COUNTRY NOTE

PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT (PISA)
RESULTS FROM PISA 2012

UNITED STATES

Key findings

- Among the 34 OECD countries, the United States performed below average in mathematics in 2012 and is ranked 27th (this is the best estimate, although the rank could be between 23 and 29 due to sampling and measurement error). Performance in reading and science are both close to the OECD average. The United States ranks 17 in reading, (range of ranks: 14 to 20) and 20 in science (range of ranks: 17 to 25). There has been no significant change in these performances over time.
- Mathematics scores for the top-performer, Shanghai-China, indicate a performance that is the equivalent of over two years of formal schooling ahead of those observed in Massachusetts, itself a strong-performing U.S. state.
- While the U.S. spends more per student than most countries, this does not translate into better performance. For example, the Slovak Republic, which spends around USD 53 000 per student, performs at the same level as the United States, which spends over USD 115 000 per student.
- Just over one in four U.S. students do not reach the PISA baseline Level 2 of mathematics proficiency – a higher-than-OECD average proportion and one that hasn't changed since 2003. At the opposite end of the proficiency scale, the U.S. has a below-average share of top performers.
- Students in the United States have particular weaknesses in performing mathematics tasks with higher cognitive demands, such as taking real-world situations, translating them into mathematical terms, and interpreting mathematical aspects in real-world problems. An alignment study between the Common Core State Standards for Mathematics and PISA suggests that a successful implementation of the Common Core Standards would yield significant performance gains also in PISA.
- Socio-economic background has a significant impact on student performance in the United States, with some 15% of the variation in student performance explained by this, similar to the OECD average. Although this impact has weakened over time, disadvantaged students show less engagement, drive, motivation and self-beliefs.
- Students in the U.S. are largely satisfied with their school and view teacher-student relations positively. But they do not report strong motivation towards learning mathematics: only 50% students agreed that they are interested in learning mathematics, slightly below the OECD average of 53%.

How does the United States perform overall?

- Among the 34 OECD countries, the United States performed below average in 2012 in mathematics (rank 26[1]), comparable with Hungary, Italy, Lithuania, Norway, Portugal, the Russian Federation, the Slovak Republic, Spain and Sweden.

- In reading, the United States performed around the average (rank 17[2]), comparable with Austria, the Czech Republic, Denmark, France, Hungary, Israel, Italy, Norway, Portugal, the United Kingdom and Viet Nam. In science, the performance of the United States was also close to the OECD average (rank 213) and comparable with that of Austria, Belgium, Croatia, Denmark, France, Hungary, Italy, Latvia, Lithuania, Luxembourg, Norway, Portugal and Spain.

- The trend data show no significant changes in the average performance of U.S. 15-year-old students in the mathematics, reading and science over time.

- Just over one-quarter (26%) of 15-year-olds in the United States do not reach the PISA baseline Level 2 of mathematics proficiency, at which level students begin to demonstrate the skills that will enable them to participate effectively and productively in life. This percentage is higher than the OECD average of 23% and has remained unchanged since 2003. By contrast, in Hong Kong-China, Korea, Shanghai-China and Singapore, 10% of students or fewer are poor performers in mathematics.

- At the other end of the performance scale, the United States also has a below-average share of top performers in mathematics. These students can develop and work with models for complex situations, and work strategically using broad, well-developed thinking and reasoning skills. Only 2% of students in the United States reach the highest level (Level 6) of performance in mathematics, compared with an OECD average of 3% and 31% of students in Shanghai-China. The proportions of top performers in reading and science in the United States are both around the OECD average.

What are the strengths and weaknesses of US students in mathematics?

Relative to their overall performance in mathematics, students in the United States are stronger in interpreting mathematical results than they are at formulating a real-world problem into mathematics. Also, they perform relatively better on tasks in the content area *change and relationships* (e.g. algebra and the study of mathematical functions and relations) and less well in the content area *space and shape* (geometry-related content).

Students in the United States have particular strengths in cognitively less-demanding mathematical skills and abilities, such as extracting single values from diagrams or handling well-structured formulae. They have particular weaknesses in items with higher cognitive demands, such as taking real-world situations, translating them into mathematical terms, and interpreting mathematical aspects in real-world problems.

Analysis of the items on which United States students performed relatively well indicates the following strengths and weaknesses in their mathematical competence:

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2 Though rank 17 is the best estimate, due to sampling and measurement error the rank could be between 14 and 20.

3 Though rank 20 is the best estimate, due to sampling and measurement error the rank could be between 17 and 25.

Strengths

- Reading data directly from tables and diagrams – requiring students only to understand a short text and read single values directly from a representation provided such as a table or a bar diagram

- Simple handling of data from tables and diagrams – requiring students to understand a short text, read two values from a given representation, and then perform some straightforward operation such as adding or comparing the values

- Handling directly manageable formulae – requiring students to use a formula provided, e.g. inserting numbers for variables, and do some easy calculation. The formulae can be used directly, without any re-structuring.

Weaknesses

- Use of the number π – requiring students to make explicit use of the number π in a calculation

- Substantial mathematization of a real-world situation – requiring students to establish a mathematical model of a given real-world situation in the form of a term or an equation with variables for geometric or physical quantities, before further actions (especially calculations) can take place. Students have to understand the situation and activate and apply the appropriate mathematical content

- Genuine interpretation of real-world aspects – requiring students to take a given real-world situation seriously and properly interpret aspects of it

- Reasoning in a geometric context – requiring authentic reasoning in a planar or spatial geometric context by using geometric concepts and facts

- U.S. students have particular problems with mathematical literacy tasks where the students have to use the mathematics they have learned in a well-founded manner. Given that even in more demanding tasks some basic skills are nevertheless needed, an implication of the findings is that much more focus is needed on higher-order activities, such as those involving mathematical modeling (understanding real world situations, translating them into mathematical models, and interpreting mathematical results), without neglecting the basic skills needed for these activities

How does PISA relate to the Common Core State Standards in Mathematics?

With most U.S. states having adopted the Common Core State Standards for Mathematics (CCSSM) as their state mathematics standard, a relevant question is: how does performance measured by PISA relate to the CCSSM? and is faithful implementation of CCSSM likely to improve U.S. performance in PISA?

The analysis suggests that a successful implementation of the Common Core Standards would yield significant performance gains also in PISA. The prominence of modeling in U.S. high school standards has already influenced developers of large-scale assessments in the United States. If more students work on more and better modeling tasks than they do today, then one could reasonably expect PISA performance to improve.

It may be that U.S. students seldom work on well-crafted tasks that situate algebra, proportional relationships and rational numbers within authentic contexts. More generally, perhaps the application problems that most students encounter today are the worst of all worlds: fake applications that strive to make the mathematics curriculum more palatable, yet do no justice either to modeling or to the pure mathematics involved. Providing students with the necessary "opportunity to learn" will therefore be

necessary in order to develop the skills in students that allow them to make frequent and productive use of mathematics in their work and life.

What difference does context make?

A country's context can be important for interpreting the PISA results. In this respect, the United States sometimes has a significant advantage compared with other industrialised countries.

The wealth of the United States means it can spend more on education

- Some 12% of the variation between OECD countries' mean scores can be predicted on the basis of per capita GDP. The United States, which ranks 3rd after Luxembourg and Switzerland in terms of per capita GDP, has a substantial economic advantage over many other OECD countries because of the amount of money it has available to spend on education.

Only Austria, Luxembourg, Norway and Switzerland spend more per student

- A comparison of countries' actual spending per student, on average, from the age of 6 up to the age of 15 also puts the United States at an advantage, since only Austria, Luxembourg, Norway and Switzerland spend more, on average, on education per student. And yet, the Slovak Republic, which spends around USD 53 000 per student, performs at the same level as the United States, which spends over USD 115 000 per student. Similarly, Korea, the highest-performing OECD country in mathematics, spends well below the average per-student expenditure.

Parents in the United States are better educated than in most other countries.

- The United States ranks sixth highest among OECD countries in the percentage of 35-44 year-olds who have attained tertiary education (the group corresponds roughly to the age group of parents of the 15-year-olds assessed in PISA).

The share of students from disadvantaged backgrounds in the United States is about average.

- A comparison of the socio-economic status of the most disadvantaged quarter of students across OECD countries puts the United States around the OECD average, while the socio-economic status of the U.S. student population as a whole ranks clearly above the OECD average.

Among OECD countries, the United States has the 6th largest proportion of students with an immigrant background.

- However, the share of students with an immigrant background explains just 4% of the performance variation between countries. Despite having large proportions of immigrant students, some countries, like Canada, perform above the OECD average.

Equity in the context of performance

Socio-economic disadvantage has a notable impact on student performance in the United States: 15% of the variation in student performance in the United States is explained by students' socio-economic status, similar to the OECD average, but with some improvement since 2003. This contrasts with less than 10% in a number of countries/economies, including Finland, Hong Kong-China, Japan and Norway. In other words, in the United States, two students from a different socio-economic background vary much more in their learning outcomes than is normally the case in these other countries/economies.

Unlike half of OECD countries, in the United States there is no significant difference between advantaged and disadvantaged schools in student-teacher ratios or in the proportion of mathematics teachers with university-level qualifications.

In the United States, 5% of students can be considered resilient, meaning that they are among the 25% most socio-economically disadvantaged students but nevertheless perform much better than would be predicted by their socio-economic status. This is below the OECD average of 7% and is only around one-third of the proportion observed in in Hong Kong-China, Macao-China, Shanghai-China and Viet Nam.

Disadvantaged students show less engagement, drive, motivation and self-beliefs than advantaged students.

How the school environment shapes learning

Punctuality and attendance at school have strong associations with performance across all countries. Some 30% of 15-year-old students in the United States reported that they had arrived late for school at least once in the two weeks prior to the PISA test, slightly below the OECD average of 35%, and some 20% of students in the United States reported that they had skipped a day of school in the previous two weeks, above the OECD average of 15%. Those who had skipped a class or a day of school scored 24 points lower in mathematics, on average, than those who hadn't.

Compared with students in other countries, 15-year-olds in the United States view the relationships between students and teachers relatively positively. Still, schools in the United States with better average performance tend to have more positive student-teacher relationships, even after accounting for the socio-economic status and demographic background of students and schools and various other school characteristics.

Schools whose principals reported that teachers' behaviour negatively affects learning to a great extent also tend to be those whose principals reported that teachers' morale is low. This relationship is particularly strong in the United States. Similarly, the United States is one of the countries with the strongest correlation between schools with a predominantly socio-economically disadvantaged student population and a more negative disciplinary climate at school.

The organisation of schooling

On average across OECD countries, schools with more autonomy over curricula and assessments tend to perform better than schools with less autonomy when they are part of school systems with more accountability arrangements and greater teacher-principal collaboration in school management.

Around three out of four students in the United States attend schools that compete with at least one other school for enrolment (similar to the OECD average), yet there is no evident cross-country relationship between the degree of competition among schools and student performance.

Students of the same age in the United States are more likely than students in other countries to be in different grades (vertical stratification) but are less likely to be streamed into separate programs (horizontal stratification).

Assessment and accountability policies

The United States is one of only three OECD countries that tends to rely not only on national examinations, but also on other, non-national, types of examinations in upper and lower secondary education.

Over 80% of U.S. students attend schools whose principals reported that achievement data are posted publicly (the OECD average is 45%), and virtually all students are in schools whose principals reported that achievement data are tracked over time by an administrative authority (the OECD average is 72%).

Resources

As already noted, among OECD countries, higher expenditure on education is not highly predictive of better mathematics scores in PISA. For example, the United States and the Slovak Republic score 481 points in mathematics, but the United States' cumulative expenditure per student is more than double that of the Slovak Republic.

In the United States, as well as in many other countries, schools whose principals reported that teacher shortages hinder learning tend to show lower performance; and the United States is one of a group of countries where advantaged and disadvantaged schools show particularly wide differences in the extent of teacher shortages.

Principals in advantaged schools in the United States tend to have much more positive views of the adequacy of material resources than principals in disadvantaged schools.

On average across countries, students who had attended pre-primary education tend to perform better at the age of 15 than those who had not attended pre-primary education. While in almost all countries this performance advantage remains even after accounting for socio-economic status, this is not the case in the United States.

Students' engagement, drive and self-beliefs

Students in the United States are largely satisfied with their school and have positive feelings towards school: 81% of students feel that they belong at school, 88% make friends easily, and 86% do not feel like an outsider or feel left out of things. Some 80% of students reported that they feel happy at school, 81% are satisfied with school, and 74% believe that conditions are ideal in their school.

Intrinsic motivation refers to the drive to perform an activity because of the pleasure and interest in the activity itself. Across OECD countries, large proportions of students reported low levels of enjoyment of mathematics. For example, only 53% of students in OECD countries agreed or strongly agreed that they are interested in the things they learn in mathematics: 58% of boys but only 49% of girls so reported. U.S. students reported similarly low levels of intrinsic motivation. Only 50% of students in the U.S. agreed or strongly agreed that they interested in learning mathematics: 53% of boys and 47% of girls.

Despite their below average performance in mathematics, U.S. students feel relatively confident in their own abilities in mathematics compared with their counterparts in other countries. For example, 69% reported that they felt confident in a mathematical task such as calculating the petrol-consumption rate of a car, compared with the OECD average of 56%.

On average across OECD countries, greater mathematics anxiety is associated with a 34-point lower score in mathematics – the equivalent of almost one year of school. Students in the United States reported below-average levels of anxiety towards mathematics: across OECD countries, 30% of students, on average, reported that they feel helpless when doing mathematics problems; only 23% of U.S. students so reported. However, girls reported more anxiety towards mathematics than boys – both in the United States and across OECD countries.

Snapshot of performance in mathematics, reading and science

Countries/economies with a mean performance/share of top-performers above the OECD average Countries/economies with a share of low-achievers below the OECD average
Countries/economies with a mean performance/share of low-achievers/share of top-performers not statistically significantly different from the OECD average
Countries/economies with a mean performance/share of top-performers below the OECD average Countries/economies with a share of low-achievers above the OECD average
Countries/economies in which the annualised change in performance is statistically significant are marked in **bold**.

	Mathematics				Reading		Science	
	Mean score in PISA 2012	Share of low-achievers (Below Level 2)	Share of top-performers in mathematics (Level 5 or 6)	Annualised change	Mean score in PISA 2012	Annualised change	Mean score in PISA 2012	Annualised change
OECD average	494	23.1	12.6	**-0.3**	496	**0.3**	501	**0.5**
Shanghai-China	613	3.8	55.4	**4.2**	570	**4.6**	580	1.8
Singapore	573	8.3	40.0	**3.8**	542	**5.4**	551	**3.3**
Hong Kong-China	561	8.5	33.7	**1.3**	545	**2.3**	555	**2.1**
Chinese Taipei	560	12.8	37.2	1.7	523	**4.5**	523	-1.5
Korea	554	9.1	30.9	1.1	536	**0.9**	538	**2.6**
Macao-China	538	10.8	24.3	**1.0**	509	**0.8**	521	**1.6**
Japan	536	11.1	23.7	0.4	538	**1.5**	547	**2.6**
Liechtenstein	535	14.1	24.8	0.3	516	**1.3**	525	0.4
Switzerland	531	12.4	21.4	0.6	509	**1.0**	515	0.6
Netherlands	523	14.8	19.3	**-1.6**	511	-0.1	522	-0.5
Estonia	521	10.5	14.6	0.9	516	**2.4**	541	1.5
Finland	519	12.3	15.3	**-2.8**	524	**-1.7**	545	**-3.0**
Canada	518	13.8	16.4	**-1.4**	523	**-0.9**	525	**-1.5**
Poland	518	14.4	16.7	**2.6**	518	**2.8**	526	**4.6**
Belgium	515	18.9	19.4	**-1.6**	509	0.1	505	-0.8
Germany	514	17.7	17.5	**1.4**	508	**1.8**	524	1.4
Viet Nam	511	14.2	13.3	m	508	m	528	m
Austria	506	18.7	14.3	0.0	490	-0.2	506	-0.8
Australia	504	19.7	14.8	**-2.2**	512	**-1.4**	521	-0.9
Ireland	501	16.9	10.7	-0.6	523	**-0.9**	522	**2.3**
Slovenia	501	20.1	13.7	**-0.6**	481	**-2.2**	514	-0.8
Denmark	500	16.8	10.0	**-1.8**	496	0.1	498	0.4
New Zealand	500	22.6	15.0	**-2.5**	512	**-1.1**	516	**-2.5**
Czech Republic	499	21.0	12.9	**-2.5**	493	-0.5	508	-1.0
France	495	22.4	12.9	**-1.5**	505	0.0	499	0.6
United Kingdom	494	21.8	11.8	-0.3	499	0.7	514	-0.1
Iceland	493	21.5	11.2	**-2.2**	483	**-1.3**	478	**-2.0**
Latvia	491	19.9	8.0	0.5	489	**1.9**	502	**2.0**
Luxembourg	490	24.3	11.2	**-0.3**	488	**0.7**	491	0.9
Norway	489	22.3	9.4	-0.3	504	0.1	495	1.3
Portugal	487	24.9	10.6	**2.8**	488	**1.6**	489	**2.5**
Italy	485	24.7	9.9	**2.7**	490	0.5	494	**3.0**
Spain	484	23.6	8.0	0.1	488	-0.3	496	1.3
Russian Federation	482	24.0	7.8	1.1	475	**1.1**	486	1.0
Slovak Republic	482	27.5	11.0	**-1.4**	463	-0.1	471	**-2.7**
United States	481	25.8	8.8	0.3	498	-0.3	497	1.4
Lithuania	479	26.0	8.1	-1.4	477	1.1	496	1.3
Sweden	478	27.1	8.0	**-3.3**	483	**-2.8**	485	**-3.1**
Hungary	477	28.1	9.3	**-1.3**	488	**1.0**	494	-1.6
Croatia	471	29.9	7.0	0.6	485	1.2	491	-0.3
Israel	466	33.5	9.4	**4.2**	486	**3.7**	470	**2.8**
Greece	453	35.7	3.9	**1.1**	477	0.5	467	-1.1
Serbia	449	38.9	4.6	**2.2**	446	**7.6**	445	1.5
Turkey	448	42.0	5.9	**3.2**	475	**4.1**	463	**6.4**
Romania	445	40.8	3.2	**4.9**	438	1.1	439	**3.4**
Cyprus[1,2]	440	42.0	3.7	m	449	m	438	m
Bulgaria	439	43.8	4.1	**4.2**	436	0.4	446	2.0
United Arab Emirates	434	46.3	3.5	m	442	m	448	m
Kazakhstan	432	45.2	0.9	**9.0**	393	0.8	425	**8.1**
Thailand	427	49.7	2.6	**1.0**	441	**1.1**	444	**3.9**
Chile	423	51.5	1.6	**1.9**	441	**3.1**	445	1.1
Malaysia	421	51.8	1.3	**8.1**	398	**-7.8**	420	-1.4
Mexico	413	54.7	0.6	**3.1**	424	**1.1**	415	0.9
Montenegro	410	56.6	1.0	**1.7**	422	**5.0**	410	-0.3
Uruguay	409	55.8	1.4	**-1.4**	411	**-1.8**	416	**-2.1**
Costa Rica	407	59.9	0.6	-1.2	441	-1.0	429	-0.6
Albania	394	60.7	0.8	**5.6**	394	**4.1**	397	2.2
Brazil	391	67.1	0.8	**4.1**	410	**1.2**	405	**2.3**
Argentina	388	66.5	0.3	1.2	396	-1.6	406	2.4
Tunisia	388	67.7	0.8	**3.1**	404	**3.8**	398	**2.2**
Jordan	386	68.6	0.6	0.2	399	-0.3	409	**-2.1**
Colombia	376	73.8	0.3	1.1	403	**3.0**	399	1.8
Qatar	376	69.6	2.0	**9.2**	388	**12.0**	384	**5.4**
Indonesia	375	75.7	0.3	0.7	396	**2.3**	382	-1.9
Peru	368	74.6	0.6	1.0	384	**5.2**	373	1.3

Countries and economies are ranked in descending order of the mathematics mean score in PISA 2012.

Source: OECD PISA 2012 database, Tables I.2.1a, I.2.1b, I.2.3a, I.2.3b, I.4.3a, I.4.3b, I.5.3a and I.5.3b.

1. Footnote by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

2. Footnote by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

What is PISA?

The Programme for International Student Assessment (PISA) is an ongoing triennial survey that assesses the extent to which 15-year-olds students near the end of compulsory education have acquired key knowledge and skills that are essential for full participation in modern societies. The assessment does not just ascertain whether students can reproduce knowledge; it also examines how well students can extrapolate from what they have learned and apply that knowledge in unfamiliar settings, both in and outside of school. This approach reflects the fact that modern economies reward individuals not for what they know, but for what they can do with what they know.

PISA offers insights for education policy and practice, and helps monitor trends in students' acquisition of knowledge and skills across countries and in different demographic subgroups within each country. The findings allow policy makers around the world to gauge the knowledge and skills of students in their own countries in comparison with those in other countries, set policy targets against measurable goals achieved by other education systems, and learn from policies and practices applied elsewhere.

Key features of PISA 2012

- The PISA 2012 survey focused on mathematics, with reading, science and problem-solving minor areas of assessment. For the first time, PISA 2012 also included an assessment of the financial literacy of young people, which was optional for countries.

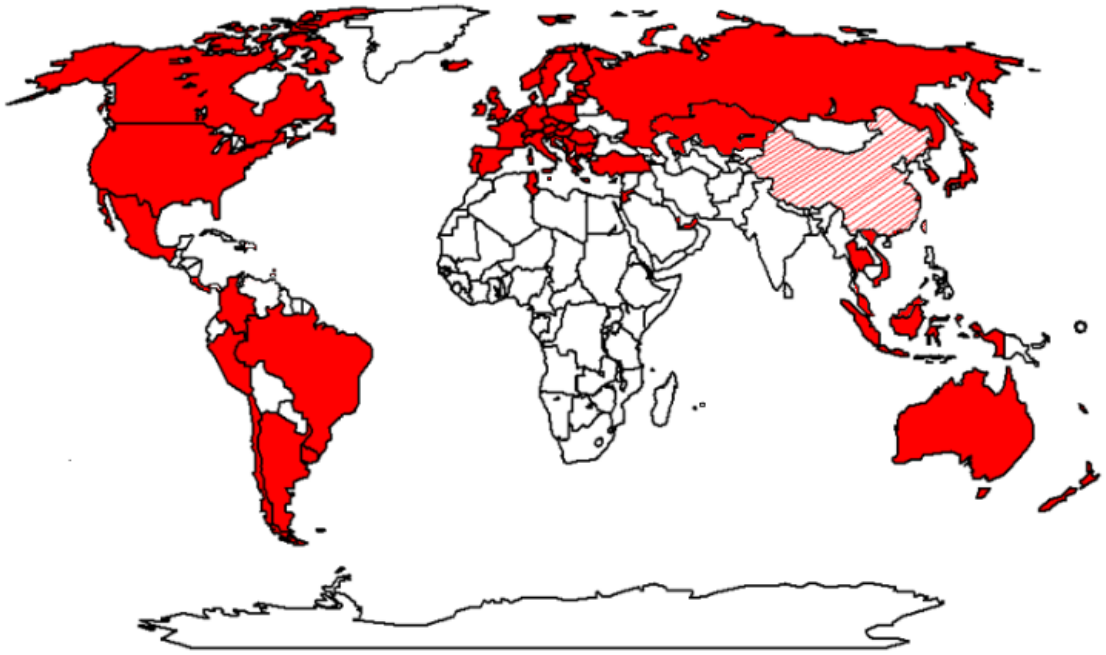
The students

- Around 510 000 students completed the assessment in 2012, representing about 28 million 15-year-olds in the schools of the 65 participating countries and economies.
- In the United States, just over 6,000 randomly selected 15-year-old students from 161 randomly selected schools participated.

The assessment

- Paper-based tests were used, with assessments lasting a total of two hours for each student. In a range of countries and economies, an additional 40 minutes were devoted to the computer-based assessment of mathematics, reading and problem solving.
- Test items were a mixture of multiple-choice items and questions requiring students to construct their own responses. The items were organised in groups based on a passage setting out a real-life situation. A total of about 390 minutes of test items were covered, with different students taking different combinations of test items.
- Students answered a background questionnaire, which took 30 minutes to complete, that sought information about themselves, their homes and their school and learning experiences. School principals were given a questionnaire, to complete in 30 minutes, that covered the school system and the learning environment. In some countries and economies, optional questionnaires were distributed to parents, who were asked to provide information on their perceptions of and involvement in their child's school, their support for learning in the home, and their child's career expectations, particularly in mathematics. Countries could choose two other optional questionnaires for students: one asked students about their familiarity with and use of information and communication technologies, and the second sought information about their education to date, including any interruptions in their schooling and whether and how they are preparing for a future career.

Map of PISA 2012 countries and economies



OECD countries

Australia	Japan
Austria	Korea
Belgium	Luxembourg
Canada	Mexico
Chile	Netherlands
Czech Republic	New Zealand
Denmark	Norway
Estonia	Poland
Finland	Portugal
France	Slovak Republic
Germany	Slovenia
Greece	Spain
Hungary	Sweden
Iceland	Switzerland
Ireland	Turkey
Israel	United States
Italy	United States

Partner countries and economies in PISA 2012

Albania	Malaysia
Argentina	Montenegro
Brazil	Peru
Bulgaria	Qatar
Colombia	Romania
Costa Rica	Russian Federation
Croatia	Serbia
Cyprus[1,2]	Shanghai-China
Hong Kong-China	Singapore
Indonesia	Chinese Taipei
Jordan	Thailand
Kazakhstan	Tunisia
Latvia	United Arab Emirates
Liechtenstein	Uruguay
Lithuania	Vietnam
Macao-China	

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For more information on the Programme for International Student Assessment and to access the full set of PISA 2012 results visit:

www.oecd.org/pisa