on individual test items in this chapter

This chapter relies on two types of analyses: analysis of student performance on sub-domains of assessment and analyses of student performance on individual test items, which are then mapped to different sub-domains and item characteristics.

Sub-domain analysis

Both the TIMSS and PISA assessments assess student performance in a number of sub-domains of the three main subjects: reading, mathematics and science (PISA) and mathematics and science (TIMSS) (see Chapter 1). While student performance across sub-domains tends to be strongly correlated, variation from a country's average performance in one subject indicates a relative strength or weakness in the

country's performance (e.g. the analysis in TIMSS and PISA might identify a relative strength in geometry because, in comparison with the national average in mathematics, performance in this sub-domain is higher than expected).

Analysis by item characteristics

Analysing the characteristics of the individual test items reveals if performance is associated with certain item characteristics, such as an item's content and cognitive sub-domain, its format (multiple-choice or open-ended) and its difficulty. The success rate of each item for students in Türkiye is compared to the average success rate for all participating OECD countries. Conspicuous items, indicating strengths or weaknesses, are those on which students in Türkiye performed particularly well or less well in comparison with the OECD average (Box 5.3).

The analyses are carried out for mathematics and science in Grades 4 and 8 in TIMSS 2015 and 2019 and for mathematics, science and reading in PISA 2018. Strengths or weaknesses identified through those two methods might shed light on different emphasises in teaching or curricula.

Box 5.3. Selection of conspicuous test items

The analysis seeks to identify the items which stand out as indicating particular strengths or weaknesses of students in Türkiye. Those items could be selected in a number of ways. The most straightforward method is to compare the success rates of students in Türkiye to the OECD average. However, such an approach would be distorted when comparing items with relatively low or high success rates overall. For instance, a difference of 10% between success rates for Türkiye and the OECD average is less notable when the two success rates are 95% and 85% than when they are 55% and 45% – in other words, the relationship between getting items correct and the items' difficulty is not linear (OECD, 2013[8]).

In order to transform success rates into a linear metric, the logit transformation of those percentages should be computed. This transformation has the effect of "stretching out" very low and very high success rates in comparison with success rates close to 50%. A logit value of 0 means that the item has a success rate of 50%; positive logits mean higher success rates and negative logits mean lower success rates.

For each test item, the logit transformation of the success rate for students in Türkiye is compared to the average of participating OECD countries. Conspicuous items are those with at least one standard deviation (both sides) between the success rate for Türkiye and that for the OECD.

The average of participating OECD countries is used for both PISA and TIMSS analyses to make the composition of the comparator group of countries similar across both surveys.

Once conspicuous items have been identified, they are divided into two groups: items on which students did particularly well (items representing strength) and those on which they did not do well (items representing weakness). Then both groups of items are described in terms of the content and cognitive sub-domains they represent. If a content (e.g. geometry) or cognitive (e.g. reasoning) sub-domain is disproportionately represented among items representing strength, then it is possible to conclude that this sub-domain represents an area of strength and vice versa.

Source: OECD (2013[8]), *Lessons from PISA 2012 for the United States*, https://dx.doi.org/10.1787/9789264207585-en.

Performance in different aspects of mathematics and science competency in Grade 4

Sub-domain analysis: In Grade 4 2015, physical science is an area of strength while geometry and life science are weaknesses

Comparing student performance in the different sub-domains in TIMSS 2015 Grade 4 to the overall average for Türkiye:

- In mathematics, geometry and reasoning are identified as areas of relative weakness.
- No sub-domain of mathematics was identified as an area of strength (Table 5.4).
- In science, physical science is an area of strength and life science is a relative weakness (see Table 5.5).

Table 5.4. Performance in mathematics sub-domains in Grade 4 (TIMSS 2015)

Country	Mean performance in mathematics	Performance in mathematics content domains			Performance in mathematics cognitive domains		
		Data display	Geometry	Number	Knowing	Applying	Reasoning
Germany	522	535	531	515	524	515	535
Poland	535	538	534	534	517	541	546
Russia	564	573	557	567	556	566	570
Türkiye	483	476	475	489	491	482	466
OECD average	524	526	526	523	523	525	527
TIMSS international average	509	504	507	510	509	508	507

Note: Where the terms "strong" and "weak" are used, they denote that the average score for the domain in question is either significantly above or below Türkiye's overall mathematics or science average score.
Relative weakness in Türkiye.
Source: IEA (2016[9]), *TIMSS 2015,* https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021).

Table 5.5. Performance in science sub-domains in Grade 4 (TIMSS 2015)

Country	Mean performance in science	Performance in science content domains			Performance in science cognitive domains		
		Earth science	Life science	Physical science	Knowing	Applying	Reasoning
Germany	528	519	528	532	527	529	532
Poland	547	540	557	540	544	554	542
Russia	567	562	569	567	569	568	561
Türkiye	483	480	472	496	478	486	483
OECD average	524	521	527	521	523	525	525
TIMSS international average	505	499	506	503	503	504	502

Note: Where the terms "strong" and "weak" are used, they denote that the average score for the domain in question is either significantly above or below Türkiye's overall mathematics or science average score.
Relative weakness in Türkiye.
Relative strength in Türkiye.
Source: IEA (2016[9]), *TIMSS 2015,* https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021).

Sub-domain analysis: In Grade 4 2019, performance in science is consistent across sub-domains

In 2019, students in Türkiye performed 40 points in mathematics and 43 in science higher compared with the country's performance in 2015. While students performed higher overall on average, the analysis here presents areas of relative weakness or strength in comparison to Türkiye's overall performance. A country with high average scores may still have areas of relative strength or weakness because students in that country do not perform uniformly across the assessed content.

Comparing student performance in the different sub-domains in TIMSS 2019 Grade 4 to the overall average for Türkiye:

- In mathematics, data and reasoning are identified as areas of relative weakness (Table 5.6). Compared to TIMSS 2015 Grade 4 , the data sub-domain has become an area of relative weakness while performance in geometry is no longer a weakness and now exceeds the mean performance in mathematics. As in 2015, reasoning in mathematics remains an area of relative weakness.
- In science, in contrast with 2015, students performed consistently across all assessed areas with no domain emerging as a strength or a weakness (Table 5.7).

Table 5.6. Performance in mathematics sub-domains in Grade 4 (TIMSS 2019)

Country	Mean performance in mathematics	Performance in mathematics content domains			Performance in mathematics cognitive domains		
		Data	Measurement and geometry	Number	Knowing	Applying	Reasoning
Germany	521	515	531	517	523	514	531
Poland	520	524	529	513	509	521	527
Russia	567	560	571	567	555	571	573
Türkiye	523	510	527	525	514	531	509
OECD average	529	531	533	530	527	528	530
TIMSS international average	501	499	504	508	503	505	503

Note: Where the terms "strong" and "weak" are used, they denote that the average score for the domain in question is either significantly above or below Türkiye's overall mathematics or science average score.
Relative weakness in Türkiye.
Source: IEA (2020[10]), *TIMSS 2019*, https://timssandpirls.bc.edu/timss2019/international-database/, (accessed on 20 December 2021).

Table 5.7. Performance in science sub-domains in Grade 4 (TIMSS 2019)

Country	Mean performance in science	Performance in science content domains			Performance in science cognitive domains		
		Earth science	Life science	Physical science	Knowing	Applying	Reasoning
Germany	518	509	521	518	520	516	518
Poland	531	529	534	526	524	538	525
Russia	567	554	570	572	562	572	569
Türkiye	526	524	519	538	531	528	521
OECD average	526	525	527	522	526	524	527
TIMSS international average	491	501	506	505	509	507	509

Note: Where the terms "strong" and "weak" are used, they denote that the average score for the domain in question is either significantly above or below Türkiye's overall mathematics or science average score.
Source: IEA (2020[10]), *TIMSS 2019*, https://timssandpirls.bc.edu/timss2019/international-database/, (accessed on 20 December 2021).

Item analysis 2015: Performance in individual test items in Grade 4

In TIMSS 2015, Grade 4 students answered 178 test items in mathematics and 200 in science. The conspicuous items (Box 5.3) in mathematics included 29 test items in which students did relatively well in comparison with the OECD average and 26 in which they performed relatively lower. In science, students did relatively well in 29 test items and relatively lower in 28.

Below, the attributes of those items are discussed with the aim of identifying patterns that characterise the performance of students in Türkiye. It is worth noting that sub-domain analysis identifies whether students are doing better in a particular sub-domain relative to the national average in that domain. In contrast, item analysis compares success rates on individual test items to average success rates of a group of countries – in this case, OECD countries. Hence, the former is based on national comparison within a country of reference while the latter is based on an international comparison between the country of reference and other countries.

In mathematics, number and knowing are areas of strength

In mathematics, the 29 items (out of 178) in which students did particularly well comprise (Figure 5.1):

- Nineteen items out of 96 covering the content sub-domain of number (representing 20% of all items covering the number sub-domain).
- Nineteen items out of 74 (representing 26% of items) covering the knowing sub-domain.

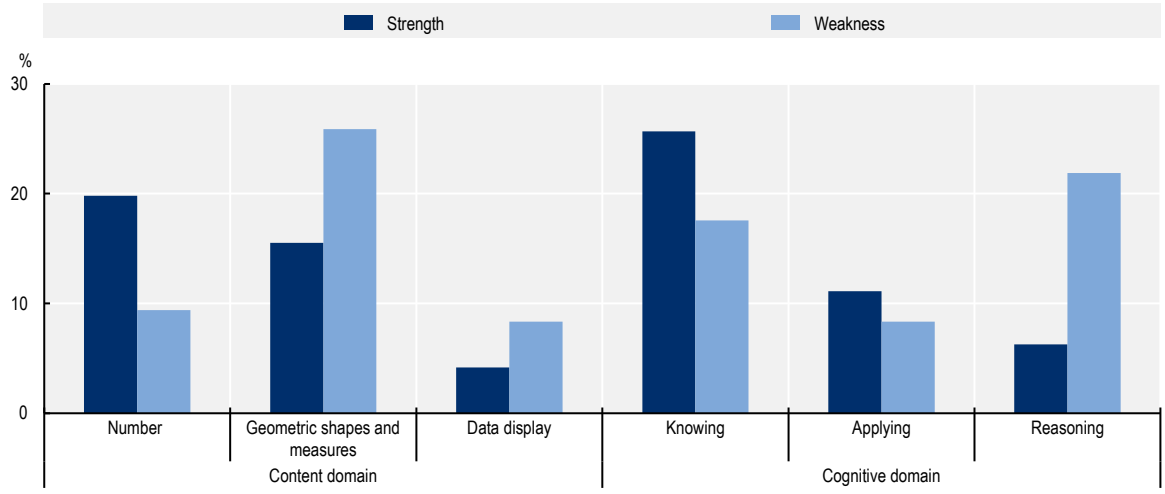
In mathematics areas of weakness include geometry and reasoning

In mathematics, the 26 items (out of 178) in which students did particularly less well comprise (Figure 5.1):

- Nine items out of 96 covering the content sub-domain of geometry (representing 16% of geometry items).
- Seven items out of 32 (representing 22% of items) covering the reasoning sub-domain.

Figure 5.1. Conspicuous items in mathematics in Grade 4 (TIMSS 2015)

Items in which students performed particularly well and less well



Note: The items represented in the figure are conspicuous, precisely top (strength) and bottom (weakness) items. Average (neither strength nor weakness) as well as non-conspicuous items were excluded.
Source: IEA (2016[9]), *TIMSS 2015,* https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021).

StatLink https://stat.link/lr10i3

The test items for the content and cognitive domains "number" and "knowing" in which students did well were relatively easy (i.e. had a level of difficulty lower than the average for their domain). In contrast, the test items in which students did well in geometry had a level of difficulty close to the average for all items in geometry, and those for the cognitive domain of applying were more difficult than the average. The two cognitive functions of applying and reasoning where students were less strong require a higher level of cognitive skills than the knowing sub-domain. Knowing entails familiarity with mathematical concepts while reasoning and applying require logical and systematic thinking and the application of mathematics in a variety of contexts (Vincent-Lancrin et al., 2019[11]).

Students in Türkiye also performed better in multiple-choice questions than open-ended questions. Open-ended questions have been used in international assessments, such as PISA, to assess higher-order skills such as applying knowledge and reasoning. For those questions, students often have to explain their answers and provide solid arguments to support those answers. At the time of the 2019 OECD report *OECD Reviews of Evaluation and Assessment in Education: Student Assessment in Türkiye*, teaching and testing in Türkiye made frequent use of multiple-choice tests so students may have had less exposure to open-ended questions than their peers in other countries (Kitchen et al., 2019[12]).

In general, the findings may reflect possible variations in curriculum coverage in terms of content domains but also in terms of coverage of knowledge and skills. For instance, students in Türkiye have a relative strength in knowledge about mathematics but weakness when it comes to skills such as mathematical reasoning.

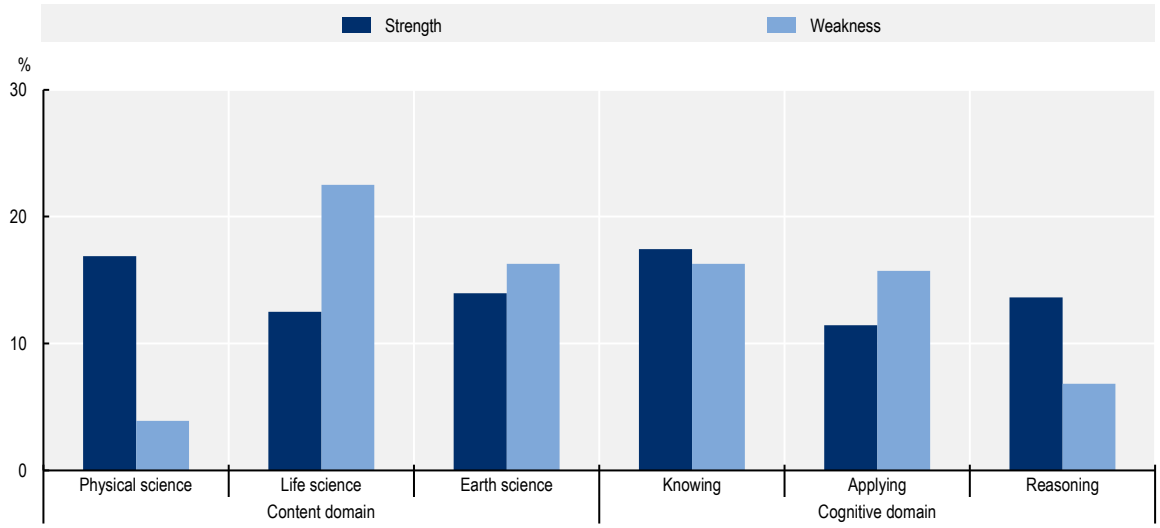
In science, physical science and reasoning are areas of strength

In science, students in Türkiye did well in (Figure 5.2):

- Physical science (13 out of 77 items, representing 17% of all items covering this domain).
- Reasoning (6 out of 44 items, representing 14% of all items in this category).

Figure 5.2. Conspicuous items in science in Grade 4 (TIMSS 2015)

Items in which students performed particularly well and less well



Note: The items represented in the figure are conspicuous, precisely top (strength) and bottom (weakness) items. Average (neither strength nor weakness) as well as non-conspicuous items were excluded.
Source: IEA (2016[9]), *TIMSS 2015,* https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021).

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In terms of difficulty, students did well in items that are more difficult than the average of all science items. This is in line with the finding that students in Türkiye perform particularly well in science, which is a national strength, and suggests that teaching and learning support students in mastering even difficult items and content.

Life science and applying sub-domains are areas of weakness

- The items representing weakness are dominated by those covering life science (18 out of 80, representing 23%) (Figure 5.2).
- About 16% of items (11 out of 70) covering the applying sub-domain were found to represent an area of weakness.

As in mathematics, students did particularly well in multiple-choice science items and less well in open-ended questions.

Item analysis 2019: Performance in individual test items in Grade 4

In the computer-based assessment of TIMSS 2019, Grade 4 students answered 262 test items in mathematics and 240 in science. The conspicuous items in mathematics included 34 test items in which students in Türkiye did relatively well in comparison with the OECD average and 37 in which they performed relatively lower. In science, students did relatively well in comparison with the OECD average in 35 test items and relatively less well in 38.

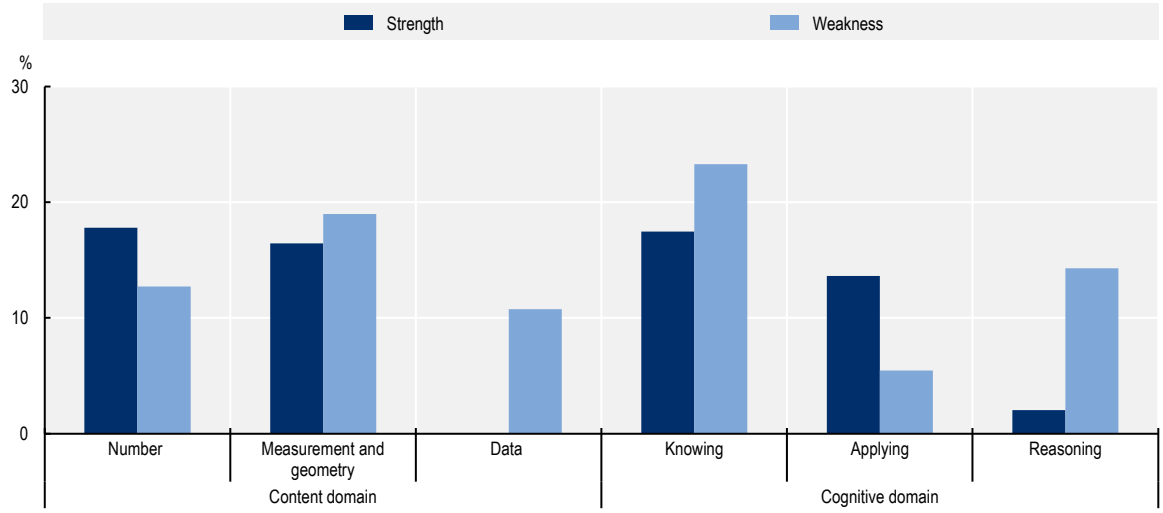
In mathematics, number and applying are areas of strength

In mathematics, the 34 items (out of 262) in which students did particularly well comprise (Figure 5.3):

- Twenty-one items out of 118 covering the content sub-domain of number (representing 18% of all items covering the number sub-domain).
- Fifteen items out of 110 (representing 14% of items) covering the applying sub-domain.

Figure 5.3. Conspicuous items in mathematics in Grade 4 (TIMSS 2019)

Items in which students performed particularly well and less well



Note: The items represented in the figure are conspicuous, precisely top (strength) and bottom (weakness) items. Average (neither strength nor weakness) as well as non-conspicuous items were excluded.
Source: IEA (2020[10]), *TIMSS 2019*, https://timssandpirls.bc.edu/timss2019/international-database/, (accessed on 20 December 2021).

StatLink https://stat.link/3tn6bd

In mathematics, the 37 items (out of 262) in which students did particularly less well comprise (Figure 5.3):

- Seven items out of 65 covering the content sub-domain of data (representing 11% of data items).
- Twenty-four out of 103 (representing 23% of items) covering the knowing sub-domain.
- Seven items out of 49 (representing 14% of items) covering the reasoning sub-domain.

From 2015 to 2019 item analysis: Strengths and weaknesses in Grade 4 mathematics

In mathematics, the number sub-domain was a strength in both TIMSS 2015 and 2019, which might suggest that curriculum coverage, as well as teaching, is particularly strong in this sub-domain across both Grade 4 – at the end of primary education – and Grade 5 – at the start of lower secondary education. The applying sub-domain – which requires students to be able to apply mathematical skills across a variety of contexts – also became a strength in 2019. The change in student performance in the application of mathematical skills between 2015 and 2019 might reflect recent curricula reform, which places greater emphasis on applying knowledge and skills to solve problems (Box 5.4). In terms of difficulty, the items where students performed well in mathematics were more difficult than average, suggesting that students are well prepared to tackle some complex content.

In the cognitive sub-domains, both the 2015 and 2019 analyses identified reasoning as an area of weakness. Reasoning in mathematics requires high-level cognitive skills as individuals must go beyond solving routine problems to integrating knowledge and skills to solve multistep problems in unfamiliar, complex situations (IEA, 2017[3]). The items where students performed less well in data, knowing and

reasoning had a higher level of difficulty than the questions on average while students tended to manage easier questions in these sub-domains well.

Box 5.4. Curriculum reform in Türkiye

Comprehensive curriculum updates were carried out for all education levels in Türkiye between 2016 and 2018 in primary, lower and upper secondary education. The objective of recent curricula reforms was to better reflect children's interests, talents and character in the curricula while reducing the number of course hours, rearranging time for breaks and leisure activities, and streamlining the content. For secondary education, the objective was to reduce the number of compulsory course hours and provide greater diversity of courses while aligning the curriculum with the needs of higher education. Another major objective was to reorient the curriculum and refocus it on applied skills rather than knowledge. The emphasis on applied skills is reflected in the introduction of: workshops to translate knowledge into living skills; in-depth field courses, projects and applied studies; and learning in non-school environments such as natural, historical and cultural places, centres for science and arts, and museums. For example, the frequency of conducting a science experiment at the Grade 4 level, after the introduction of the new curriculum, was above the international average (World Bank, 2021[13]).

In the recent reforms, particular emphasis was given to the curriculum in the Sciences and Social Sciences High Schools with the aim of enabling students to build in-depth knowledge in the disciplines of natural and social sciences. In Vocational and Technical Anatolian High Schools, the emphasis of the reforms is on helping students to develop the skills needed by industry. This includes refocusing the curriculum on practical skills needed in the job market and introducing skills-based workshops to shift the focus from knowledge to 21st century skills.

The recent curricula reforms started by reviewing curricula in other countries and by working with experts on the different subjects including those not assessed by international surveys like PISA and TIMSS (e.g. civics, social sciences and humanities). Topics of international and current interest such as climate change and sustainability were introduced to the curriculum with the aim of making it more aligned with global developments. Examples include an elective course on environment for Grades 6, 7 and 8. These changes were implemented across the different phases of education with a simplified version of the curriculum for open high schools. After the development of the new curriculum, teachers were invited to participate in training programmes organised by the Directorate General for Teacher Training. Trained teachers were then expected to train other teachers in their provinces and to provide feedback about curriculum implementation to the Monitoring and Evaluation Department.

Sources: Government of Turkey (2019[14]), *Strategic Plan 2019-2023*; World Bank (2021[13]), "Türkiye's improvements in the quality of learning: TIMSS 2019 results", https://www.worldbank.org/en/country/Türkiye/brief/Türkiyes-improvements-in-the-quality-of-learning (accessed on 21 May 2021).

In science, physical science is an area of strength

In science, students in Türkiye did well in (Figure 5.4):

- Physical science (15 out of 82 items, representing 18% of all items covering this domain).

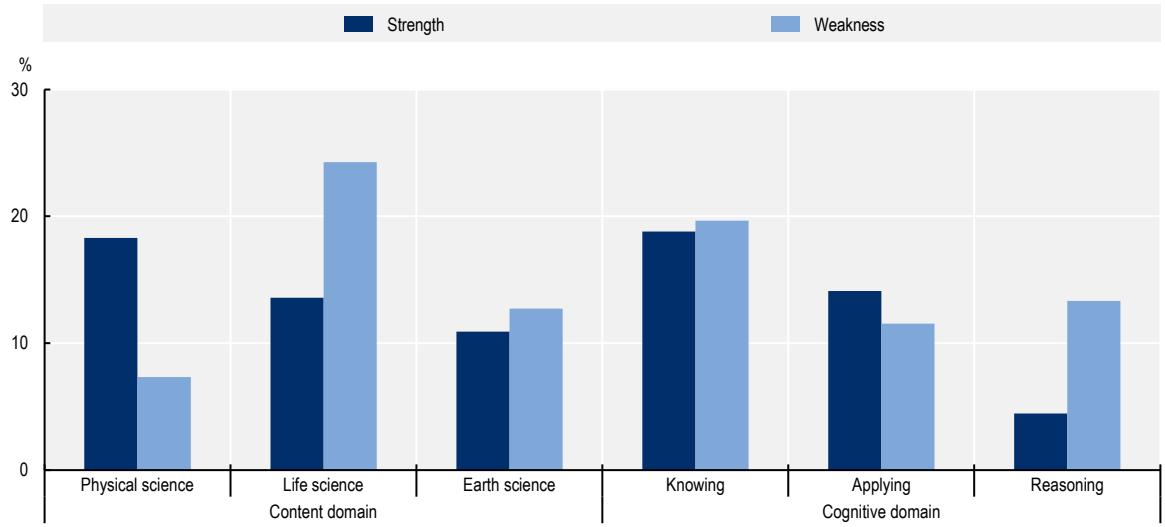
Life science and reasoning sub-domains are areas of weakness

- The items representing a weakness are dominated by those covering life science (25 out of 103, representing 24%) (Figure 5.4).

- About 13% of items covering reasoning (6 out of 45) were found to represent an area of weakness.

Figure 5.4. Conspicuous items in science in Grade 4 (TIMSS 2019)

Items in which students performed particularly well and less well



Note: The items represented in the figure are conspicuous, precisely top (strength) and bottom (weakness) items. Average (neither strength nor weakness) as well as non-conspicuous items were excluded.
Source: IEA (2020[10]), *TIMSS 2019*, https://timssandpirls.bc.edu/timss2019/international-database/, (accessed on 20 December 2021).

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From 2015 to 2019 item analysis: Strengths and weaknesses in Grade 4 science

Across 2015 and 2019 in science, students in Türkiye performed consistently well in physical science, while the life science sub-domain emerges as a weakness. As in mathematics, the items where students performed well were more difficult than average, again suggesting that students have the knowledge and skills to do well when faced with difficult questions. In contrast, the life science items where students did less well had a lower difficulty than average. As students do not do well even in comparatively easier life science items, their performance might reflect the balance of content in Türkiye's curriculum with less time devoted to life science. In contrast, the strength of student performance in physical science might suggest that it is a domain that receives greater emphasis. Students' high performance in physical science is also facilitated by their strength in number skills and knowledge since the two content domains are highly related (Rossdy et al., 2019[15]).

Also, in line with the results in mathematics, there was an improvement in the applying sub-domain in science which was a weakness in 2015. Applying in science requires high-level skills with individuals using their knowledge to compare, contrast and classify groups of objects or materials, relating knowledge of a science concept to a specific context, generating explanations and solving practical problems (IEA, 2017[3]).

Similarly, in line with the performance across different mathematics sub-domains, reasoning in science also emerges as a weakness in 2019. Reasoning in science refers to using evidence and science understanding to analyse, synthesise and generalise, often in unfamiliar situations and complex contexts (IEA, 2017[3]). Students also did not perform well even in easier items, suggesting that they might not be exposed to many activities or content that develops reasoning skills. The identification of reasoning as a

weakness in both science and mathematics in 2019 also suggests that the pattern of performance might reflect emphasis in the curriculum and pedagogical approaches.

Performance in different aspects of mathematics and science competency in lower secondary education

Sub-domain analysis: In Grade 8 2015, physics continues to be a strength while earth science is a weakness

In line with student performance in Grade 4, physics was a relative strength for students in Türkiye while earth science (which shares some similar content areas with the life science sub-domain in Grade 4, which was a weakness) was a relative weakness (Table 5.9). In mathematics, however, in contrast to student performance in Grade 4, reasoning in mathematics was a relative strength in Grade 8 (Table 5.8). All other differences were not found to be statistically significant.

Table 5.8. Mathematics sub-domains in Grade 8 2015

Country	Mean performance in Mathematics	Performance in mathematics content domains			Performance in mathematics cognitive domains			
		Algebra	Data and chance	Number	Geometry	Knowing	Applying	Reasoning
Russia	538	558	507	533	536	543	541	520
Türkiye	458	459	467	447	463	447	460	472
OECD average	507	496	515	511	503	503	508	510
TIMSS international average	481	483	472	482	477	481	480	479

Note: Where the terms "strong" and "weak" are used, they denote that the average score for the domain in question is either significantly above or below Türkiye's overall mathematics or science average score.
Relative strength in Türkiye.
Source: IEA (2016[9]), *TIMSS 2015,* https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021).

Table 5.9. Science sub-domains in Grade 8 2015

Country	Mean performance in science	Performance in science content domains				Performance in science cognitive domains		
		Chemistry	Earth science	Biology	Physics	Knowing	Applying	Reasoning
Russia	544	558	532	539	548	558	538	538
Türkiye	493	493	477	491	506	489	492	495
OECD average	519	513	523	521	516	517	519	521
TIMSS international average	485	485	481	483	485	484	485	484

Note: Where the terms "strong" and "weak" are used, they denote that the average score for the domain in question is either significantly above or below Türkiye's overall mathematics or science average score.
Relative weakness in Türkiye.
Relative strength in Türkiye.
Source: IEA (2016[9]), *TIMSS 2015,* https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021).

Sub-domain analysis: In Grade 8 2019, reasoning is a strength in mathematics

In line with student performance in Grade 8 in 2015, reasoning in mathematics continues to be an area of relative strength (Table 5.10). In both TIMSS 2015 and 2019, reasoning was a weakness in Grade 4 but became a strength in Grade 8, perhaps suggesting that the curriculum in Türkiye focuses on developing this cognitive domain in lower secondary education.

Table 5.10. Mathematics sub-domains in Grade 8 2019

Country	Mean performance in mathematics	Performance in mathematics content domains				Performance in mathematics cognitive domains		
		Algebra	Data and chance	Number	Geometry	Knowing	Applying	Reasoning
Russia	543	560	517	541	540	550	543	536
Türkiye	496	493	502	493	490	494	491	504
OECD average	513	506	518	513	513	510	514	514
TIMSS international average	489	497	489	495	497	497	496	499

Note: Where the terms "strong" and "weak" are used, they denote that the average score for the domain in question is either significantly above or below Türkiye's overall mathematics or science average score.
Relative strength in Türkiye.
Source: IEA (2020[10]), *TIMSS 2019*, https://timssandpirls.bc.edu/timss2019/international-database/, (accessed on 20 December 2021).

In line with the pattern that emerged in science in Grade 4 in 2019, performance across all content domains and cognitive domains in Grade 8 was consistent, with no domain being statistically different from the mean (Table 5.11).

Table 5.11. Science sub-domains in Grade 8 2019

Country	Mean performance in science	Performance in science content domains				Performance in science cognitive domains		
		Chemistry	Earth science	Biology	Physics	Knowing	Applying	Reasoning
Russia	543	551	533	543	540	543	543	543
Türkiye	515	516	509	513	518	506	515	524
OECD average	519	510	525	520	516	516	518	522
TIMSS international average	490	490	487	493	491	492	492	491

Note: Where the terms "strong" and "weak" are used, they denote that the average score for the domain in question is either significantly above or below Türkiye's overall mathematics or science average score.
Source: IEA (2020[10]), *TIMSS 2019*, https://timssandpirls.bc.edu/timss2019/international-database/, (accessed on 20 December 2021).

Item analysis 2015: Performance in individual test items in Grade 8

In TIMSS 2015, Grade 8 students answered 215 test items in mathematics and 260 in science. The conspicuous items in mathematics included 30 test items in which students did particularly well in comparison with the OECD average and 32 in which they did poorly. In science, students did particularly well in 31 test items and poorly in 32.

In mathematics, areas of strength include geometry, data and chance, algebra and reasoning

Students performed relatively equally, doing well (and less well) across a number of sub-domains. However, items in which students did particularly well included (Figure 5.5):

- Nine out of 43 items covering geometry (representing 21% of all items in this sub-domain).
- Seven out of 41 items covering data and chance (representing 17% of all items in this sub-domain).
- Nine out of 63 items covering algebra (representing 14% of all items in this sub-domain).
- Eight out of 46 items covering reasoning (representing 17% of all items in this sub-domain).

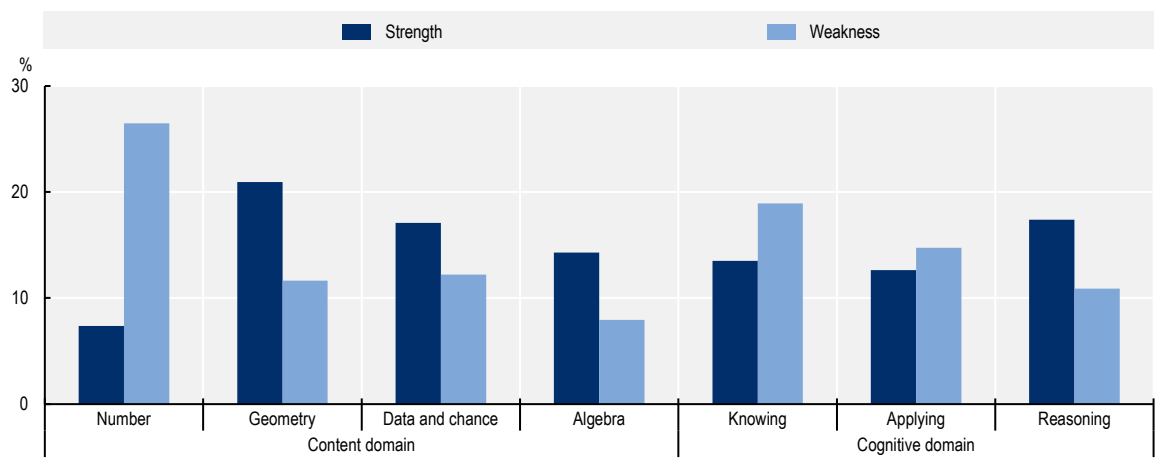
In mathematics, weaknesses include the sub-domains of number and knowing

- Eighteen out of 68 items covering the number sub-domain (representing 26% of all items in this sub-domain) (Figure 5.5).
- Fourteen out of 74 items covering the knowing sub-domain (representing 19% of all items in this sub-domain).

As with mathematics and science in Grade 4, students did better in multiple-choice questions and less well in open-ended questions. Moreover, average test item difficulty did not vary much between items representing strengths and those representing weaknesses. The two exceptions were knowing and multiple-choice questions, where the items representing a strength were more difficult than those representing a weakness. Variations in difficulty between items representing strengths and weaknesses could reflect exposure to certain topics in the curriculum, certain teaching practices emphasising particular cognitive skills, or certain assessment tools used more frequently in classrooms in Türkiye, such as multiple-choice questions.

Figure 5.5. Conspicuous items in mathematics in Grade 8 (TIMSS 2015)

Items in which students performed well and not well



Note: The items represented in the figure are conspicuous, precisely top (strength) and bottom (weakness) items. Average (neither strength nor weakness) as well as non-conspicuous items were excluded.
Source: IEA (2016[9]), *TIMSS 2015,* https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021).

In comparison with Grade 4, there was a reversal in the areas of strength and weakness in Grade 8. Geometry and reasoning, which were areas of weakness in Grade 4, became areas of strength in Grade 8, and the reverse is true for number and knowing. Data from PISA and TIMSS show that students in Türkiye

tend to perform less well in mathematics compared with the other domains of reading and science. While the reasons for this cannot be identified through the data alone, this might reflect a less consistent approach across the curriculum and teaching in mathematics in the country. The performance in mathematics contrasts notably with science, where there are clear consistencies in the patterns of strength and weakness across grades and domains in Türkiye.

In science, physics is an area of strength

- Twelve conspicuous physics items out of 62 (representing 19% of all physics items) fell into the group of items representing strengths (Figure 5.6)

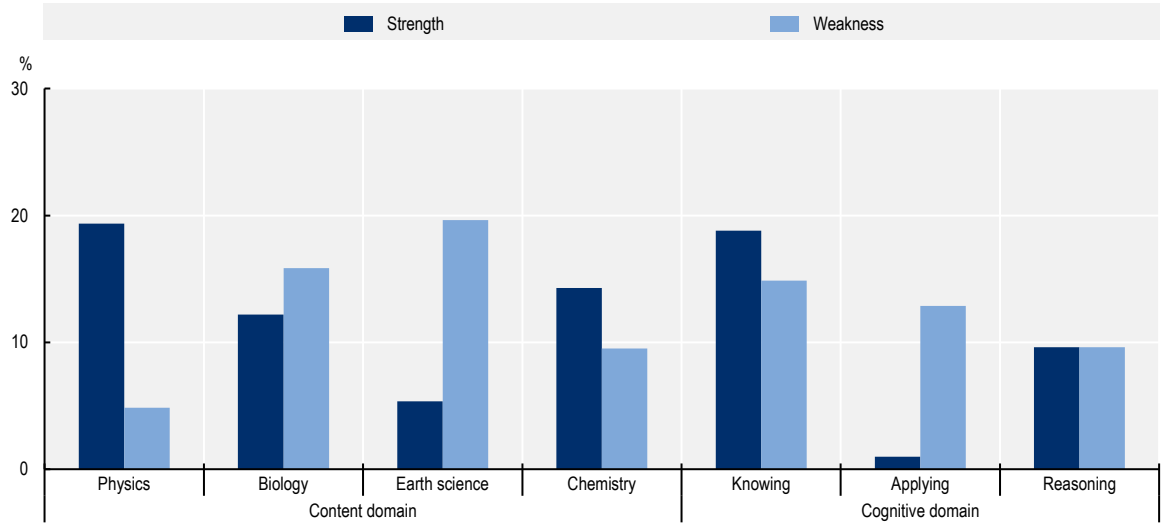
In science, earth science and applying are areas of weakness

- Eleven out of 56 items covering earth science (representing 20% of all items in this sub-domain) fell into the group of items representing weaknesses (Figure 5.6).
- Thirteen out of 101 items covering the cognitive domain of applying (representing 13% of those items) also fell into this group.

The test items covering physics in which students did particularly well were more difficult than those representing weaknesses. This seems counterintuitive and could be for a number of reasons. One might be because students make less effort in items that they perceive to be easier, another might be differences in emphasis in the physics curriculum or approaches to teaching and learning in physics in Türkiye. For the rest of the content and cognitive domains the average difficulty did not vary hugely between items representing strengths and those representing weaknesses. In comparison with Grade 4, physics remains an area of strength while applying scientific knowledge remains an area of weakness.

Figure 5.6. Conspicuous items in science in Grade 8 (TIMSS 2015)

Items in which students performed well and not well



Note: The items represented in the figure are conspicuous, precisely top (strength) and bottom (weakness) items. Average (neither strength nor weakness) as well as non-conspicuous items were excluded.
Source: IEA (2016[9]), *TIMSS 2015,* https://timss2015.org/timss-2015/about-timss-2015/ (accessed on 21 May 2021).

Item analysis 2019: Performance in individual test items in Grade 8

In mathematics, areas of strength include algebra, knowing and reasoning

Items in which students did particularly well included (Figure 5.7):

- Ten out of 74 items covering algebra (representing 14% of all items in this sub-domain).
- Twenty out of 93 items covering knowing (representing 22% of all items in this sub-domain).
- Six out of 53 items covering reasoning (representing 11% of all items in this sub-domain).

In mathematics, weaknesses include geometry, data and probability and applying

Items in which students did less well included (Figure 5.7):

- Thirteen out of 60 items covering geometry (representing 22% of all items in this sub-domain).
- Eight out of 59 items covering data and probability (representing 14% of all items in this sub-domain).
- Twenty-two out of 134 items covering applying (representing 16% of all items in this sub-domain).

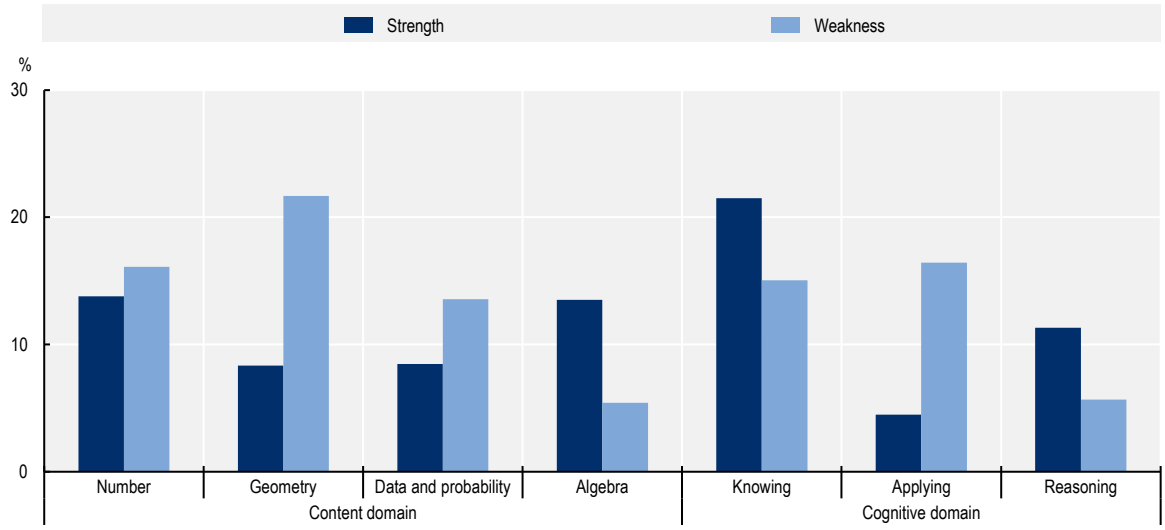
From 2015 to 2019 item analysis: Strengths and weaknesses in Grade 8 across years in mathematics

From both the analysis of 2015 and 2019, algebra emerges as a strong area of content in Türkiye in Grade 8. The consistency of algebra as a strength might reflect the focus of the curriculum in Türkiye. However, aside from this, there is no clear pattern in the strengths and weaknesses in mathematics over 2015 and 2019 or in comparison with Grade 4. This might reflect the impact of curriculum changes or more broadly a less consistent approach to mathematics teaching across schooling.

In Grade 8 mathematics, students performed better in multiple-choice questions. This is consistent with the results from 2015 and might be related to the frequent use of multiple-choice questions in classroom tests at school in Türkiye (Kitchen et al., 2019[12]). Regarding difficulty, in mathematics, students did well in items that were more difficult on average compared to other items, suggesting that they master these areas, such as number in Grade 4 and algebra in Grade 8. At the same time, the items in which students performed less well were more difficult on average, indicating that students are still able to respond well to questions covering the basis of geometry, data and probability and applying.

Figure 5.7. Conspicuous items in mathematics in Grade 8 (TIMSS 2019)

Items in which students performed well and not well



Note: The items represented in the figure are conspicuous, precisely top (strength) and bottom (weakness) items. Average (neither strength nor weakness) as well as non-conspicuous items were excluded.
Source: IEA (2020[10]), *TIMSS 2019*, https://timssandpirls.bc.edu/timss2019/international-database/, (accessed on 20 December 2021).

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In science, chemistry is an area of strength

Items in which students did particularly well included (Figure 5.8):

- Sixteen out of 63 items covering chemistry (representing 25% of all items in this sub-domain).

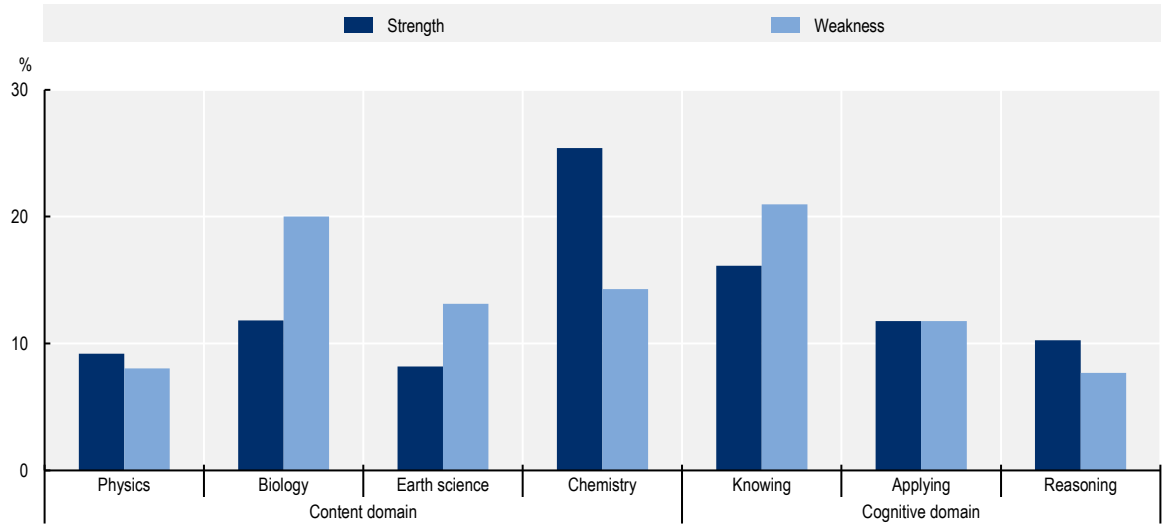
In science, biology, earth science and knowing are areas of weakness

Items in which students did less well included (Figure 5.8):

- Twenty-two out of 110 items covering biology (representing 20% of all items in this sub-domain).
- Eight out of 61 items covering earth science (representing 13% of all items in this sub-domain).
- Twenty-six out of 124 items covering knowing (representing 21% of all items in this sub-domain).

Figure 5.8. Conspicuous items in science in Grade 8 (TIMSS 2019)

Items in which students performed well and not well



Note: The items represented in the figure are conspicuous, precisely top (strength) and bottom (weakness) items. Average (neither strength nor weakness) as well as non-conspicuous items were excluded.
Source: IEA (2020[10]), *TIMSS 2019*, https://timssandpirls.bc.edu/timss2019/international-database/, (accessed on 20 December 2021).

StatLink https://stat.link/ofu5jd

From 2015 to 2019 item analysis: Strengths and weaknesses in Grade 8 across years in science

In Grade 8 in 2019, students performed particularly well in chemistry. Students in Türkiye are strong in both algebra and chemistry, which reflects the shared skills that underpin these subjects – chemistry uses algebra to express relationships between quantities and substances (Cunningham and Whelan, 2014[16]). In line with Grade 4 in 2019, students improved in the domain of applying and this is might be related to the new curriculum implemented in 2018 (Box 5.4). In science, earth science was an area of weakness in both 2015 and 2019, which might point to this sub-domain having less coverage in Türkiye's curriculum.

In science, students performed well in items that were relatively easy compared to the other items in the same domains showing that even in the weaker ones – biology, earth science and the cognitive domains of knowing items – students are able to respond to easier questions covering the basics. However, students struggled with more difficult items, which might suggest that the curriculum or pedagogy does not cover or prepare students for topics that are more difficult. Only in chemistry, students performed well in difficult items. This reflects the high performance of students in Türkiye in chemistry compared to other OECD countries.

Performance in different aspects of reading competency in upper secondary education

At the age of 15, almost all students in Türkiye were in upper secondary education. Students who sat the PISA 2018 test responded to a series of test items in mathematics, reading and science selected from a pool of 243 reading items, 70 mathematics items and 115 science items. Since reading was the major domain of assessment in PISA 2018, more test items were used to assess this domain than for

mathematics and science, so the analysis in this chapter focuses on reading. Moreover, sub-scales were constructed only for reading and not for mathematics and science.

Sub-domain analysis: At age 15, understanding and evaluating and reflecting are areas of strength

In each of the domains – reading, mathematics and science – PISA items differ in terms of content and cognitive process (Table 5.3). Items are also differentiated by proficiency (with levels ascending with difficulty) and question format. Chapter 1 provides a full description of the assessment framework. The reading test items were characterised by a number of attributes such as: cognitive process (understand, locate information, evaluate and reflect), text source (single or multiple texts), item format (i.e. simple multiple-choice, complex multiple-choice, open-ended), text type (e.g. argumentative, narrative, exposition) and text format (i.e. continuous, non-continuous and mixed). The design of the reading test is described in detail in the PISA 2018 assessment and analytical framework (OECD, 2019[17]).

Comparing student performance in the different reading sub-domains to the overall average for Türkiye, understanding, evaluating and reflecting, in addition to proficiency with single texts, were found to be areas in which students did better than the national average for reading as a whole (Table 5.12). It is possible that those results are driven by curriculum coverage or by student exposure to teaching practices that emphasise certain cognitive skills.

Table 5.12. Reading sub-domains in PISA

Country	Mean performance in reading	Mean performance in reading process sub-scales			Mean performance in the single- and multiple-source sub-scales	
		Locate information	Understand	Evaluate and reflect	Single text	Multiple text
Germany	498	498	494	497	494	497
Poland	512	514	514	514	512	514
Russia	479	479	480	479	477	482
Türkiye	466	463	474	475	473	471
OECD average	487	487	486	489	485	490

Note:
Relative strength in Türkiye.
Source: OECD (2021[18]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en (accessed on 21 May 2021).

Item analysis: Performance in individual test items in upper secondary education

In reading, areas of strength included evaluating and reflecting

- In terms of cognitive processes, only one process stood out: evaluate and reflect (Figure 5.9). Out of 63 test items, 15 items (24%) were identified as representing a strength against only four items representing a weakness (6%). In evaluating and reflecting, students should reflect on the content and form of the text and critically assess the quality and validity of the information therein.

The PISA items can also be differentiated in terms of the types of sources that students were required to engage with. Particular strengths among students in Türkiye included:

- Out of the 45 test items covering narration texts, 11 items (24% of all items covering this text type) were identified as conspicuous items in which Turkish students did exceptionally well. The information in narration texts refers to the properties of objects in time. Narration texts typically require students to answer questions relating to when, in what sequence and why characters in stories behave as they do.
- Six out of 38 items covering argumentative text (representing 16% of those items) were found to represent an area of strength. Argumentation texts present the relationship among concepts or propositions and often answer "why" questions.
- Turkish students did particularly well in test items covering continuous texts, with 26 out of 158 items identified as representing an area of strength (representing 16% of all items covering this type). Continuous texts are formed by sentences organised into paragraphs. Examples of continuous texts include newspaper reports, essays, novels, short stories, reviews and letters. In contrast, no test items covering non-continuous texts fell into the category representing strength. Examples of non-continuous texts include lists, tables, graphs, diagrams, advertisements, schedules, catalogues, indices and forms.

No major differences in average difficulty were observed between items in the category representing a strength and those representing a weakness with the exception of the cognitive process of evaluating and reflecting. For this sub-domain, the items representing an area of strength were easier than those representing a weakness. This could reflect variations in students' effort when answering test questions, as they may put more effort into answering difficult questions rather than easy ones. It could also reflect exposure to certain teaching practices or particular topics in the curriculum that are associated with the cognitive process of evaluating and reflecting.

In reading, area of weakness across the cognitive domains was locating information

- Twelve out of 49 items (24%) covering the cognitive process of locating information fell into the category of conspicuous items representing a weakness (Figure 5.9). Locating information consists of accessing and retrieving information within a piece of text and searching for and selecting relevant text.

Other weaknesses reflected the types of sources students were required to engage with including description, multiple-source and non-continuous texts.

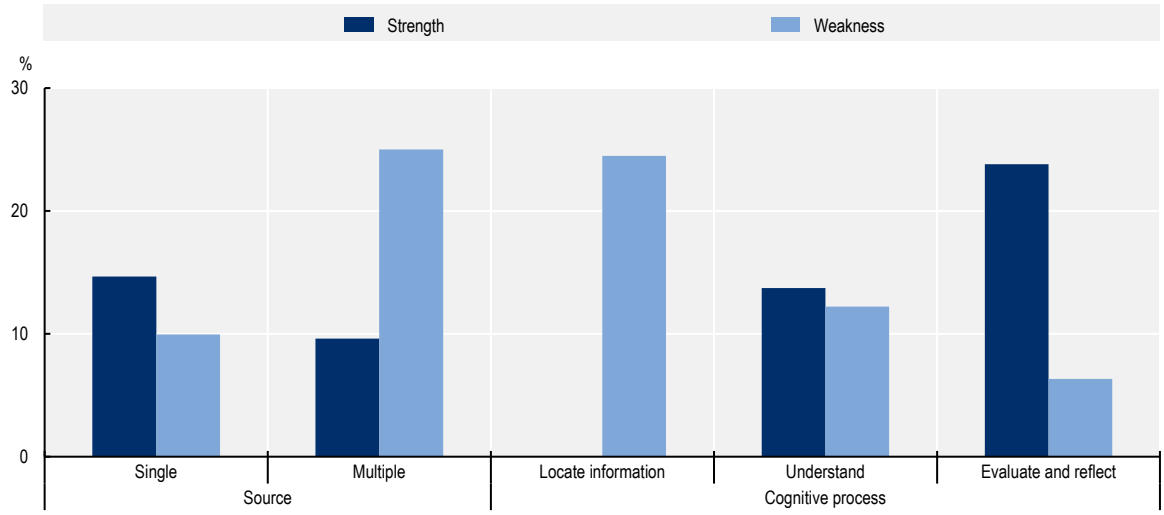
- Six out of 30 items (20%) covering description texts were identified as conspicuously weak items. Description texts are texts where the information refers to the properties of objects in space. Such texts typically provide an answer to "what" questions.
- Students also did worse in test items covering multiple-source texts with 38% of all items covering this type (8 out of 21 items) being identified as representing an area of weakness.
- Students did particularly worse in test items covering non-continuous texts such as lists, tables, graphs, diagrams, advertisements, schedules, catalogues and forms. Six out of 30 (20%) test items fell into this category.

These results could reflect certain exposure at school to particular types of text or instructional strategies. Students are probably more exposed to continuous texts such as newspapers, reports, essays and novels than non-continuous texts such as tables, graphs, diagrams, indices and forms.

Finally, students found it more difficult to engage with complex, multiple-choice questions, with eight out of 32 test items (25%) being identified as representing an area of weakness. No major differences in average difficulty were observed between items in the category representing a strength and those representing a weakness.

Figure 5.9. Conspicuous items in reading in PISA 2018

Items in which students performed well and not well



Note: The items represented in the figure are conspicuous, precisely top (strength) and bottom (weakness) items. Average (neither strength nor weakness) as well as non-conspicuous items were excluded.
Source: OECD (2021[18]), "PISA: Programme for International Student Assessment", https://dx.doi.org/10.1787/data-00365-en.

StatLink https://stat.link/2vjith

In science, students did well in test items covering evaluating and designing scientific enquiry and in open-ended test questions while in mathematics no clear patterns emerged

Since mathematics and science were not the major domains of assessment in PISA 2018, fewer items were included in the assessment and fewer were identified as conspicuous. Therefore:

- In science, students did well in the content domain of physical systems (6 items representing 16% of all items in this group) and did worse in items covering living systems (8 items representing 17% of all items in this group).
- Students also did particularly well in test items covering the cognitive process of "evaluate and design scientific enquiry" with 5 out of 30 items (17%) identified as representing an area of strength.
- Eleven out of 49 (24%) test items covering the cognitive process of explaining phenomena scientifically were identified as conspicuous items representing a weakness.

Students did well in open-ended science questions and less well in complex multiple-choice ones. In physics and in the cognitive domain of explaining phenomena scientifically, the items in which students did particularly well were slightly more difficult than those in which they did poorly. In mathematics, only 14 conspicuous items (8 representing strength and 6 representing weakness) were identified out of 70 test items without a clear pattern emerging in terms of item characteristics.

Conclusions

By analysing the results from TIMSS Grade 4 and 8 in 2015 and 2019, as well as PISA 2018, physics emerges as an area of strength across all levels of schooling (except in Grade 8 in 2019). This may be related to the curriculum's focus as well as strong pedagogical practices that support students to do particularly well in this domain. Students also performed very well in chemistry in Grade 8 in 2019. Earth science and life science are areas of weakness for students in Türkiye in all grades. These two domains are closely related and the students' performance may reflect relatively less exposure to this kind of content. From TIMSS 2015 to TIMSS 2019, applying scientific knowledge improved, possibly reflecting the curriculum reform that took place in 2017/18.

In mathematics, in contrast with science, there is less consistency across areas of strength and weakness over the different levels of school and different assessments. However, sub-domains number in Grade 4 and algebra in Grade 8 were identified as areas of strength. Students' strength in these domains may facilitate their competency in the complex science domains of physics and chemistry since these mathematical skills underpin the skills required in these two science domains (Rossdy et al., 2019[15]). Overall, strengths and weaknesses that emerge from this chapter's analysis of the international assessments might be associated with curricula coverage or teaching and learning practices in Türkiye and might warrant further analysis nationally.

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Note

[1] In this report, the terminology of "TIMSS, Grade 4" is used throughout since this is the official name of the assessment. However, the data refer to Grade 5 students in lower secondary education in Türkiye.

Annex A. Description of variables

Students' socio-economic status

OECD Programme for International Student Assessment (PISA)

In PISA, a student's socio-economic status is estimated by the PISA index of economic, social and cultural status (ESCS), a composite score based on three indicators: highest parental occupation, parental education, and home possessions. As no direct income measure has been available from the PISA data, the existence of household items has been used as a proxy for family wealth.

Highest parental occupation: Occupational data for both the student's mother and the student's father were obtained from responses to open-ended questions.

Home possessions: students reported on the availability of 16 household items at their home including three country-specific household items that were seen as local measures of family wealth within the country's context. In addition, students reported the amount of possessions and books at home.

In Türkiye the three country-specific items in PISA 2018 were:

- Air conditioning type heating-cooling system
- TV subscriptions with payment
- A holiday for at least one week in a year

Parental education: based on an internationally standardised transformation of the index of highest educational level of parents into years of education. The values used for each level of education are the median values observed in 2015 across all countries (OECD, 2018[1]).

In PISA the terms "advantaged students" and "disadvantaged students" refer respectively to those students coming from the top and bottom quartile of the ESCS scale.

Trends in International Mathematics and Science Study (TIMMS)

Socio-economic status of students in TIMSS Grade 4 is measured by the Home Resources for Learning scale based on students' and parents' reports. Students were scored according to their own and their parents' reports regarding the availability of five resources on the Home Resources for Learning scale. Cut scores divide the scale into three categories. Students with Many Resources had a score at or above the cut score corresponding to students reporting they had more than 100 books and both home study supports in their home and their parents reporting they had more than 25 children's books in their home, that at least one parent finished university, and that at least one parent had a professional occupation, on average. Students with Few Resources had a score at or below the cut score corresponding to students reporting they had 25 or fewer books and neither of the home study supports in their home and their parents reporting they had ten or fewer children's books in the home, that neither parent had gone beyond upper secondary education, and that neither parent was a small business owner or worked in a clerical or professional occupation, on average. All other students had Some Resources.

Socio-economic status of students in TIMSS Grade 8 is measured by Home Educational Resources scale based on students' reports. Students were scored according to their reports regarding the availability of

three resources on the Home Educational Resources scale. Cut scores divide the scale into three categories. Students with Many Resources had a score at or above the cut score corresponding to reporting they had more than 100 books and both home study supports in their home and that at least one parent finished university, on average. Students with Few Resources had a score at or below the cut score corresponding to reporting they had 25 or fewer books and neither of the home study supports in the home and that neither parent had gone beyond upper secondary education, on average. All other students had Some Resources (IEA, 2020[2]).

In this report, the terms “students with many resources” and “students with few resources” are replaced respectively by advantaged and disadvantaged students for consistency with the terminology used in PISA.

Early childhood education and care (ECEC) participation

PISA

PISA provides the starting age of early childhood education and care and the duration in years (OECD, 2018[1]).

TIMSS

Early childhood education and care attendance in TIMSS is collected only for students in Grade 4 and it is based on the parents’ reports. It includes four categories that measure ECEC attendance: Attended 3 Years or More, Attended 2 Years, Attended 1 Year or Less, Did Not Attend (IEA, 2020[2]).

School location

PISA

PISA asks schools principals which definition best describes the community in which their school is located. The options include city, town and rural (OECD, 2018[1]).

TIMSS

TIMSS collects data from principals on a number of school characteristics including school location. The variables includes the following categories: urban area, suburban area, medium sized city, small town and remote area (IEA, 2020[2]).

School socio-economic status

PISA

Advantaged and disadvantaged schools are defined in terms of the socio-economic profile of schools. All schools in each PISA-participating education system are ranked according to their average PISA index of economic, social and cultural status (ESCS) and then divided into four groups with approximately an equal number of students (quarters). Schools in the bottom quarter are referred to as “socio-economically disadvantaged schools”; and schools in the top quarter are referred to as “socio-economically advantaged schools” (OECD, 2019[3]).

TIMSS

TIMSS characterises schools in terms of socio-economic composition based on principals' reports of the percentages of economically-disadvantaged and economically-affluent students in the school. "More affluent" schools were defined as having more than 25 percent of students from economically affluent homes and not more than 25 percent from economically disadvantaged homes, while "more disadvantaged" schools had more than 25 percent of students from disadvantaged homes and not more than 25 percent from affluent homes. All other combinations were considered to be "neither more affluent nor more disadvantaged (IEA, 2020[2]).

In this report, the same terminology of PISA was adopted for TIMSS for consistency, so more affluent and more disadvantaged schools are referred as advantaged and disadvantaged schools.

School resources

PISA

PISA 2018 included a question with eight items about school resources, measuring the school principal's perceptions of potential factors hindering the provision of instruction at school. The four response categories were "Not at all", "Very little", "To some extent", and "A lot". Both the scale on staff shortage and the scale on shortage of educational material were based on four items each (OECD, 2018[1]).

TIMSS

School resources in TIMSS are calculated with the Resource Shortages scale. It is based on principals' reports and it includes two kinds of resource shortages affecting instruction: general school resources and resources specific to mathematics instruction. Students were scored according to their principals' responses regarding thirteen school and classroom resources on the Instruction Affected by Mathematics Resource Shortages scale. Cut scores divide the scale into three categories. Students in schools where instruction was Not Affected by resource shortages had a score at or above the cut score corresponding to their principals reporting that shortages affected instruction "not at all" for seven of the thirteen resources and "a little" for the other six, on average. Students in schools where instruction was Affected A Lot had a score at or below the cut score corresponding to their principals reporting that shortages affected instruction "a lot" for seven of the thirteen resources and "some" for the other six, on average. All other students attended schools where instruction was Somewhat Affected by resource shortages (IEA, 2020[2]).

Language spoken at home

PISA

Students indicated which language they usually speak at home. For students who do not speak the test language at home, they were asked whether the language spoken is: mostly the heritage language, about equally often the heritage language and the test language, or mostly the test language (OECD, 2018[1]).

TIMSS

TIMSS asks students in both Grade 4 and 8 how often they speak the language of the test at home. The variable includes the following categories: "always," "almost always," "sometimes," or "never" speak the language of the TIMSS test at home (IEA, 2020[2]).

Private schools

PISA

Schools are classified as either public or private according to whether a private entity or a public agency has the ultimate power for decision making concerning its affairs. The variable include the following categories: Private independent, Private Government-dependent, Public. This index was calculated in 2018 and in all previous cycles. In PISA 2018, however, a few countries provided this information from administrative record (e.g., Ireland, Singapore) (OECD, 2018[1]).

Isolation index

PISA

Isolation indices provide an indication of whether school systems create “clusters” of students based on their academic performance. Higher values in the indices mean that low achievers are more often isolated in certain schools with students of similar ability; lower values in the indices correspond to a more varied distribution of student abilities within schools. From these indices, one may calculate the opportunities available for a student from one particular group to interact at school with students who do not belong to the same group. For instance, a value of 0.30 in the isolation index of low achievers means that a student who scores in the bottom quarter of the distribution of PISA performance within a country has around one-in-two chance of attending the same school as students who are also low achievers, while this likelihood would have been only one in four if students had been uniformly distributed across schools. Similarly, the isolation index of high achievers measures the concentration in certain schools of those students who score in the top quarter of the distribution of PISA performance in their country, i.e. whether these students are isolated in certain schools with other high-performing students (high values in the index) or are more often “mixed” with students of lower ability (low values in the index) (OECD, 2019[4]).

Student-teacher ratio

PISA

The student-teacher ratio in PISA was obtained by dividing the number of enrolled students by the total number of teachers (OECD, 2018[1]).

Study help

PISA

PISA asks schools principals whether the school provides room(s) where students can do their homework, staff provides help with homework and peer-to-peer tutoring if offered (OECD, 2018[1]).

Extra-curricular activities

PISA

School principals were asked to report what extra-curricular activities their schools offered to 15-year-old students. The index of creative extra-curricular activities at school was computed as the total number of the following activities that occurred at school: band, orchestra or choir; school play or school musical; and art club or art activities (OECD, 2018[1]).

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Student Achievement in Türkiye

FINDINGS FROM PISA AND TIMSS INTERNATIONAL ASSESSMENTS

The Republic of Türkiye's trajectory of improvement over the past two decades stands out internationally. Few other countries have been able to bring previously out-of-school children into the education system and improve performance at the same time. This report provides a picture on how student performance has evolved over this period. It is based on data from the OECD Programme for International Student Assessment (PISA) and the International Association for the Evaluation of Educational Achievement (IEA) Trends in International Mathematics and Science Study (TIMSS). The report analyses if factors related to student background – such as gender or socio-economic status – are associated with performance. It also analyses student performance across different cognitive and content domains of learning.

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