INDICATOR A5

WHAT ARE STUDENTS' ATTITUDES TOWARDS MATHEMATICS?

This indicator examines how 15-year-old students' attitudes toward and approaches to learning and school vary across countries and across groups of countries, as well as the relationship between these characteristics and students' performance in mathematics. The indicator draws on data from the OECD Programme for International Student Assessment's (PISA) 2003 survey.

Key results

- Students from countries that are in close geographical or cultural proximity to one another tend to share similar attitudes toward learning and similar school contexts, though the attitudes and characteristics bringing them together differ across subgroups of countries. The strength of the relationship between students' attitudes toward mathematics, approaches to learning and school contexts and their mathematics performance vary in similar ways across groups of countries.

- In Denmark, Finland and Sweden, students' attitudes toward mathematics have a strong relationship with students' achievement in mathematics. In these countries above-average positive relationship between interest, instrumental motivation, and self-concept with performance and an above-average negative relationship between anxiety and mathematics performance can be observed.

- Japan and Korea, as well as the Nordic countries, show above-average positive associations between at least two of the PISA 2003 indices of students' approaches to learning and their mathematics performance, indicating the importance of strategic learning techniques for students in these countries.

- Of the school-related indices, disciplinary climate consistently has the largest positive effect on mathematics performance across countries. Among the other school-related indices, the largest positive associations are between students' attitudes toward school and teacher support in the countries in the two subgroups that represent most of the Anglophone and Nordic countries in the sample.

Policy context

PISA measures several facets of students' attitudes and approaches to learning and the contexts in which they learn. PISA's conceptual framework is founded on a general model of student learning in which students are active participants in the learning process, with learning involving the strategic engagement of one's cognitive, affective and behavioural processes within their particular cultural, social, and school contexts. In PISA, 15-year-olds' attitudes and approaches to learning are treated as important outcomes in their own right, as well as factors that account for variation in cognitive performance.

There is considerable empirical support for the influence of students' learning attitudes and approaches on academic performance, and vice versa. At the same time, however, it is important to note that the extent and nature of such relationships may differ across countries and cultures. Students' attitudes toward learning and their perceptions of their abilities to regulate their own learning and select appropriate strategies for achieving their goals are shaped in part by their outside environment – the society and culture in which they live and the schools they attend. Education systems differ in the extent to which they value particular learning attitudes or courses of action. For example, in countries that may place a high premium on academic performance, particularly in mathematics, students may display considerably higher levels of anxiety about their performance in mathematics than in countries that do not share this goal.

This indicator examines how 15-year-old students' attitudes toward and approaches toward learning and the school contexts of learning vary across countries and across groups of countries, and also the relationship between these characteristics and students' performance in mathematics.

Evidence and explanations

The indicator is based on the PISA 2003 survey and draws on eight composite scales describing students' attitudes towards mathematics and their approaches to learning, as well as four school-related scales describing the social contexts and climates in which learning occurs. Each of the 12 scales is based on a number of survey items that provide ordinal values, which are summarised into composite scales, with varying but reasonable levels of scale reliabilities. (See *Learning for Tomorrow's World: First Results from PISA 2003* [OECD 2004a] for additional information on the construction of these scales.)

Students' attitudes include their interest in and enjoyment of mathematics, instrumental motivation, self-concept in mathematics, self-efficacy in mathematics, and anxiety in mathematics. Learning approaches include students' reported use of control strategies, memorisation strategies, and elaboration strategies. School-related indices include students' attitudes toward school, their sense of belonging in school, and indices of teacher support and of disciplinary climate. Box 5.1 describes these scales in more detail.

Classifying countries by students' attitudes toward mathematics, approaches to learning, and school-related indices

Chart A5.1 shows the results of a classification analysis, which grouped countries according to similarities among their averages on the 12 scales. Box 5.2 provides additional information on how the classification analysis was performed. The ordering of groups from top to bottom in the chart is arbitrary and implies no sense of hierarchy.

Box A5.1. Descriptions of indices of students' attitudes towards mathematics, approaches to learning and school-related indices

Attitudes towards mathematics

Students' interest in and enjoyment of mathematics refer to intrinsic motivation, and may affect the intensity and continuity of their engagement in learning situations, their selection of learning strategies and the depth of their understanding.

Instrumental motivation in mathematics refers to the extent to which students are encouraged to learn mathematics by external rewards such as good job prospects, an orientation which can influence both study choices and performance.

Self-concept in mathematics refers to students' beliefs about their own mathematical competence.

Self-efficacy in mathematics refers to the extent to which students believe that they can handle mathematics learning situations effectively and overcoming difficulties, which can affect students' willingness to take on challenging task and persist with it.

Anxiety in mathematics refers to the extent to which students feel helpless and under emotional stress when dealing with mathematics.

Approaches to learning

Memorisation strategies refer to those strategies students use that involve representations of knowledge and procedures stored in memory with little or no further processing.

Elaboration strategies are those strategies in which students connect new material to prior learning, which can result in deeper understanding than through simple memorisation.

Control strategies are those in which students monitor what they are learning, compare it with their goals, and identify what still needs to be learned, which can allow them to adapt their learning to the task at hand.

School-related indices

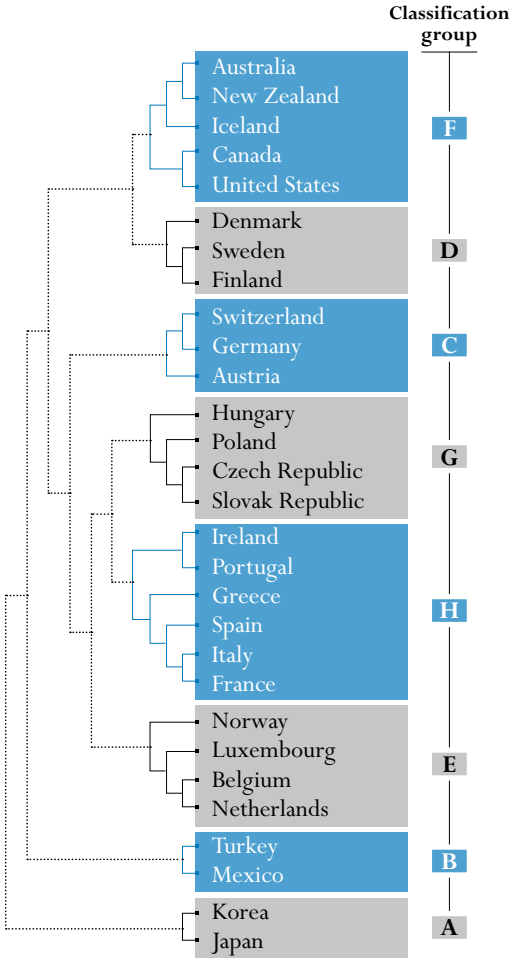
Students' attitudes towards school refer to the degree to which they believe that school has prepared them for life and work and given them the confidence to make decisions.

Sense of belonging at school refers to students' perceptions about whether school is a place where they feel like an outsider, feel awkward, out-of-place and lonely, or where they feel like they belong and can make friends easily.

Teacher support refers to the individual support students receive from teachers in learning situations. The index was based on students' reports on the degree to which their teachers demonstrate interest and willingness to help their students.

Disciplinary climate refers to the level of disorder and disruption in the classroom. The index was based on students' reports on the degree to which there is noise in the classroom, how quickly they are able to quiet down and get to work, and whether or not other students listen to their teacher.

Chart A5.1. Classification of countries based on means of students' attitudes toward mathematics, approaches to learning and school-related indices (2003)



Source: OECD PISA 2003 database.

StatLink http://dx.doi.org/10.1787/068056433507

The results show that group membership is related to countries' geographical or cultural proximity. For example, two East Asian countries – Japan and Korea – form one group while three of the Nordic countries (Finland, Sweden, and Denmark) form another, and the Central European countries Hungary, Poland, the Czech Republic, and the Slovak Republic form a third group. In these cases, the grouped countries share geographic proximity as well as some commonality in the way the education systems have developed historically. The four Central European countries, for example, share characteristics based on their having developed over the past two decades from centralised socialist states. Western and Southern European countries also cluster together, as do the Benelux countries (with Norway as an anomalous addition to that group).

In the case of the United States, Canada, New Zealand and Australia, which are classified closely, the proximity is not in terms of geography, but language – these countries represent most of the predominantly Anglophone OECD countries that participate in PISA. The group of Austria, Germany and Switzerland shares both geographic and linguistic similarities.

Mexico and Turkey share an economic context that differs significantly from the majority of OECD countries.

To some extent, the group membership may also be influenced by similarities in the way students in certain countries tend to report to self-reported questions on their attitudes.

Box A5.2. How classification analysis was performed

The hierarchical cluster analysis is employed to identify relatively homogeneous groups of countries based on the 12 selected characteristics (see Box A5.1). The algorithm starts with each country in a separate cluster and combines clusters sequentially until only one is left.

Shown above, Chart A5.1, a tree diagram, is used to illustrate the arrangement of the clusters produced by the hierarchical cluster analysis. The axis represents an index of the distances between countries at each point of aggregation. Cutting the tree at a given height will give a clustering at a selected precision. A partition in eight groups was adopted here.

How subgroups are distinct

Table A5.1 provides countries' averages on the 12 scales, which were used in the prior classification analysis, as well as a standardised version of the average scores (*i.e.* Z-scores) for each subgroup. For the analysis presented here, the standardised subgroup averages must be examined.

In the table, subgroups of countries are introduced from top to bottom by the degree of distinctiveness, which is calculated as the mean of the absolute value of the Z-scores. Additionally, values are highlighted in the table when they are greater than 1 or smaller than -1, to indicate that the countries are either on the high or low end of the score distribution for the scale. The table also reports the number of high or low scores as defined by the standardised averages. This provides another indication of the degree of distinctiveness, as the higher the number, the more distinct are the subgroups of countries, as the countries deviate from the average in light of the scales of interest.

Japan and Korea (Group A) form the most distinct subgroup of countries, and are consistently either high or low on all twelve scales. While these are among the best performing education systems in terms of student achievement, students in these countries tend to be more anxious about mathematics and feel more socially isolated than other OECD students (*i.e.* they report relatively negative attitudes towards school and low sense of belonging). They also do not feel positive about mathematics or their mathematical skills, and they rely comparatively little on the systematic learning strategies studied in PISA.

Two other countries form a quite distinct subgroup, Mexico and Turkey (Group B), although the attitudes and characteristics bringing them together are different than in the previous example. Mexican and Turkish students tend to report what are generally considered to be educationally positive and favourable attitudes and approaches. In particular, students report high levels of interest in mathematics, they rely heavily on elaboration strategies for learning, and they report

a high level of teacher support. However, their anxiety in mathematics is high compared to other OECD students and their sense of belonging and self-efficacy in mathematics are the second weakest of any of the subgroups of countries, after Japan and Korea.

Austria, Germany, and Switzerland (Group C), as a subgroup, are distinguished by the seemingly favourable social environment of their schools. Students report a relatively strong disciplinary climate and relatively high levels of sense of belonging, as well as positive attitudes towards mathematics such as high levels of self-efficacy and low levels of anxiety. Additionally, students in these countries show common patterns with regard to their preferred approaches to learning (not seen among other subgroups of countries), with a relatively high reliance on control strategies and lesser reliance on memorisation or elaboration strategies.

Compared to these subgroups, the remaining countries are less distinctive. Still, in Denmark, Finland and Sweden (Group D) students report the lowest levels of anxiety in mathematics and they tend to shy away from control strategies (and, to some extent, memorisation strategies) compared to students in other countries. Australia, Canada, Iceland, New Zealand and the United States, (Group F) are somewhat distinct from other subgroups in the relatively high reported levels of teacher support and students' self-concept in mathematics. Students in the Czech Republic, Hungary, Poland and the Slovak Republic (Group G) reported the highest levels of self-efficacy in math. Finally, the subgroup of France, Greece, Ireland, Italy, Portugal and Spain (Group H) was mostly at the average across countries on the 12 scales.

Relating students' attitudes towards mathematics, approaches to learning, and school-related indices with mathematics performance

Tables A5.2a, A5.2b and A5.2c show, for each OECD country, the positive or negative difference in the mathematics score per one-unit change in the index score and whether or not that difference varies from the OECD average. In other words, the data provide an indication of the size of the effect of each of the 12 indices on students' mathematics performance and how that relates to the average effect. For example, in Australia, the mathematics score increases 18.6 points on average for each one-unit increase in the index of students' interest in and enjoyment of mathematics, which is a significantly greater increase than that of the OECD average increase of 11.9 points (at the 95% probability level). In other words, interest in and enjoyment of mathematics has a stronger relationship with performance in Australia than it does in OECD countries generally.

The three tables present each set of indices: attitudes toward mathematics, approaches to learning, and school-related indices. Additionally, the countries are presented by the subgroups identified in the previous analysis. This allows an examination of whether or not the similarities in students' attitudes, approaches and contexts translate into similarities in their effects on mathematics performance.

These tables also provide the general trend of how each of the scales is related to mathematics performance, with the OECD average shown at the bottom of the page. Some of the results are initially counter-intuitive. For example, teacher support, a factor that is generally expected to be positively related to student achievement, is negatively correlated with the mathematics score. However, the change in mathematics score for each unit of increase in the index of teacher support, compared with those for other indices, is small. The use of elaboration strategies and memorisation strategies are also negatively correlated, but again the effect sizes are small.

It is also possible that students who generally are lower performers may be more likely to be choosing these strategies (or, as in the previous example, may be with teachers whose role it is to provide extra support and remediation) and the scales may be sensitive to low performing students. The other indices show the expected directions, with particularly strong relationships between mathematics performance and self-concept in mathematics, self-efficacy in mathematics, anxiety in mathematics and disciplinary climate.

Table A5.2a shows the relationship between students' attitudes towards mathematics and their performance in that subject. In Denmark, Finland and Sweden (Group D), students' attitudes toward mathematics has a strong relationship with students' achievement in mathematics, with above-average positive effects of interest, instrumental motivation and self-concept and an above-average negative effect of anxiety on mathematics performance in all three countries. This is true for the other Nordic countries in PISA 2003 (Norway and Iceland), although in Iceland, the relationship of anxiety with mathematics is similar to that of the OECD average.

Japan and Korea (Group A), on the other hand, have more mixed results across the indices on attitudes. In these two countries, there are above-average positive relationships of interest, instrumental motivation and self-efficacy with mathematics scores. However, anxiety does not have as large a negative effect in these two countries as it does in OECD countries on average.

Similarly, Austria, Germany, and Switzerland (Group C), while internally consistent, also have mixed results across the indices on attitudes. Like Japan and Korea, in these countries, anxiety in mathematics does not have as strong an association with student performance as it does in OECD countries on average. Yet, unlike most other OECD countries, instrumental motivation and self-concept also have a lesser impact on mathematics performance than average, and in Austria and Switzerland, the change in mathematics score related to students' instrumental motivation in mathematics is in the opposite direction (negative) than the OECD average.

With regard to the relationship of attitudes towards mathematics and performance, Mexico and Turkey (Group B) are unique among countries in that their statistics are around the averages, with none of the indices having a relatively strong or weak relationship with mathematics performance compared to other countries.

Table A5.2b shows the relationship between students' approaches to learning and mathematics performance. Japan and Korea (Group A), as well as Finland (Group D) and Norway (Group E), show above-average positive associations between the three indices and students' mathematics performance, indicating the importance of strategic learning techniques for students in these countries. Turkey and Spain (from Groups B and H) also show consistently positive (although generally smaller) associations of all three learning strategies and mathematics performance. In contrast, Austria, Germany and Switzerland (Group C), the Czech and Slovak Republics (Group G), and Belgium and Luxembourg (from Group E) show above-average negative associations between control and, in particular, memorisation strategies and students' performance in mathematics.

Table A5.2c shows the relationship between the selected school-related indices and mathematics performance. Of the school-related indices, disciplinary climate has the largest positive effect on mathematics performance consistently across countries. Among the other school-related indices, the largest positive associations are between students' attitudes toward school and teacher support in the countries in Groups F and D, representing most of the Anglophone and Nordic

countries in the sample. These countries also are similar in the consistently weak associations of sense of belonging and mathematics performance. Germany, Switzerland and Austria (Group C) are similar only in the above-average negative association of teacher support and mathematics performance. In these countries, students with low mathematics scores may be more likely to receive additional support, indicating that these systems may be rich in teacher support for those students who need it.

Definitions and methodologies

PISA was most recently administered in 2006; however, since those data are not yet available, this indicator is based on data from the PISA 2003 survey.

The target population for this indicator was all 15-year-old students (in participating countries) enrolled in educational institutions at the secondary-school level regardless of grade level, type of institution, and part- or full-time enrolment status. Fifteen-year olds were defined as students who were between 15 years and 3 months to 16 years and 2 months at the beginning of the PISA testing period.

Tables A5.2a through A5.2c provide data on the change in a country's mathematics score per unit of the relevant indices. The indices summarise student responses to a series of related questions constructed on the basis of previous research (see Annex A1 of *Learning for Tomorrow's World: First Results from PISA 2003* [OECD 2004a]). The validity of comparisons across countries was explored using structural equation modelling. In describing students in terms of each characteristic (*i.e.* self-concept in mathematics), scales were constructed on which the average OECD student (*i.e.* the student with an average level of self-concept) was given an index value of zero, and about two-thirds of the OECD student population are between the values of -1 and 1 (*i.e.* the index has a standard deviation of 1). Negative values on an index do not necessarily imply that students responded negatively to the underlying questions. Rather, a student with a negative score responded less positively than students on average across OECD countries. Likewise, a student with a positive score responded more positively than the average in the OECD area.

Tables A5.2a, A5.2b and A5.2c also provide an OECD average and an OECD total, per the standard PISA reporting conventions. The OECD average takes the OECD countries as a single entity, to which each country contributes with equal weight. For statistics such as percentages or mean scores, the OECD average corresponds to the arithmetic mean of the respective country statistics. In contrast, for statistics relating to variation, the OECD average may differ from the arithmetic mean of the country statistics because it not only reflects variation within countries, but also variation that lies between countries. The OECD total, rather, takes OECD countries as a single entity, to which each country contributes in proportion to the number of 15-year-olds enrolled in its schools. It illustrates how a country compares with the OECD as a whole and may be used to refer to the stock of human capital in the OECD region. As in the indicator, the average is used when the focus is on comparing performance or other attributes across countries. All averages include data for the United Kingdom, even when the data are not shown in the respective data tables.

The United Kingdom did not reach PISA's unit response rate standard, which precludes its comparison with the other countries on whole population analyses. Estimates for the United Kingdom are still reported in charts and tables dealing with subsets of the population

for the purposes of comparison within the country. When estimates for the United Kingdom are reported, they are reported at the end of charts and tables separate from the estimates of other countries as a cautionary reminder that the estimate may not be as reliable as the estimates of countries that met PISA's unit response rate standard.

Further references

For further information about PISA 2003, see *Learning for Tomorrow's World – First Results from PISA 2003* (OECD, 2004a), and the *PISA 2003 Technical Report* (OECD, 2005b). PISA data are also available on the PISA website: *www.pisa.oecd.org*.

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Table A5.1.

Means on students' attitudes towards mathematics, approaches to learning, and school-related indices (2003)

OECD countries	Classification group	Number of high or low scores	Mean of absolute values of standardised means	Attitudes towards mathematics					Approaches to learning			School-related indices			
				Instrumental motivation	Interest in mathematics	Self-concept in mathematics	Self-efficacy in mathematics	Anxiety in mathematics	Control strategies	Memorisation strategies	Elaboration strategies	Attitudes toward school	Sense of belonging	Teacher support	Disciplinary climate
Japan	A			-0.66	-0.39	-0.53	-0.53	0.44	-0.54	-0.56	-0.75	-0.50	-0.53	-0.34	0.44
Korea	A			-0.44	-0.12	-0.35	-0.42	0.41	-0.49	-0.35	-0.39	-0.37	-0.39	-0.22	0.12
Average				*-0.55*	*-0.25*	*-0.44*	*-0.47*	*0.43*	*-0.51*	*-0.45*	*-0.57*	*-0.44*	*-0.46*	*-0.28*	*0.28*
Standardised average		*12*	*1.89*	*-1.98*	*-1.13*	*-2.52*	*-2.25*	*1.62*	*-1.95*	*-2.17*	*-1.95*	*-2.25*	*-2.02*	*-1.19*	*1.70*
Mexico	B			0.58	0.58	0.17	-0.22	0.47	0.45	0.56	0.85	0.42	0.08	0.48	0.00
Turkey	B			0.23	0.55	0.02	-0.18	0.34	0.26	0.10	0.44	0.13	-0.44	0.41	-0.12
Average				*0.40*	*0.56*	*0.10*	*-0.20*	*0.41*	*0.35*	*0.33*	*0.65*	*0.28*	*-0.18*	*0.45*	*-0.06*
Standardised average		*8*	*1.38*	*1.45*	*2.51*	*0.54*	*-0.95*	*1.53*	*1.34*	*1.55*	*2.20*	*1.42*	*-0.81*	*1.90*	*-0.37*
Austria	C			-0.49	-0.28	0.07	0.16	-0.27	0.52	0.06	-0.27	0.12	0.44	-0.39	0.21
Germany	C			-0.04	0.04	0.15	0.15	-0.25	0.38	-0.06	-0.31	-0.08	0.24	-0.29	0.30
Switzerland	C			-0.04	0.12	0.13	0.32	-0.29	0.19	-0.19	-0.06	0.03	0.19	0.01	0.10
Average				*-0.19*	*-0.04*	*0.12*	*0.21*	*-0.27*	*0.37*	*-0.06*	*-0.21*	*0.02*	*0.29*	*-0.22*	*0.21*
Standardised average		*5*	*0.80*	*-0.70*	*-0.19*	*0.67*	*1.00*	*-1.02*	*1.38*	*-0.30*	*-0.73*	*0.11*	*1.29*	*-0.96*	*1.25*
Denmark	D			0.37	0.41	0.24	-0.07	-0.46	-0.19	-0.27	0.07	-0.03	0.01	0.14	-0.08
Finland	D			0.06	-0.24	0.01	-0.15	-0.31	-0.48	-0.19	-0.14	0.11	-0.02	0.08	-0.15
Sweden	D			0.02	0.09	0.13	0.03	-0.49	-0.40	-0.08	-0.02	0.02	0.25	0.20	-0.05
Average			*0.15*	*0.15*	*0.09*	*0.13*	*-0.06*	*-0.42*	*-0.36*	*-0.18*	*-0.03*	*0.03*	*0.08*	*0.14*	*-0.09*
Standardised average		*2*		*0.54*	*0.38*	*0.71*	*-0.30*	*-1.58*	*-1.36*	*-0.87*	*-0.11*	*0.18*	*0.35*	*0.59*	*-0.55*
Belgium	E			-0.32	-0.17	-0.03	-0.04	0.09	-0.05	-0.09	-0.17	-0.19	-0.28	-0.11	0.04
Luxembourg	E			-0.41	-0.26	0.07	0.10	-0.01	0.08	-0.05	-0.25	-0.23	0.23	-0.30	-0.21
Netherlands	E			-0.26	-0.20	0.00	-0.09	-0.38	-0.27	-0.16	-0.26	-0.19	-0.06	-0.27	-0.13
Norway	E			0.15	-0.17	-0.18	-0.04	-0.05	-0.26	-0.12	-0.16	-0.21	0.24	-0.11	-0.24
Average			*0.13*	*-0.21*	*-0.20*	*-0.04*	*-0.02*	*-0.09*	*-0.12*	*-0.11*	*-0.21*	*-0.21*	*0.03*	*-0.20*	*-0.13*
Standardised average		*1*		*-0.76*	*-0.88*	*-0.21*	*-0.10*	*-0.33*	*-0.48*	*-0.51*	*-0.72*	*-1.06*	*0.13*	*-0.85*	*-0.81*
Australia	F			0.23	0.01	0.13	0.10	-0.05	0.01	0.17	0.06	0.25	0.04	0.25	-0.01
Canada	F			0.23	-0.01	0.19	0.25	-0.04	0.06	0.16	0.08	0.06	0.02	0.27	0.02
Iceland	F			0.31	-0.11	0.03	0.04	-0.20	0.00	-0.03	-0.06	0.00	0.16	0.20	-0.15
New Zealand	F			0.29	0.12	0.15	0.01	-0.10	-0.03	0.13	0.13	0.10	-0.01	0.16	-0.17
United States	F			0.17	0.04	0.25	0.27	-0.10	0.01	0.31	0.18	0.09	m	0.34	0.12
Average			*0.11*	*0.25*	*0.01*	*0.15*	*0.13*	*-0.10*	*0.01*	*0.15*	*0.08*	*0.10*	*0.05*	*0.24*	*-0.04*
Standardised average		*1*		*0.88*	*0.04*	*0.85*	*0.63*	*-0.37*	*0.03*	*0.69*	*0.26*	*0.51*	*0.23*	*1.04*	*-0.23*
Czech Republic	G			0.01	-0.19	-0.09	0.16	-0.05	0.06	-0.05	0.13	-0.01	-0.27	-0.16	-0.01
Hungary	G			-0.11	-0.21	-0.15	0.36	-0.01	0.06	0.16	-0.10	-0.22	0.08	-0.08	0.17
Poland	G			0.04	0.11	0.03	0.05	0.04	-0.03	0.15	0.25	-0.12	-0.17	-0.18	0.10
Slovak Republic	G			-0.05	0.03	-0.05	0.39	0.04	0.07	0.13	0.38	0.03	-0.16	-0.10	-0.10
Average			*0.09*	*-0.03*	*-0.06*	*-0.07*	*0.24*	*0.01*	*0.04*	*0.09*	*0.16*	*-0.08*	*-0.13*	*-0.13*	*0.04*
Standardised average		*1*		*-0.10*	*-0.29*	*-0.39*	*1.12*	*0.03*	*0.14*	*0.44*	*0.56*	*-0.42*	*-0.58*	*-0.56*	*0.24*
France	H			-0.08	0.04	-0.17	-0.01	0.34	0.15	-0.06	-0.10	0.14	-0.18	-0.17	-0.13
Greece	H			-0.05	0.10	0.11	-0.26	0.16	0.27	0.20	0.33	0.08	0.04	-0.06	-0.22
Ireland	H			0.10	-0.05	-0.03	-0.03	0.07	-0.01	0.11	-0.14	0.13	0.08	0.00	0.27
Italy	H			-0.15	0.07	0.00	-0.11	0.29	0.21	0.03	0.04	-0.06	0.05	-0.12	-0.10
Portugal	H			0.27	0.16	-0.18	-0.06	0.15	0.14	-0.11	0.16	0.27	0.09	0.27	0.01
Spain	H			-0.05	-0.07	-0.19	-0.04	0.28	-0.02	0.07	0.09	0.14	0.20	-0.07	-0.04
Average			*0.07*	*0.01*	*0.04*	*-0.08*	*-0.08*	*0.22*	*0.12*	*0.04*	*0.06*	*0.12*	*0.05*	*-0.02*	*-0.04*
Standardised average		*0*		*0.02*	*0.19*	*-0.44*	*-0.40*	*0.81*	*0.47*	*0.18*	*0.21*	*0.60*	*0.21*	*-0.11*	*-0.21*
United Kingdom[1]				0.12	0.00	0.11	-0.11	-0.08	-0.11	0.11	0.04	0.12	0.08	0.18	-0.01

Note: Cells shaded in darker blue indicates that the average is at the high or low end of the distribution.

1. Response rate too low to ensure comparability.

Source: OECD PISA 2003.

StatLink http://dx.doi.org/10.1787/068056433507

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Table A5.2a.

Relationship between students' attitudes towards mathematics and mathematics performance (2003)

		Attitudes towards mathematics														
		Change in the mathematics score per unit of the index														
		Interest in and enjoyment of mathematics			Instrumental motivation in mathematics			Self-concept in mathematics			Self-efficacy in mathematics			Anxiety in mathematics		
	Classification group	Effect	*	S.E.	Effect	*	S.E.	Effect	*	S.E.	Effect	*	S.E.	Effect	*	S.E.
OECD countries																
Japan	A	27.6	>	(2.44)	23.9	>	(2.25)	21.2	<	(1.96)	54.9	>	(2.06)	-14.3	>	(2.06)
Korea	A	36.2	>	(1.62)	32.8	>	(1.77)	47.3	>	(1.89)	54.0	>	(1.71)	-24.5	>	(1.66)
Mexico	B	-6.3	<	(2.50)	5.4		(2.44)	24.1	<	(2.42)	30.9	<	(2.20)	-34.0		(2.61)
Turkey	B	16.9		(3.08)	12.9		(2.39)	34.8		(4.23)	48.6		(5.07)	-34.6		(4.01)
Austria	C	8.7		(1.92)	-3.7	<	(1.60)	25.7	<	(1.75)	45.5		(1.80)	-25.1	>	(1.67)
Germany	C	10.2		(1.67)	1.1	<	(1.93)	22.7	<	(1.51)	50.2		(1.86)	-28.1	>	(1.42)
Switzerland	C	10.4		(1.47)	-2.4	<	(1.62)	24.2	<	(1.47)	53.2	>	(2.33)	-28.9	>	(1.73)
Denmark	D	27.7	>	(1.71)	20.9	>	(1.77)	46.5	>	(1.32)	50.8	>	(1.80)	-44.6	<	(1.50)
Finland	D	30.5	>	(1.59)	26.9	>	(1.70)	45.5	>	(1.12)	45.9		(1.41)	-41.9	<	(1.53)
Sweden	D	27.0	>	(1.79)	23.0	>	(2.00)	47.0	>	(1.70)	52.8	>	(1.65)	-42.8	<	(1.69)
Belgium	E	15.0	>	(1.55)	11.0		(1.63)	23.3	<	(1.44)	45.2		(1.52)	-26.1	>	(1.72)
Luxembourg	E	6.7	<	(1.48)	0.0	<	(1.35)	19.1	<	(1.35)	40.5	<	(1.37)	-25.0	>	(1.43)
Netherlands	E	14.3		(2.09)	6.1		(2.00)	22.2	<	(1.75)	44.6		(1.99)	-22.6	>	(2.32)
Norway	E	34.3	>	(1.41)	28.5	>	(1.49)	46.6	>	(1.16)	46.8		(1.49)	-42.1	<	(1.22)
Australia	F	18.6	>	(1.36)	16.9	>	(0.91)	42.3	>	(1.40)	49.6		(1.28)	-37.8		(1.50)
Canada	F	20.3	>	(0.96)	19.8	>	(0.96)	35.9	>	(0.78)	43.8	<	(0.77)	-32.6	>	(0.81)
Iceland	F	24.5	>	(1.44)	17.7	>	(1.72)	39.7	>	(1.15)	40.2	<	(1.33)	-33.4		(1.36)
New Zealand	F	11.4		(1.72)	15.6	>	(1.81)	44.9	>	(1.47)	52.0	>	(1.44)	-48.0	<	(1.56)
United States	F	7.8	<	(1.47)	13.6	>	(1.52)	35.1		(1.54)	46.7		(1.30)	-34.4		(1.52)
Czech Republic	G	22.5	>	(2.22)	10.7		(1.82)	39.8	>	(1.60)	55.5	>	(1.54)	-42.1	<	(1.88)
Hungary	G	10.0		(2.30)	7.9		(1.90)	28.4	<	(1.99)	52.6	>	(1.74)	-33.2		(1.83)
Poland	G	15.6	>	(1.48)	17.0	>	(1.82)	46.0	>	(1.48)	53.3	>	(1.98)	-46.4	<	(1.53)
Slovak Republic	G	12.1		(2.26)	6.3		(1.98)	44.5	>	(1.89)	55.0	>	(1.99)	-44.8	<	(1.71)
France	H	20.9	>	(1.76)	13.7	>	(1.61)	28.3	<	(1.71)	47.4		(1.72)	-25.0	>	(1.68)
Greece	H	23.7	>	(1.88)	14.9	>	(1.76)	42.6	>	(1.88)	45.5		(2.13)	-34.5		(1.75)
Ireland	H	17.4	>	(1.78)	7.7		(1.45)	34.4		(1.77)	47.5		(1.32)	-32.9		(1.65)
Italy	H	10.3		(1.70)	8.5		(1.58)	25.3	<	(1.43)	52.4	>	(2.24)	-33.2		(1.70)
Portugal	H	14.2		(2.20)	17.3	>	(2.04)	36.8	>	(1.53)	55.3	>	(1.92)	-34.2		(1.81)
Spain	H	20.4	>	(1.61)	19.4	>	(1.39)	31.9		(1.61)	42.7	<	(1.46)	-26.7	>	(1.79)
OECD total		***5.1***		***(0.72)***	***3.0***		***(0.75)***	***25.5***		***(0.65)***	***44.4***		***(0.71)***	***-31.9***		***(0.61)***
OECD average		***11.9***		***(0.45)***	***8.5***		***(0.41)***	***32.4***		***(0.37)***	***47.2***		***(0.42)***	***-35.3***		***(0.37)***

Note: * indicates that the effect is statistically significantly greater (>) than that of the OECD average; effect is statistically significantly less (<) than that of the OECD average.

Source: OECD PISA 2003.

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Table A5.2b.

Relationship between students' approaches to learning and mathematics performance (2003)

OECD countries	Classification group	Learning approaches								
		Change in mathematics score per unit of the index								
		Control strategies			Memorisation strategies			Elaboration strategies		
		Effect	*	S.E.	Effect	*	S.E.	Effect	*	S.E.
Japan	A	17.2	>	(2.44)	13.9	>	(2.30)	14.4	>	(2.39)
Korea	A	38.0	>	(1.75)	19.6	>	(1.77)	30.0	>	(1.64)
Mexico	B	7.1		(1.77)	2.0	>	(1.42)	-1.0	>	(1.63)
Turkey	B	14.4	>	(2.15)	1.2	>	(2.62)	5.7	>	(2.17)
Austria	C	-4.0	<	(1.47)	-18.5	<	(1.72)	-4.1		(1.59)
Germany	C	-7.3	<	(1.87)	-17.9	<	(1.46)	-5.5		(1.71)
Switzerland	C	-2.6	<	(1.43)	-17.1	<	(1.64)	-5.9		(1.42)
Denmark	D	4.6		(2.23)	9.3	>	(1.79)	10.4	>	(2.13)
Finland	D	11.5	>	(1.42)	6.7	>	(1.53)	16.9	>	(1.52)
Sweden	D	-0.4	<	(1.95)	14.1	>	(1.88)	9.8	>	(2.18)
Belgium	E	-1.7	<	(1.69)	-9.3	<	(1.96)	-10.6	<	(1.92)
Luxembourg	E	-5.4	<	(1.41)	-8.6	<	(1.39)	-7.7		(1.25)
Netherlands	E	-1.2	<	(2.84)	12.8	>	(2.08)	-3.5		(2.43)
Norway	E	14.5	>	(1.59)	22.3	>	(1.48)	8.4	>	(1.46)
Australia	F	15.6	>	(1.14)	9.7	>	(1.29)	-2.1	>	(1.17)
Canada	F	13.2	>	(1.13)	6.2	>	(1.02)	6.2	>	(1.12)
Iceland	F	4.5		(1.66)	-0.7	>	(1.50)	0.1	>	(1.61)
New Zealand	F	11.1	>	(1.85)	4.3	>	(1.96)	-8.2		(2.04)
United States	F	3.4		(1.60)	0.3	>	(1.38)	-7.0		(1.39)
Czech Republic	G	0.4	<	(2.10)	-14.2	<	(2.06)	13.0	>	(1.75)
Hungary	G	-4.4	<	(1.99)	-7.3		(1.88)	-4.9		(2.23)
Poland	G	4.3		(1.88)	-4.5		(1.85)	5.9	>	(1.90)
Slovak Republic	G	-4.7	<	(1.93)	-10.5	<	(1.92)	0.4	>	(1.79)
France	H	7.9		(1.34)	-0.9	>	(1.41)	-1.2	>	(1.69)
Greece	H	6.8		(1.55)	-2.9		(2.09)	8.9	>	(1.82)
Ireland	H	3.9		(1.54)	5.0	>	(1.74)	-3.1		(2.16)
Italy	H	3.6		(1.87)	-11.8	<	(1.97)	-3.9		(1.46)
Portugal	H	18.2	>	(1.79)	-5.4		(1.87)	9.2	>	(2.07)
Spain	H	12.6	>	(1.22)	7.7	>	(1.45)	10.2	>	(1.41)
OECD total		***-0.5***		***(0.73)***	***-7.5***		***(0.72)***	***-11.4***		***(0.76)***
OECD average		***6.42***		***m***	***-4.5***		***(0.41)***	***-5.3***		***(0.43)***

Note: * indicates that the effect is statistically significantly greater (>) than that of the OECD average; effect is statistically significantly less (<) than that of the OECD average.

Source: OECD PISA 2003.

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Table A5.2c.
Relationship between school-related indices and mathematics performance (2003)

OECD countries	Classification group	School-related indices: Change in mathematics score per unit of the index											
		Attitudes towards school			Students' sense of belonging at school			Teacher support			Disciplinary climate		
		Effect	*	S.E.	Effect	*	S.E.	Effect	*	S.E.	Effect	*	S.E.
Japan	A	2.6		(2.03)	12.9	>	(2.16)	12.9	>	(3.27)	32.7	>	(2.91)
Korea	A	0.2		(1.78)	11.1	>	(2.09)	7.5	>	(2.56)	14.7		(2.17)
Mexico	B	21.4	>	(1.71)	13.3	>	(1.41)	-1.6		(1.41)	18.9		(2.05)
Turkey	B	-3.3		(3.75)	21.0	>	(2.87)	3.8	>	(3.54)	30.0	>	(4.37)
Austria	C	-2.7	<	(1.72)	2.9		(1.64)	-8.4	<	(1.91)	19.3		(2.03)
Germany	C	-9.4	<	(1.98)	-1.4	<	(1.81)	-10.9	<	(1.93)	18.6		(1.73)
Switzerland	C	1.1		(1.95)	8.4	>	(1.90)	-10.3	<	(2.97)	17.3		(2.56)
Denmark	D	7.0	>	(1.78)	3.1		(1.92)	6.7	>	(2.05)	10.4	<	(2.07)
Finland	D	12.5	>	(1.50)	-1.9	<	(1.37)	4.4	>	(1.83)	10.4	<	(1.50)
Sweden	D	14.3	>	(1.65)	0.3	<	(1.57)	4.5	>	(1.81)	15.4		(2.09)
Belgium	E	-4.3	<	(2.16)	6.3		(2.18)	-6.0		(1.61)	23.5	>	(1.57)
Luxembourg	E	-9.2	<	(1.46)	5.9		(1.45)	-9.8	<	(1.30)	13.9	<	(1.40)
Netherlands	E	3.8		(3.05)	7.0		(2.31)	0.3	>	(2.21)	12.4	<	(2.36)
Norway	E	16.3	>	(1.80)	0.1	<	(1.57)	14.0	>	(1.93)	11.8	<	(1.85)
Australia	F	13.8	>	(1.03)	3.1		(1.63)	10.8	>	(1.43)	21.0	>	(1.07)
Canada	F	7.2	>	(1.00)	-1.0	<	(0.85)	6.3	>	(1.08)	17.3		(0.92)
Iceland	F	15.3	>	(1.42)	0.5		(1.55)	9.5	>	(1.87)	12.6	<	(1.71)
New Zealand	F	14.6	>	(1.70)	2.6		(1.51)	3.9	>	(1.62)	17.9		(1.60)
United States	F	6.6	>	(1.39)	m		m	7.9	>	(1.27)	25.8	>	(1.40)
Czech Republic	G	3.6		(1.72)	12.7	>	(1.98)	-5.1		(2.11)	16.7		(2.05)
Hungary	G	-6.5	<	(2.28)	10.0	>	(1.63)	-0.3		(2.14)	20.3		(2.30)
Poland	G	-3.3	<	(1.73)	7.7	>	(1.51)	-2.9		(1.86)	13.5	<	(1.98)
Slovak Republic	G	-10.5	<	(1.51)	3.1		(1.41)	-16.0	<	(1.83)	13.6	<	(1.59)
France	H	6.8	>	(1.69)	1.2		(1.28)	-5.2		(1.93)	12.1	<	(1.83)
Greece	H	-11.4	<	(1.74)	5.8		(1.69)	-6.4		(2.07)	14.1		(2.95)
Ireland	H	6.8	>	(1.53)	-5.2	<	(1.55)	-2.9		(1.81)	15.5		(1.60)
Italy	H	-5.6	<	(1.73)	-3.7	<	(1.92)	-16.3	<	(1.67)	12.5	<	(1.79)
Portugal	H	9.5	>	(1.73)	15.7	>	(1.72)	-5.5		(1.76)	23.7	>	(2.08)
Spain	H	4.2	>	(1.41)	2.4		(1.34)	-1.1	>	(1.55)	16.9		(1.67)
OECD total		***-1.8***		***(0.61)***	***2.0***		***(0.63)***	***-5.9***		***(0.58)***	***23.4***		***(0.65)***
OECD average		***0.9***		***(0.35)***	***3.5***		***(0.38)***	***-4.2***		***(0.36)***	***18.3***		***(0.38)***

Note: * indicates that the effect is statistically significantly greater (>) than that of the OECD average; effect is statistically significantly less (<) than that of the OECD average.
Source: OECD PISA 2003.
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Reader's Guide

Coverage of the statistics

Although a lack of data still limits the scope of the indicators in many countries, the coverage extends, in principle, to the entire national education system (within the national territory) regardless of the ownership or sponsorship of the institutions concerned and regardless of education delivery mechanisms. With one exception described below, all types of students and all age groups are meant to be included: children (including students with special needs), adults, nationals, foreigners, as well as students in open distance learning, in special education programmes or in educational programmes organised by ministries other than the Ministry of Education, provided the main aim of the programme is the educational development of the individual. However, vocational and technical training in the workplace, with the exception of combined school and work-based programmes that are explicitly deemed to be parts of the education system, is not included in the basic education expenditure and enrolment data.

Educational activities classified as "adult" or "non-regular" are covered, provided that the activities involve studies or have a subject matter content similar to "regular" education studies or that the underlying programmes lead to potential qualifications similar to corresponding regular educational programmes. Courses for adults that are primarily for general interest, personal enrichment, leisure or recreation are excluded.

Calculation of international means

For many indicators an OECD average is presented and for some an OECD total.

The OECD average is calculated as the unweighted mean of the data values of all OECD countries for which data are available or can be estimated. The OECD average therefore refers to an average of data values at the level of the national systems and can be used to answer the question of how an indicator value for a given country compares with the value for a typical or average country. It does not take into account the absolute size of the education system in each country.

The OECD total is calculated as a weighted mean of the data values of all OECD countries for which data are available or can be estimated. It reflects the value for a given indicator when the OECD area is considered as a whole. This approach is taken for the purpose of comparing, for example, expenditure charts for individual countries with those of the entire OECD area for which valid data are available, with this area considered as a single entity.

Note that both the OECD average and the OECD total can be significantly affected by missing data. Given the relatively small number of countries, no statistical methods are used to compensate for this. In cases where a category is not applicable (code "a") in a country or where the data value is negligible (code "n") for the corresponding calculation, the value zero is imputed for the purpose of calculating OECD averages. In cases where both the numerator and the denominator of a ratio are not applicable (code "a") for a certain country, this country is not included in the OECD average.

For financial tables using 1995 data, both the OECD average and OECD total are calculated for countries providing both 1995 and 2004 data. This allows comparison of the OECD average and OECD total over time with no distortion due to the exclusion of certain countries in the different years.

For many indicators an EU19 average is also presented. It is calculated as the unweighted mean of the data values of the 19 OECD countries that are members of the European Union for which data are available or can be estimated. These 19 countries are Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Ireland, Luxembourg, the Netherlands, Poland, Portugal, the Slovak Republic, Spain, Sweden and the United Kingdom.

Classification of levels of education

The classification of the levels of education is based on the revised International Standard Classification of Education (ISCED-97). The biggest change between the revised ISCED and the former ISCED (ISCED-76) is the introduction of a multi-dimensional classification framework, allowing for the alignment of the educational content of programmes using multiple classification criteria. ISCED is an instrument for compiling statistics on education internationally and distinguishes among six levels of education. The glossary available at *www.oecd.org/edu/eag2007* describes in detail the ISCED levels of education, and Annex 1 shows corresponding typical graduation ages of the main educational programmes by ISCED level.

Symbols for missing data

Six symbols are employed in the tables and charts to denote missing data:

a Data is not applicable because the category does not apply.

c There are too few observations to provide reliable estimates (*i.e.* there are fewer than 3% of students for this cell or too few schools for valid inferences). However, these statistics were included in the calculation of cross-country averages.

m Data is not available.

n Magnitude is either negligible or zero.

w Data has been withdrawn at the request of the country concerned.

x Data included in another category or column of the table (*e.g.* *x*(2) means that data are included in column 2 of the table).

~ Average is not comparable with other levels of education.

Further resources

The website *www.oecd.org/edu/eag2007* provides a rich source of information on the methods employed for the calculation of the indicators, the interpretation of the indicators in the respective national contexts and the data sources involved. The website also provides access to the data underlying the indicators as well as to a comprehensive glossary for technical terms used in this publication.

Any post-production changes to this publication are listed at *www.oecd.org/edu/eag2007*.

The website *www.pisa.oecd.org* provides information on the OECD Programme for International Student Assessment (PISA), on which many of the indicators in this publication draw.

Education at a Glance uses the OECD's StatLinks service. Below each table and chart in *Education at a Glance 2007* is a url which leads to a corresponding Excel workbook containing the underlying data for the indicator. These urls are stable and will remain unchanged over time. In addition, readers of the *Education at a Glance* e-book will be able to click directly on these links and the workbook will open in a separate window.

Codes used for territorial entities

These codes are used in certain charts. Country or territorial entity names are used in the text. Note that in the text the Flemish Community of Belgium is referred to as "Belgium (Fl.)" and the French Community of Belgium as "Belgium (Fr.)".

AUS	Australia	ITA	Italy
AUT	Austria	JPN	Japan
BEL	Belgium	KOR	Korea
BFL	Belgium (Flemish Community)	LUX	Luxembourg
BFR	Belgium (French Community)	MEX	Mexico
BRA	Brazil	NLD	Netherlands
CAN	Canada	NZL	New Zealand
CHL	Chile	NOR	Norway
CZE	Czech Republic	POL	Poland
DNK	Denmark	PRT	Portugal
ENG	England	RUS	Russian Federation
EST	Estonia	SCO	Scotland
FIN	Finland	SVK	Slovak Republic
FRA	France	SVN	Slovenia
DEU	Germany	ESP	Spain
GRC	Greece	SWE	Sweden
HUN	Hungary	CHE	Switzerland
ISL	Iceland	TUR	Turkey
IRL	Ireland	UKM	United Kingdom
ISR	Israel	USA	United States

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