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International Outcomes of Learning in Mathematics Literacy and Problem Solving

PISA 2003 Results From the U.S. Perspective

Highlights

U.S. Department of Education
Institute of Education Sciences
NCES 2005-003

NCES International Outcomes of Learning in Mathematics Literacy and Problem Solving: PISA 2003 Results From the U.S. Perspective 2004

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Summary

The Program for International Student Assessment (PISA) is a system of international assessments that measures 15-year-olds' capabilities in reading literacy, mathematics literacy, and science literacy every 3 years. PISA was first implemented in 2000 and is carried out by the Organization for Economic Cooperation and Development (OECD), an intergovernmental organization of industrialized countries. Each PISA data-collection effort assesses one subject area in depth, even as all three are assessed in each cycle so that participating countries have an ongoing source of achievement data in every subject area (figure 1). In addition to the major subject areas of reading literacy, mathematics literacy, and science literacy, PISA also measures general or cross-curricular competencies such as learning strategies. In this second cycle, PISA 2003, mathematics literacy was the subject area assessed in depth, along with the new cross-curricular area of problem solving. Major findings for 2003 in mathematics literacy and problem solving are provided here, as well as brief discussions of student performance in reading literacy and science literacy and changes in performance between 2000 and 2003.

U.S. Performance in Mathematics Literacy and Problem Solving

In 2003, U.S. performance in mathematics literacy and problem solving was lower than the average performance for most OECD countries (tables 2 and 3). The United States also performed below the OECD average on each mathematics literacy subscale representing a specific content area (*space and shape, change and relationships, quantity,* and *uncertainty*). This is somewhat different from the PISA 2000 results, when reading literacy was the major subject area, which showed the United States performing at the OECD average (Lemke et al. 2001).

Along with scale scores, PISA 2003 also uses six proficiency levels (levels 1 through 6, with level 6 being the highest level of proficiency) to describe student performance in mathematics literacy (exhibit 5) and three proficiency levels (levels 1 through 3, with level 3 being the highest level of proficiency) to describe student performance in problem solving (exhibit 9). In mathematics literacy, the United States had greater percentages of students below level 1 and at levels 1 and 2 than the OECD average percentages (figure 5, table B-6). The United States also had a lower percentage of students at levels 4, 5, and 6 than the OECD average percentages. Results for each of the four mathematics content areas followed a similar pattern. In problem solving, the United States also had greater percentages of students below level 1 and at level 1 than the OECD average percentages, and a lower percentage of students at levels 2 and 3 than the OECD average percentages (figure 8, table B-15).

This is also somewhat different from the PISA 2000 reading literacy results, which showed that while the percentages of U.S. students performing at level 1 and below were not measurably different from the OECD averages, the United States had a greater percentage of students performing at the highest level (level 5) compared to the OECD average (Lemke et al. 2001). In mathematics literacy and problem solving in 2003, even the highest U.S. achievers (those in the top 10 percent in the United States) were outperformed on average by their OECD counterparts (figures 4 and 7, tables B-4 and B-13).

There were no measurable changes in the U.S. scores from 2000 to 2003 on either the *space and shape* subscale or the *change and relationships* subscale, the only content areas for which trend data from 2000 to 2003 are available (table B-11). In both 2000 and 2003, about two-thirds of the other participating OECD countries outperformed the United States in these content areas.

U.S. Performance in Reading Literacy and Science Literacy

The U.S. average score in reading literacy was not measurably different from the OECD average in 2000 or 2003 (figure 9, table B-16), nor was there any measurable change in the U.S. reading literacy score from 2000 to 2003.

The U.S. score was below the OECD average science literacy score in 2003 (figure 9, table B-17). There was no measurable change in the U.S. science literacy score from 2000 to 2003.

Differences in Performance by Selected Student Characteristics

Sex

Males outperformed females in mathematics literacy in the United States and in two-thirds of the other countries (figure 10, table B-18). Within the United States, greater percentages of male students performed at level 6 (the highest level) than female students in mathematics literacy, but larger percentages of females were not seen at lower levels (below level 1 and levels 1 through 5; table B-19). In other words, differences in the overall scores between males and females in the United States were due at least in part to the fact that a higher percentage of males were found among the highest performers, not to a higher percentage of females found among the lowest performers.

In the majority of the PISA 2003 countries (32 out of 39 countries), including the United States, there were no measurable differences in problem-solving scores by sex (figure 10, table B-21). However, females outscored their male peers in problem solving in six of the seven remaining participating countries, as well as at the OECD average. Males outscored females in problem solving in Macao-China.

Socioeconomic Background

In 2003, a few countries showed stronger relationships between socioeconomic background (as measured by parental occupational status) and student performance than the United States, while more showed weaker relationships. In 2003, the relationship between socioeconomic background and student performance in mathematics literacy was stronger in 5 countries (Belgium, Czech Republic, Germany, Hungary, and Poland) than in the United States, while 11 countries had weaker relationships (table B-25). Three of the same five countries (Belgium, Germany, and Hungary) had stronger relationships between socioeconomic background and problem-solving performance than the United States, while 12 had weaker relationships.

Race/Ethnicity

In the United States in PISA 2003, Blacks and Hispanics scored lower on average than Whites, Asians, and students of more than one race in mathematics literacy and problem solving (figure 11, table B-26). Hispanic students, in turn, outscored Black students. In both mathematics literacy and problem solving, the average scores for Blacks and Hispanics were below the OECD average scores, while scores for Whites were above the OECD average scores.

For further results from PISA 2003, see the Organization for Economic Cooperation and Development (OECD) publication *Learning for Tomorrow's World — First Results From PISA 2003*, available at http://www.pisa.oecd.org (OECD 2004). A technical report for PISA 2003—which describes in detail all the procedures used in the design, data collection, quality control, and analysis for the study, as well as the PISA 2003 data itself—will also be made available at that site.

Acknowledgments

The authors of this report cannot take full credit for its production. Many people contributed to making this report possible, and the authors wish to thank all those who have assisted with various aspects of the report, including data analysis, reviews, and design.

Members of the Trends in International Mathematics and Science Study-Program for International Student Assessment (TIMSS-PISA) expert panel provided valuable input on issues related to communication and dissemination. Members are listed in appendix C.

We also wish to thank the technical reviewers, Marilyn Seastrom, Devon Carlson, and Zeyu Xu, and other reviewers (Mary Lindquist, Jeremy Kilpatrick, Joan Ferrini-Mundy, and Dana Kelly) for their comments. Thanks are also owed to Brian Henigin, Michael Stock, and Tracey Summerall of Westat for their design work.

Members of the PISA international management team, including the Australian Council for Educational Research (ACER) and the Organization for Economic Cooperation and Development (OECD), graciously assisted with data analysis and documentation questions. In particular, we would like to gratefully acknowledge the assistance of Claudia Tamassia, Andreas Schleicher, and Claire Shewbridge at the OECD.

Finally, we wish to especially thank the students, schools, and principals who participated in PISA 2003. Their time and effort provide us with data to look beyond our borders and gain valuable insight into our own educational practices.

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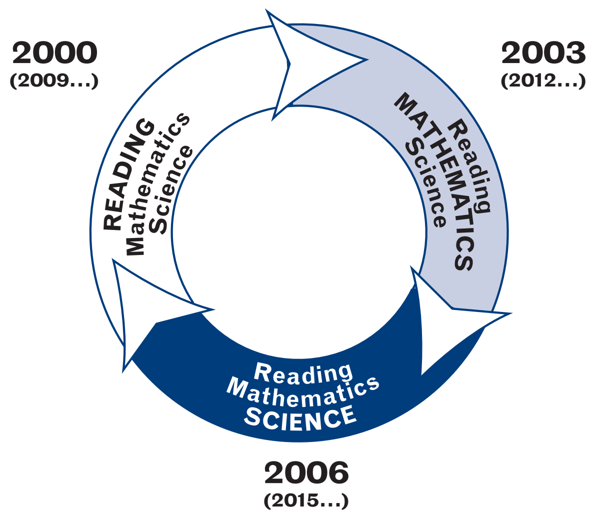
Introduction

PISA in Brief

The Program for International Student Assessment (PISA) is a system of international assessments that measures 15-year-olds' capabilities in reading literacy, mathematics literacy, and science literacy every 3 years. PISA was first implemented in 2000 (figure 1).

PISA is sponsored by the Organization for Economic Cooperation and Development (OECD), an intergovernmental organization of 30 industrialized nations. In 2003, 41 countries participated in PISA, including 30 OECD countries and 11 non-OECD countries (table 1). Of those 41 countries, comparisons for 39 countries (29 OECD countries and 10 non-OECD countries) are provided in this report. Data for one country, Brazil, were not available at the time of report production, and data for one other, the United Kingdom, are not discussed due to low response rates.

Figure 1. Program for International Student Assessment (PISA) cycle



NOTE: The subject in all capital letters in each assessment cycle is the major domain for that cycle.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table 1. Participation in the Program for International Student Assessment (PISA), by country: 2000 and 2003

Country	2000	2003
Organization for Economic Cooperation and Development (OECD) countries		
Australia	•	•
Austria	•	•
Belgium	•	•
Canada	•	•
Czech Republic	•	•
Denmark	•	•
Finland	•	•
France	•	•
Germany	•	•
Greece	•	•
Hungary	•	•
Iceland	•	•
Ireland	•	•
Italy	•	•
Japan	•	•
Korea, Republic of	•	•
Luxembourg	•	•
Mexico	•	•
Netherlands[1]	•	•
New Zealand	•	•
Norway	•	•
Poland	•	•
Portugal	•	•
Slovak Republic		•
Spain	•	•
Sweden	•	•
Switzerland	•	•
Turkey		•
United Kingdom[2]	•	•
United States	•	•
Non-OECD countries		
Brazil[3]	•	•
Hong Kong-China		•
Indonesia		•
Latvia	•	•
Liechtenstein	•	•
Macao-China		•
Russian Federation	•	•
Serbia and Montenegro		•
Thailand		•
Tunisia		•
Uruguay		•

[1]Due to low response rates, PISA 2000 data for the Netherlands are not discussed in this report. For information on the results for the Netherlands, see OECD (2001).
[2]Due to low response rates, PISA 2003 data for the United Kingdom are not discussed in this report.
[3]Although Brazil participated in PISA 2003, its data were not available in time for production of this report.
NOTE: A "•" indicates that the country participated in PISA in the specific year. Because PISA is principally an OECD study, non-OECD countries are displayed separately from the OECD countries.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2000 and 2003.

Each PISA data-collection effort assesses one subject area in depth, even as all three are assessed in each cycle so that participating countries have an ongoing source of achievement data in every subject area. In addition to the reading literacy, mathematics literacy, and science literacy, PISA also measures general or cross-curricular competencies such as learning strategies. In this second cycle, PISA 2003, mathematics literacy was the subject area assessed in depth, along with the new cross-curricular area of problem solving. In 2006, PISA will focus on science literacy. Results from PISA 2000, which focused on reading literacy, are described in Lemke et al. (2001) and Organization for Economic Cooperation and Development (OECD) (2001). In addition, a series of thematic reports exploring topics related to reading literacy in greater depth are available through http://www.pisa.oecd.org (see also the PISA resources and publications section of this report for information about PISA publications).

This report focuses on the performance of U.S. students in the two major areas assessed in 2003, mathematics literacy and problem solving. Achievement in the minor domains of reading literacy and science literacy in 2003 is also presented, and differences in achievement by selected student characteristics are covered in the final section.

The Unique Contribution of PISA

The United States has conducted surveys of student achievement at a variety of grade levels and in a variety of subject areas through the National Assessment of Educational Progress (NAEP) for many years. NAEP provides a regular benchmark for states and the nation and a means to monitor progress in achievement over time.

In order to provide a critical external perspective on the achievement of U.S. students through comparisons to other nations, the United States participates at the international level in PISA, the Progress in International Reading Literacy Study (PIRLS), and the Trends in International Mathematics and Science Study (TIMSS).[1] TIMSS and PIRLS seek to measure students' mastery of specific knowledge, skills, and concepts, and are designed to reflect curriculum frameworks in the United States and other participating countries.

PISA provides a unique and complementary perspective to these studies by not focusing explicitly on curricular outcomes, but on the application of knowledge in reading, mathematics, and science to problems with a real-life context (OECD 1999). The framework for each assessment area is based upon content, processes, and situations or contexts. For example, for mathematics literacy, the content is made up of major mathematical ideas, such as *space and shape* and *uncertainty*. The processes describe what strategies students use to solve mathematics problems, such as making connections or performing simple calculations. The situations or contexts refer to the kinds of places in which students might encounter mathematical problems, such as personal or educational. Assessment items are then developed based on these descriptions.

PISA uses the terminology of "literacy" in each subject area to denote its broad focus on application of knowledge and skills; that is, PISA seeks to ask if 15-year-olds are mathematically literate, or to what extent they can apply mathematical knowledge and skills to a range of different situations they may encounter in their lives. Literacy itself refers to a continuum of skills—it is not a condition that one has or does not have (i.e., literacy or illiteracy), but rather each person's skills place them in a particular place on the literacy continuum.

[1] The United States has also participated in international comparative assessments of civics knowledge and skills (CivEd 1999) and adult literacy (International Adult Literacy Survey [IALS 1994] and Adult Literacy and Lifeskills Survey [ALL 2003]).

The target age of 15 allows countries to compare outcomes of learning as students near the end of compulsory schooling. PISA's goal is to answer the question "what knowledge and skills do students have at age 15?" taking into account schooling and other factors that may influence their performance. In this way, PISA's achievement scores represent a "yield" of learning at age 15, rather than a direct measure of attained curriculum knowledge at a particular grade level, since 15-year-olds in the United States and elsewhere come from several grade levels and are enrolled in a variety of classes (figures 2 and 3, tables B-1 and B-2).

How PISA 2003 Was Conducted

PISA 2003 was sponsored by the OECD and carried out at the international level through a contract with the PISA Consortium, led by the Australian Council for Educational Research (ACER).[2] The National Center for Education Statistics (NCES) of the Institute of Education Sciences at the U.S. Department of Education was responsible for the implementation of PISA in the United States. Data collection in the United States was carried out through a contract with Westat. A review panel (see appendix C for a list of members) provides input on the development and dissemination of PISA (and TIMSS) in the United States.

PISA 2003 was a 2-hour paper-and-pencil assessment of 15-year-olds collected from nationally representative samples in participating countries. Like other large-scale assessments, PISA was not designed to provide individual student scores, but rather national and sub-national estimates of performance. Every student in PISA 2003 was assessed in mathematics literacy; reading, problem solving, and science questions were spread among students (for more information on PISA 2003's design, see the technical notes in appendix A).

PISA 2003 was administered between March and May 2003. The U.S. sample included both public and private schools, randomly selected and weighted to be representative of the nation.[3] In the United States, to improve response rates (a response rate of approximately 50 percent was projected for the end of the data collection period) and better accommodate school schedules, a second testing window was opened from September through November 2003. In total, 262 schools and 5,456 students participated in PISA 2003 in the United States. An overall weighted school response rate of 65 percent before the use of replacement schools and a weighted student response rate of 83 percent was achieved after testing in the second window was complete (see technical notes in appendix A for additional details on sampling, administration, response rates, and other issues).

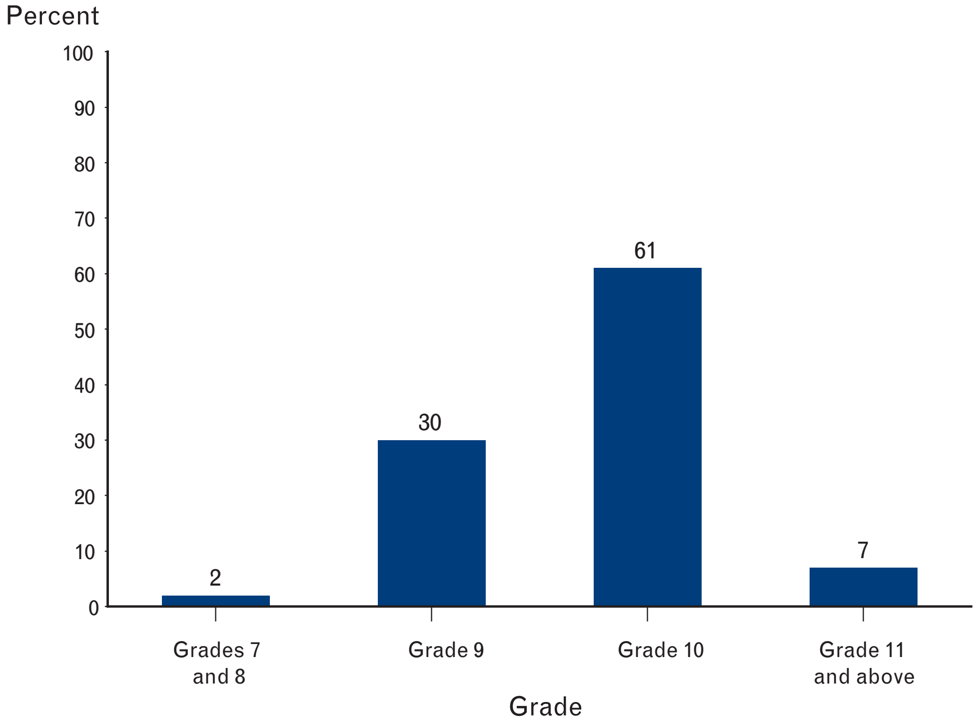
For further results from PISA 2003, see the Organization for Economic Cooperation and Development (OECD) publication *Learning for Tomorrow's World — First Results From PISA 2003*, available at http://www.pisa.oecd.org (OECD 2004). A technical report for PISA 2003—which describes in detail all the procedures used in the design, data collection, quality control, and analysis for the study, as well as the PISA 2003 data itself—is also available at that site.

This report provides results for the United States in relation to the other countries participating in PISA 2003, distinguishing OECD countries and non-OECD countries. All differences described in this report have been tested for statistical significance at the .05 level. Additional information on statistical procedures used in this report is provided in the technical notes.

[2] The PISA Project Consortium consists of the Australian Council for Educational Research (ACER), the Netherlands National Institute for Educational Measurement (CITO), Educational Testing Service (ETS, USA), National Institute for Educational Policy Research (NIER, Japan), and Westat (USA).

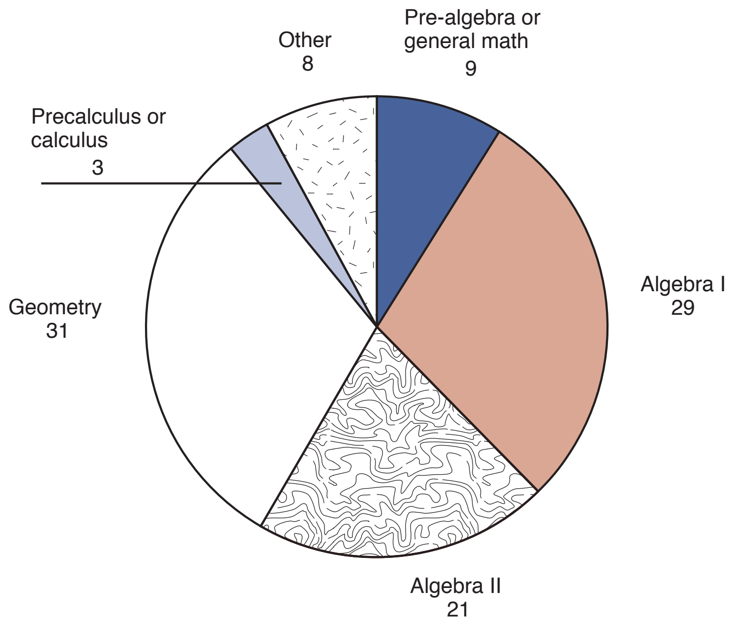
[3] The sample frame data for the United States for public schools were from the Common Core of Data (CCD), and the data for private schools were from the Private School Survey (PSS). Any school containing at least one 7th- through 12th-grade class as of the school year 2000–01 was included on the school sampling frame.

Figure 2. Percentage distribution of U.S. 15-year-old students, by grade: 2003



NOTE: Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Figure 3. Percentage distribution of U.S. 15-year-old students, by type of mathematics class: 2003



NOTE: Type of class refers to the mathematics class in which the student was enrolled at the time of assessment. Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

U.S. Performance in Mathematics Literacy

PISA's major focus in 2003 was mathematics literacy. Mathematics literacy is defined as:

> *...an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned, and reflective citizen. (OECD 2003, p.24)*

PISA's emphasis is on the ability to apply a range of knowledge and skills to a variety of problems with real-life contexts. In the PISA 2003 mathematics literacy assessment, students completed exercises designed to assess their capabilities in using a range of mathematical competencies, grouped and described as "competency clusters." These clusters—reproduction, connections, and reflection—describe sets of skills students may use to solve problems. The reproduction cluster involves the reproduction of the practiced material and performing routine operations. The connections cluster calls for integration and connection of material, and the modest extension of practiced material. The reflection cluster relates to students' abilities in advanced reasoning, argumentation, abstraction, generalization, and modeling applied to new contexts.

The problems themselves were designed to come from the variety of situations (personal, educational/occupational, public, or scientific) that students encounter, and to have a real-life context. The mathematical content of the problems was drawn from four overarching ideas: *space and shape, change and relationships, quantity,* and *uncertainty*. These overarching ideas represent a way to organize mathematical content broadly and encompass many traditional curricular areas such as algebra or geometry (see also Steen 1990).

- *Space and shape* includes recognizing shapes and patterns, describing, encoding, and decoding visual information, understanding dynamic changes to shapes, understanding similarities and differences and relative positions, and understanding the relationship between visual representations and real shapes and images.
- *Change and relationships* covers the representation of change, including mathematical functions such as linear, exponential, or logistic, as well as data analysis needed to specify relationships or translate between representations.
- *Quantity* focuses on quantitative reasoning (including number sense, estimating, mental arithmetic, understanding meaning of operations, having a feel for the magnitude of numbers, and computations) and understanding of numerical patterns, counts, and measures.
- *Uncertainty* includes the two related topics of data and chance, or statistics and probability, including data analysis and graphic and numeric representations of data.

A comparative analysis of the NAEP, PISA, and TIMSS mathematics assessments sponsored by NCES found that the 2003 PISA mathematics literacy assessment used far fewer multiple-choice items than NAEP or TIMSS. PISA also had a much stronger content focus on the "data" area (which often deals with using charts and graphs), which fits with PISA's emphasis on using materials with a real-world context (see technical notes for more information on the results of the assessment comparisons).[4]

[4] See Neidorf, T.S., Binkley, M., Gattis, K., and Nohara, D. (forthcoming) and the technical notes in appendix A for more information. Other comparative analyses focus on assessments of science and reading in PISA, NAEP, TIMSS, and PIRLS. See Neidorf, T.S., Binkley, M., and Stephens, M. (forthcoming); Binkley, M., and Kelly, D. (2003); Binkley, M., Afflerbach, P., and Kelly, D. (forthcoming); and Nohara, D. (2001).

Sample mathematics literacy items for each of these areas and student responses are shown here. For more information about the mathematics literacy domain, refer to *The PISA 2003 Assessment Framework: Mathematics, Reading, Science, and Problem Solving Knowledge and Skills* (OECD 2003). Additional mathematics literacy sample items can be found at http://nces.ed.gov/surveys/pisa, in the PISA 2003 framework document referenced above, in *Measuring Student Knowledge and Skills: The PISA 2000 Assessment of Reading, Mathematical and Scientific Literacy* (OECD 2000) and in *Sample Tasks from the PISA 2000 Assessment: Reading, Mathematical and Scientific Literacy* (OECD 2002).

Exhibit 1. Space and shape sample item: 2003

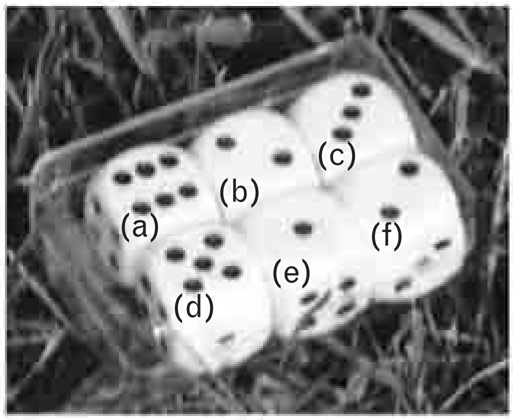
Cubes

Question 20: CUBES

M145Q01

In this photograph you see six dice, labeled (a) to (f). For all dice there is a rule:

The total number of dots on two opposite faces of each die is always seven.



Write in each box the number of dots on the **bottom** face of the dice corresponding to the photograph.

(a)	(b)	(c)
1	5	4
2	6	5
(d)	(e)	(f)

RESULTS:

U.S. percent correct............... 62.7
OECD percent correct............ 68.0
Item difficulty: Level 2
Situation: Occupational
Competency: Reproduction

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Exhibit 2. Change and relationships sample item: 2003

The Best Car

A car magazine uses a rating system to evaluate new cars, and gives the award of "The Car of the Year" to the car with the highest total score. Five new cars are being evaluated, and their ratings are shown in the table.

Car	Safety Features (S)	Fuel Efficiency (F)	External Appearance (E)	Internal Fittings (T)
Ca	3	1	2	3
M2	2	2	2	2
Sp	3	1	3	2
N1	1	3	3	3
KK	3	2	3	2

The ratings are interpreted as follows:

3 points = Excellent
2 points = Good
1 point = Fair

Question 5: THE BEST CAR M704Q01

To calculate the total score for a car, the car magazine uses the following rule, which is a weighted sum of the individual score points:

Total Score = (3 x S) + F + E + T

Calculate the total score for Car "Ca". Write your answer in the space below.

Total score for "Ca": ....15........

RESULTS:

U.S. percent correct................ 74.6
OECD percent correct............. 72.9
Item difficulty: Level 2
Situation: Public
Competency: Reproduction

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Exhibit 2. Change and relationships sample item: 2003—Continued

The Best Car

Question 6: THE BEST CAR M704Q02

The manufacturer of car "Ca" thought the rule for the total score was unfair.

Write down a rule for calculating the total score so that Car "Ca" will be the winner.

Your rule should include all four of the variables, and you should write down your rule by filling in positive numbers in the four spaces in the equation below.

Total score = ...3... × S + ...1... × F + ...1... × E + ...3... × T.

3S + F + E + 3T

ca = 21
m2 = 16
Sp = 19
NI = 18
KK = 20

RESULTS:
U.S. percent correct................20.2
OECD percent correct............25.4
Item difficulty: Level 5
Situation: Public
Competency: Reflection

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Exhibit 3. Quantity sample item: 2003

Exchange Rate

Mei-Ling from Singapore was preparing to go to South Africa for 3 months as an exchange student. She needed to change some Singapore dollars (SGD) into South African rand (ZAR).

Question 14: EXCHANGE RATE M413Q02 - 0 1 9

On returning to Singapore after 3 months, Mei-Ling had 3 900 ZAR left. She changed this back to Singapore dollars, noting that the exchange rate had changed to:

1 SGD = 4.0 ZAR

How much money in Singapore dollars did Mei-Ling get?

Answer: 975 ....

RESULTS:
U.S. percent correct....................67.8
OECD percent correct................73.9
Item difficulty: Level 2
Situation: Public
Competency: Reproduction

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Exhibit 3. Quantity sample item: 2003—Continued

Exchange Rate

Question 15: EXCHANGE RATE M413Q03 - 01 02 11 99

During these 3 months the exchange rate had changed from 4.2 to 4.0 ZAR per SGD.

Was it in Mei-Ling's favor that the exchange rate now was 4.0 ZAR instead of 4.2 ZAR, when she changed her South African rand back to Singapore dollars? Give an explanation to support your answer.

if 4.0 . . . then 3900/4 = 975

if 4.2 . . . then 3900/4.2 = 928.57

Yes because she would receive more money.

RESULTS:

U.S. percent correct................37.2
OECD percent correct............40.3
Item difficulty: Level 4
Situation: Public
Competency: Reflection

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

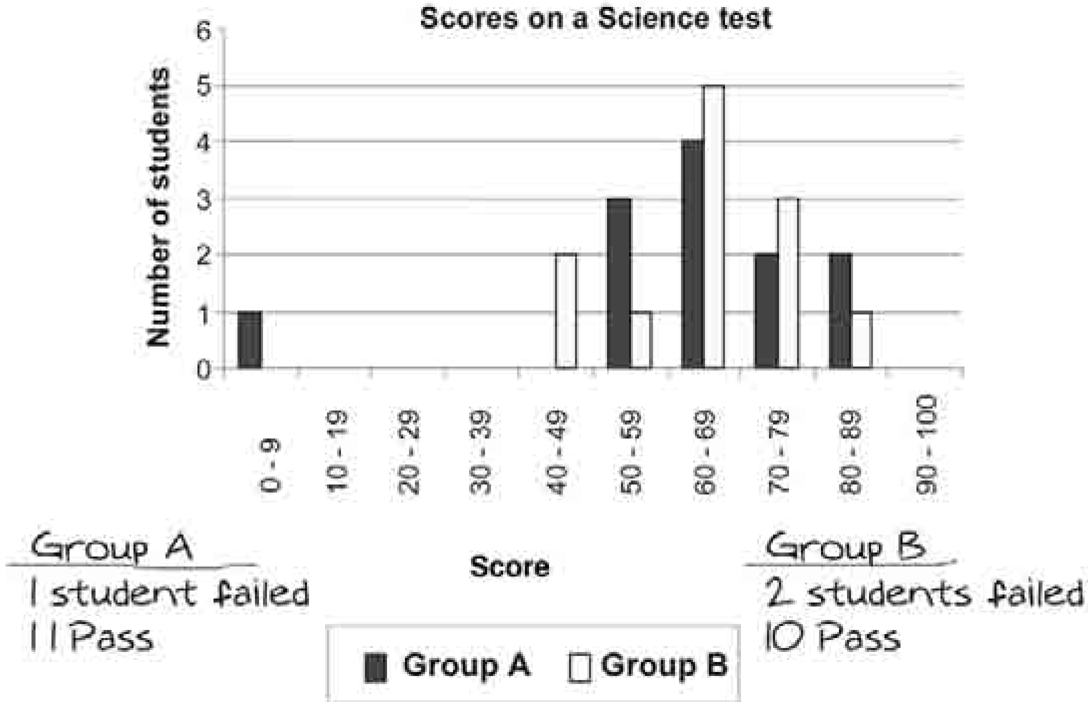
Exhibit 4. Uncertainty sample item: 2003

Test Scores

Question 32: TEST SCORES M513Q01 - 0 1 9

The diagram below shows the results on a Science test for two groups, labeled as Group A and Group B.

The mean score for Group A is 62.0 and the mean for Group B is 64.5. Students pass this test when their score is 50 or above.



Looking at the diagram, the teacher claims that Group B did better than Group A in this test.

The students in Group A don't agree with their teacher. They try to convince the teacher that Group B may not necessarily have done better.

Give one mathematical argument, using the graph, that the students in Group A could use.

Group A could argue that 11 people from their group passed, and only 10 from group B did.

RESULTS:

U.S. percent correct................39.8
OECD percent correct............32.2
Item difficulty: Level 5
Situation: Educational
Competency: Connections

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Combined mathematics literacy scores are reported on a scale with a mean of 500 and standard deviation of 100.[5] Fifteen-year-old students in the United States had an average score of 483 on the combined mathematics literacy scale, lower than the OECD average score of 500 (tables 2 and B-3). U.S. students were less mathematically literate than their peers in 20 of the other 28 OECD countries and 3 of the 10 non-OECD countries. Eleven countries (5 OECD countries and 6 non-OECD countries) reported lower scores compared to the United States in mathematics literacy.

U.S. students also had lower scores than the OECD average scores for each of the four content area subscales (*space and shape, change and relationships, quantity*, and *uncertainty*). Twenty-four countries (20 OECD and 4 non-OECD countries) outperformed the United States on the *space and shape* subscale, 21 countries (18 OECD and 3 non-OECD countries) outperformed the United States on the *change and relationships* subscale, 26 countries (23 OECD and 3 non-OECD countries) outscored the United States on the *quantity* subscale, and 19 countries (16 OECD and 3 non-OECD countries) outscored the United States on the *uncertainty* subscale.

[5]Because the average was set for the combined mathematics literacy scale, average scores for the mathematics literacy subscales differ slightly from 500. PISA 2000 mathematics literacy scores were re-scaled using the greater detail in PISA 2003 data in order to provide a more complete measure of achievement than that available in 2000. See technical notes in appendix A for more information on scaling. PISA's intent for each subject area is to draw baseline information for describing changes and trends in achievement from the cycle in which that subject area is the major domain. The use of minor domains allows PISA to provide indicative information about changes in performance over time; however, changes in a subject area are best measured from the cycle in which it is the major domain. Thus, changes in reading literacy achievement are based upon PISA 2000 data, when reading literacy was the major domain, and changes in mathematics literacy scores, in turn, are based upon this 2003 cycle. Science literacy scores from 2000 and 2003 may be re-scaled based up on the much greater detail for science literacy which will be available in 2006.

Table 2. Average combined mathematics literacy scores and subscale scores of 15-year-old students, by country: 2003

		Mathematics subscales			
Combined mathematics literacy		Space and shape		Change and relationships	
Country	Score	Country	Score	Country	Score
OECD average	**500**	**OECD average**	**496**	**OECD average**	**499**
OECD countries		OECD countries		OECD countries	
Finland	544	Japan	553	Netherlands	551
Korea	542	Korea	552	Korea	548
Netherlands	538	Switzerland	540	Finland	543
Japan	534	Finland	539	Canada	537
Canada	532	Belgium	530	Japan	536
Belgium	529	Czech Republic	527	Belgium	535
Switzerland	527	Netherlands	526	New Zealand	526
Australia	524	New Zealand	525	Australia	525
New Zealand	523	Australia	521	Switzerland	523
Czech Republic	516	Canada	518	France	520
Iceland	515	Austria	515	Czech Republic	515
Denmark	514	Denmark	512	Iceland	509
France	511	France	508	Denmark	509
Sweden	509	Slovak Republic	505	Germany	507
Austria	506	Iceland	504	Ireland	506
Germany	503	Germany	500	Sweden	505
Ireland	503	Sweden	498	Austria	500
Slovak Republic	498	Poland	490	Hungary	495
Norway	495	Luxembourg	488	Slovak Republic	494
Luxembourg	493	Norway	483	Norway	488
Poland	490	Hungary	479	Luxembourg	487
Hungary	490	Spain	476	**United States**	**486**
Spain	485	Ireland	476	Poland	484
United States	**483**	**United States**	**472**	Spain	481
Portugal	466	Italy	470	Portugal	468
Italy	466	Portugal	450	Italy	452
Greece	445	Greece	437	Greece	436
Turkey	423	Turkey	417	Turkey	423
Mexico	385	Mexico	382	Mexico	364
Non-OECD countries		Non-OECD countries		Non-OECD countries	
Hong Kong-China	550	Hong Kong-China	558	Hong Kong-China	540
Liechtenstein	536	Liechtenstein	538	Liechtenstein	540
Macao-China	527	Macao-China	528	Macao-China	519
Latvia	483	Latvia	486	Latvia	487
Russian Federation	468	Russian Federation	474	Russian Federation	477
Serbia and Montenegro	437	Serbia and Montenegro	432	Serbia and Montenegro	419
Uruguay	422	Thailand	424	Uruguay	417
Thailand	417	Uruguay	412	Thailand	405
Indonesia	360	Indonesia	361	Tunisia	337
Tunisia	359	Tunisia	359	Indonesia	334

See notes at end of table.

Table 2. Average combined mathematics literacy scores and subscale scores of 15-year-old students, by country: 2003—Continued

Mathematics subscales

Quantity: Country	Score	Uncertainty: Country	Score
OECD average	**501**	**OECD average**	**502**
OECD countries		OECD countries	
Finland	549	Netherlands	549
Korea	537	Finland	545
Switzerland	533	Canada	542
Belgium	530	Korea	538
Netherlands	528	New Zealand	532
Canada	528	Australia	531
Czech Republic	528	Japan	528
Japan	527	Iceland	528
Australia	517	Belgium	526
Denmark	516	Ireland	517
Germany	514	Switzerland	517
Sweden	514	Denmark	516
Iceland	513	Norway	513
Austria	513	Sweden	511
Slovak Republic	513	France	506
New Zealand	511	Czech Republic	500
France	507	Austria	494
Ireland	502	Poland	494
Luxembourg	501	Germany	493
Hungary	496	Luxembourg	492
Norway	494	**United States**	**491**
Spain	492	Hungary	489
Poland	492	Spain	489
United States	**476**	Slovak Republic	476
Italy	475	Portugal	471
Portugal	465	Italy	463
Greece	446	Greece	458
Turkey	413	Turkey	443
Mexico	394	Mexico	390
Non-OECD countries		Non-OECD countries	
Hong Kong-China	545	Hong Kong-China	558
Liechtenstein	534	Macao-China	532
Macao-China	533	Liechtenstein	523
Latvia	482	Latvia	474
Russian Federation	472	Russian Federation	436
Serbia and Montenegro	456	Serbia and Montenegro	428
Uruguay	430	Thailand	423
Thailand	415	Uruguay	419
Tunisia	364	Indonesia	385
Indonesia	357	Tunisia	363

- Average is significantly higher than the U.S. average
- Average is not significantly different than the U.S. average
- Average is significantly lower than the U.S. average

NOTE: Statistical comparisons between the U.S. average and the Organization for Economic Cooperation and Development (OECD) average take into account the contribution of the U.S. average toward the OECD average. The OECD average is the average of the national averages of the OECD member countries with data available. Because the Program for International Student Assessment (PISA) is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. Due to low response rates, data for the United Kingdom are not discussed in this report.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

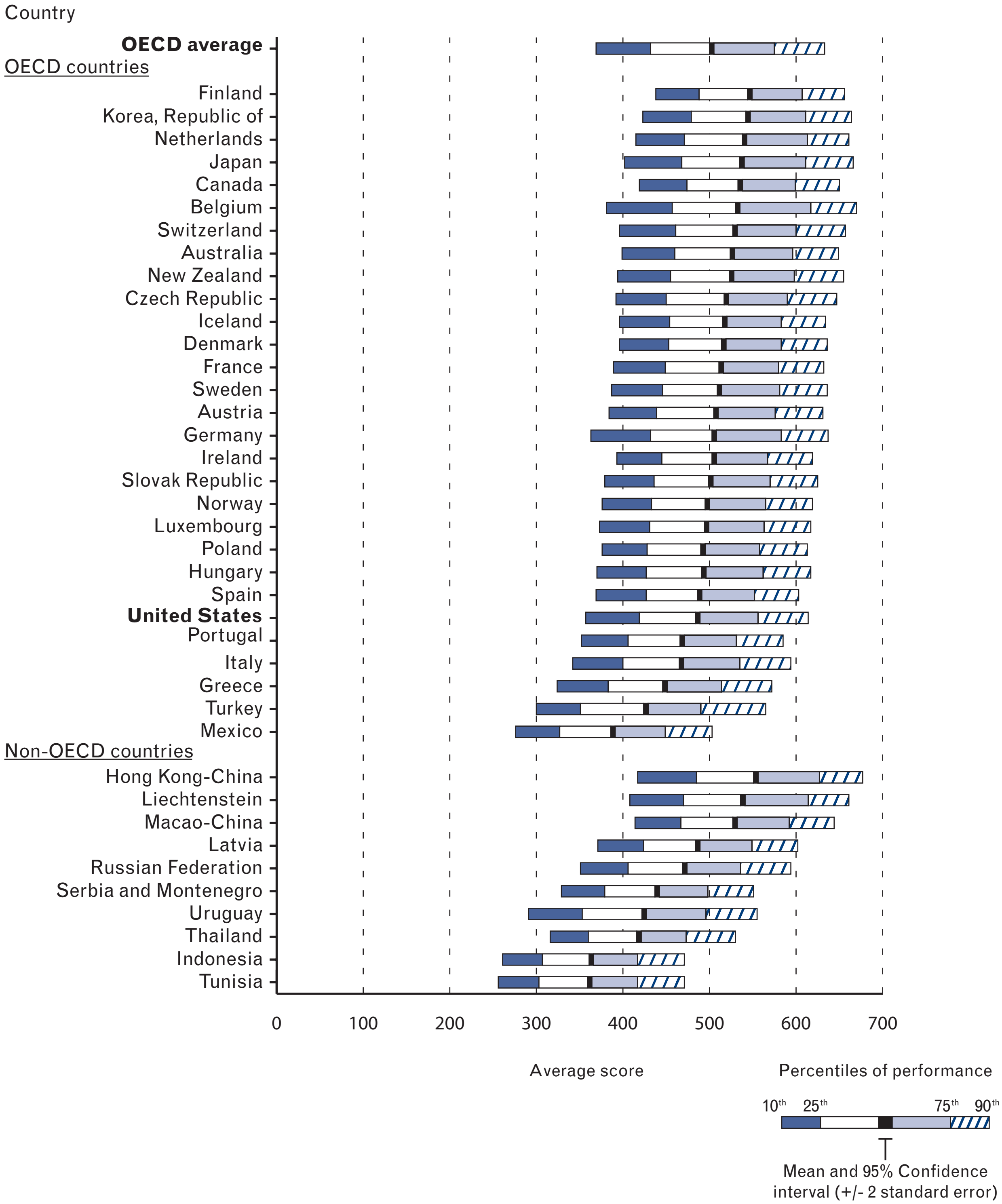
On average, the highest U.S. achievers (those in the top 10 percent of U.S. students) were outperformed by their OECD counterparts (figure 4, table B-4). To be in the top 10 percent in the United States, students had to score 607 or higher, while on average across the OECD countries, students would have had to score 628 or higher to be in the top 10 percent. Scores for the top 10 percent of students within countries ranged from 466 or better in Indonesia and Tunisia to 672 or better in Hong Kong-China. Low performers in the United States (those in the bottom 10 percent) had a cutoff score of 356 or lower, which was lower than the cutoff score of 369 or lower for the OECD average. There was approximately a 251 point score difference, or about two and a half standard deviations, between the cutoff scores for the top 10 percent and the bottom 10 percent of 15-year-old students for mathematics literacy in the United States, compared to about a 259 point difference using the OECD average scores.

The standard deviation (which measures the spread of scores around the average) for the United States (95), in fact, was lower than the OECD average standard deviation of 100 (table B-5). Sixteen countries (10 OECD and 6 non-OECD countries) showed less variation in performance than the United States, while three countries (Belgium, Germany, and Uruguay) had larger standard deviations.

Along with scale scores, PISA 2003 also uses six proficiency levels (levels 1 through 6, with level 6 being the highest level of proficiency) to describe student performance in mathematics literacy (exhibit 5). An additional level (below level 1) encompasses students whose skills cannot be described using these proficiency levels. The proficiency levels describe what students at each level can do and allow comparisons of the percentages of students in each country who perform at different levels of mathematics literacy (see technical notes in appendix A for more information about how levels were set).

The U.S. average score of 483 on the combined mathematics literacy scale was just above the bottom cut point for level 3; the OECD average score of 500 was near the midpoint of level 3 (table 2, exhibit 5). The cutoff score of 607 for U.S. high performers (those in the top 10 percent in the United States) placed it just into level 5; the OECD score for high performers was near the midpoint of level 5. The cutoff U.S. score of 356 for low performers (those in the bottom 10 percent) was below level 1, while the OECD cutoff score of 369 for the bottom 10 percent was a level 1 score (figure 4, exhibit 5).

Figure 4. Distribution of combined mathematics literacy scores of 15-year-old students, by country: 2003



NOTE: The Organization for Economic Cooperation and Development (OECD) average is the average of the national averages of the OECD member countries with data available. Because the Program for International Student Assessment (PISA) is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. Due to low response rates, data for the United Kingdom are not discussed in this report.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Exhibit 5. Description of proficiency levels for combined mathematics literacy: 2003

Proficiency level	Task descriptions
Level 1	At Level 1 students can answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined. They are able to identify information and to carry out routine procedures according to direct instructions in explicit situations. They can perform actions that are obvious and follow immediately from the given stimuli.
Level 2	At Level 2 students can interpret and recognize situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formula, procedures, or conventions. They are capable of direct reasoning and making literal interpretations of the results.
Level 3	At Level 3 students can execute clearly described procedures, including those that require sequential decisions. They can select and apply simple problem solving strategies. Students at this level can interpret and use representations based on different information sources and reason directly from them. They can develop short communications reporting their interpretations, results, and reasoning.
Level 4	At Level 4 students can work effectively with explicit models for complex concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations, including symbolic, linking them directly to aspects of real-world situations. Students at this level can utilize well-developed skills and reason flexibly, with some insight, in these contexts. They can construct and communicate explanations and arguments based on their interpretations, arguments, and actions.
Level 5	At Level 5 students can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare, and evaluate appropriate problem solving strategies for dealing with complex problems related to these models. Students at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterizations, and insight pertaining to these situations. They can reflect on their actions and formulate and communicate their interpretations and reasoning.
Level 6	At Level 6 students can conceptualize, generalize, and utilize information based on their investigations and modeling of complex problem situations. They can link different information sources and representations and flexibly translate among them. Students at this level are capable of advanced mathematical thinking and reasoning. These students can apply this insight and understandings along with a mastery of symbolic and formal mathematical operations and relationships to develop new approaches and strategies for attacking novel situations. Students at this level can formulate and precisely communicate their actions and reflections regarding their findings, interpretations, arguments, and the appropriateness of these to the original situations.

NOTE: In order to reach a particular level, a student must have been able to correctly answer a majority of items at that level. Students were classified into mathematics literacy levels according to their scores. Exact cut point scores are as follows: below level 1 (*a score less than or equal to 357.77*); level 1 (*a score greater than 357.77 and less than or equal to 420.07*); level 2 (*a score greater than 420.07 and less than or equal to 482.38*); level 3 (*a score greater than 482.38 and less than or equal to 544.68*); level 4 (*a score greater than 544.68 and less than or equal to 606.99*); level 5 (*a score greater than 606.99 and less than or equal to 669.3*); level 6 (*a score greater than 669.3*).

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

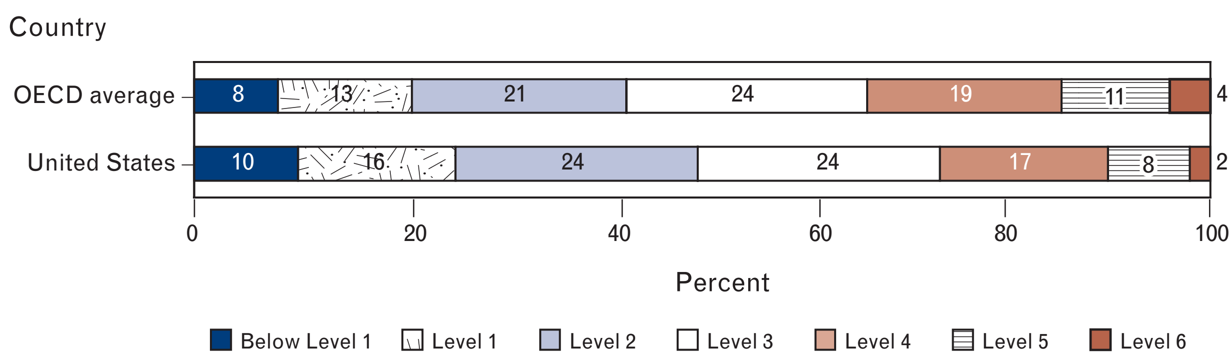
The United States had greater percentages of students below level 1 and at levels 1 and 2 than the OECD average percentages (figure 5, table B-6). The United States also had a lower percentage of students at levels 4, 5, and 6, than the OECD average percentages. This is somewhat different from the 2000 results, when reading literacy was the major domain. PISA 2000 results showed that while the percentages of U.S. students performing at level 1 and below were not measurably different from the OECD averages, the United States had a greater percentage of students performing at the highest level (level 5) compared to the OECD average (Lemke et al. 2001).

In mathematics literacy in 2003, half (19) of the other 38 countries had a higher percentage of students at level 6 than the United States, including 16 OECD countries and 3 non-OECD countries (Hong Kong-China, Liechtenstein, and Macao-China) (figure 6, table B-6). In contrast, nine countries had a higher percentage of students below level 1 than the United States (four of these nine—Greece, Italy, Mexico, and Turkey—were OECD countries). These same nine countries, as well as the Russian Federation and Portugal, had more students at level 1 than the United States.

The United States had a lower percentage of students at level 6 than the OECD average for each of the four content area subscales (*space and shape, change and relationships, quantity,* and *uncertainty*) and a smaller percentage than the OECD average at level 4 and level 5 on three of the four subscales (exceptions were for *uncertainty* at level 5 and *change and relationships* at level 4) (tables B-7 through B-10).

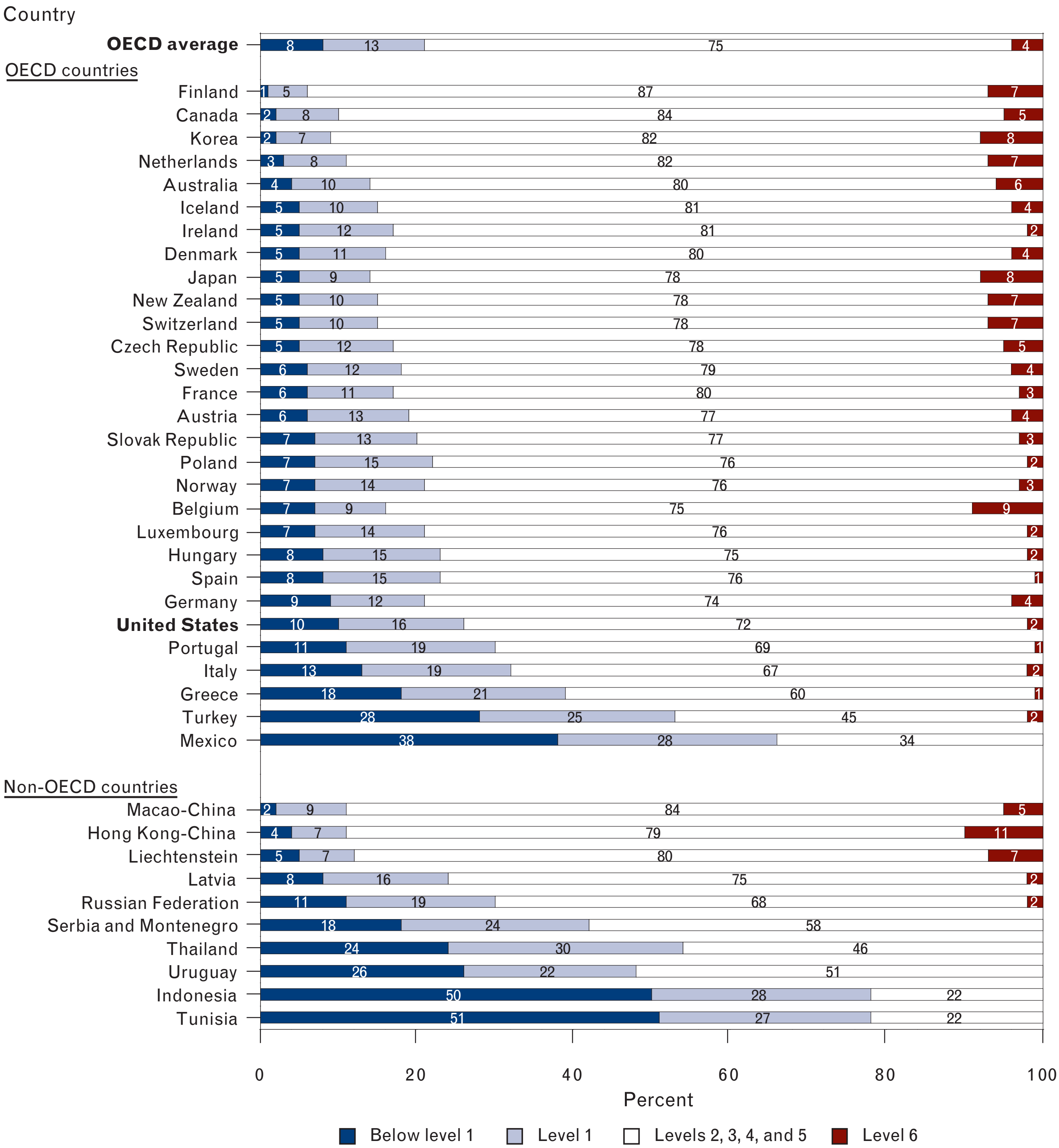
The United States also had a higher percentage of students at level 1 than the OECD average on each of the four subscales and more at level 2 for all subscales except *uncertainty*. On the *quantity* and *uncertainty* subscales, the United States also had greater percentages of students than the OECD average percentages below level 1.

Figure 5. Percentage distribution of 15-year-old students in the OECD countries and the United States on the combined mathematics literacy scale, by proficiency level: 2003



NOTE: In order to reach a particular proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into mathematics literacy levels according to their scores. Exact cut point scores are as follows: below level 1 (*a score less than or equal to 357.77*); level 1 (*a score greater than 357.77 and less than or equal to 420.07*); level 2 (*a score greater than 420.07 and less than or equal to 482.38*); level 3 (*a score greater than 482.38 and less than or equal to 544.68*); level 4 (*a score greater than 544.68 and less than or equal to 606.99*); level 5 (*a score greater than 606.99 and less than or equal to 669.3*); level 6 (*a score greater than 669.3*). The Organization for Economic Cooperation and Development (OECD) average is the average of the national averages of the OECD member countries with data available. Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Figure 6. Percentage distribution of 15-year-old students on the combined mathematics literacy scale, by proficiency level and country: 2003



NOTE: In order to reach a particular proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into mathematics literacy levels according to their scores. Exact cut point scores are as follows: below level 1 (*a score less than or equal to 357.77*); level 1 (*a score greater than 357.77 and less than or equal to 420.07*); level 2 (*a score greater than 420.07 and less than or equal to 482.38*); level 3 (*a score greater than 482.38 and less than or equal to 544.68*); level 4 (*a score greater than 544.68 and less than or equal to 606.99*); level 5 (*a score greater than 606.99 and less than or equal to 669.3*); level 6 (*a score greater than 669.3*). The Organization for Economic Cooperation and Development (OECD) average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. Due to low response rates, data for the United Kingdom are not discussed in this report. Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Changes in Mathematics Literacy Performance From 2000 to 2003

Because mathematics literacy was a minor domain in 2000, items from only two content areas (*space and shape* and *change and relationships*) were administered in that assessment cycle. As a result, it is not possible to describe changes since 2000 for the combined mathematics literacy scale or for the other two content areas (*quantity* or *uncertainty*). Rather, changes can only be discussed for the two content areas represented in 2000 and 2003 (*space and shape* and *change and relationships*). Data from 2000 were re-scaled using 2003 mathematics literacy data in order to make these comparisons.[6] Comparisons were available only for OECD countries common to both the 2000 and 2003 cycle (28 countries) but results for the United Kingdom and the Netherlands are not discussed here due to low response rates for the United Kingdom in 2003 and the Netherlands in 2000. In total, results for 26 OECD countries were available for comparisons and are discussed here.

There were no measurable changes in the U.S. scores from 2000 to 2003 on either the *space and shape* subscale or the *change and relationships* subscale (table B-11). In both 2000 and 2003, about two-thirds of the other countries outperformed the United States on these scales. Eighteen of the other 25 OECD countries outscored the United States on the *space and shape* scale in 2003 (compared to 19 in 2000); 17 OECD countries outscored the United States on the *change and relationships* scale in 2003 (compared to 14 in 2000).

Five countries had their scores improve on the *space and shape* subscale. Four of the five countries with improved scores on the *space and shape* subscale also showed improvements on the *change and relationships* scale (Belgium, Czech Republic, Luxembourg, and Poland; Italy improved its score on the *space and shape* scale but not on the *change and relationships* scale).

Of the five countries that showed increases on the *space and shape* subscale, Belgium and the Czech Republic already outperformed the United States in 2000 and also improved their scores in 2003. Italy, despite its improvement in score, was not measurably different from the United States in either year. Poland, which was not measurably different from the United States in 2000, outscored the United States in 2003, and Luxembourg, which scored below the United States in 2000, also outscored the United States in 2003.

Two countries (Mexico and Iceland) showed decreased scores from 2000 to 2003 on the *space and shape* scale. Despite these decreases in performance, there was no change in the relative position of either country compared to the United States: that is, Iceland outperformed the United States in 2000 and 2003 on the *space and shape* subscale, and Mexico performed worse than the United States in 2000 and 2003.

Of the other 25 OECD countries, 11 had their scores improve from 2000 to 2003 on the *change and relationships* subscale, while no country had a decrease. Of the 11 countries that improved from 2000 to 2003, several already outperformed the United States in 2000: Belgium, Canada, Denmark, Finland, and Korea all scored higher than the United States in 2000 on the *change and relationships* subscale. Several other countries were not measurably different from the United States in 2000, but outperformed the United States in 2003 (Czech Republic, Germany, Hungary). Three countries (Luxembourg, Poland, and Spain) had lower scores than the United States in 2000 on the *change and relationships* subscale, but were not measurably different from the United States in 2003. Portugal, despite its improvement in score, still scored lower than the United States in 2000 and 2003.

[6]For more information on scaling, see the technical notes in appendix A.

U.S. Performance in Problem Solving

As noted, one of PISA's major goals is to assess skills that cut across traditional curricular areas. In 2003, PISA assessed students' abilities in problem solving.[7]

Problem solving is defined as:

> *...an individual's capacity to use cognitive processes to confront and resolve real, cross-disciplinary situations where the solution is not immediately obvious, and where the literacy domains or curricular areas that might be applicable are not within a single domain of mathematics, science, or reading. (OECD 2003, p. 156).*

Students completed exercises that assessed their capabilities in using reasoning processes not only to draw conclusions but to make decisions, to troubleshoot (i.e., to understand the reasons for malfunctioning of a system or device), or to analyze the procedures and structures of a complex system (such as a simple kind of programming language). Problem-solving items required students to apply various reasoning processes, such as inductive and deductive reasoning, reasoning about cause and effects, or combinatorial reasoning (i.e., systematically comparing all the possible variations which can occur in a well-described situation). Students were also assessed in their skills in working toward a solution and communicating the solution to others through appropriate representations. Sample problem-solving items and student responses are shown here.

For more information about the problem-solving framework, please refer to *The PISA 2003 Assessment Framework: Mathematics, Reading, Science, and Problem Solving Knowledge and Skills* (OECD 2003). Additional released problem-solving items can be found at http://nces.ed.gov/surveys/pisa.

[7]PISA 2003's problem-solving assessment focused explicitly on problem-solving skills, using a variety of contexts, disciplines, and problem types. The items used to measure problem solving in PISA 2003 were different from other items, such as those measuring mathematics literacy. Problem solving can also be embedded within measures of content areas such as mathematics or science, however. TIMSS 2003, for example, incorporated an explicit aspect of problem solving and inquiry into the description of desired outcomes for mathematics and science. A review of mathematics and science items in PISA and TIMSS showed that 38 percent of eighth-grade TIMSS 2003 mathematics items and 48 percent of PISA 2003 mathematics literacy items measured some aspect of problem solving; additionally, 26 percent of eighth-grade TIMSS 2003 science items and 49 percent of PISA science literacy items measured problem-solving skills (Dossey, O'Sullivan, and McCrone forthcoming).

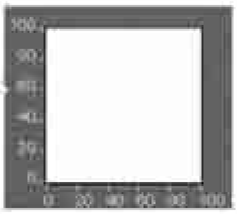
Exhibit 6. Problem-solving sample item 1: 2003

Design By Numbers©[1]

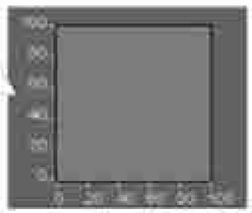
Design by Numbers is a design tool for generating graphics on computers. Pictures can be generated by giving a set of commands to the program.

Study carefully the following example commands and pictures before answering the questions.

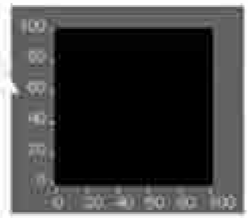
Paper 0



Paper 50

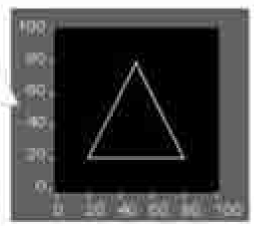


Paper 100



Paper 0
Pen 100
Line 20 0 80 60

Paper 100
Pen 0
Line 20 20 80 20
Line 80 20 50 80
Line 50 80 20 20

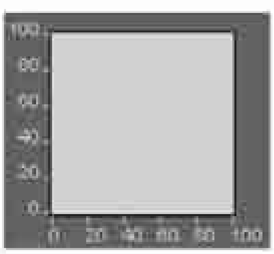


Question 4: DESIGN BY NUMBERS

X412Q01

Which of the following commands generated the graphic shown below?

A Paper 0
(B) Paper 20
C Paper 50
D Paper 75



RESULTS:
U.S. percent correct 41.3
OECD percent correct 50.3
Item difficulty: Level 2
Problem Type: System analysis and design

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

[1]Design by Numbers was developed by the Aesthetics and Computation Group at the MIT Media Laboratory. Copyright 1999, Massachusetts Institute of Technology. The program can be downloaded from http://dbn.media.mit.edu.

Exhibit 6. Problem-solving sample item 1: 2003—Continued

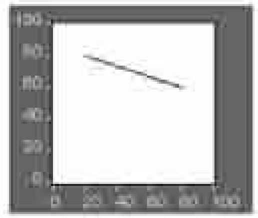
Design By Numbers

X412Q02

Question 5: DESIGN BY NUMBERS

Which of the following set of commands generated the graphic shown below?

A	Paper 100	Pen 0	Line 80 20 80 60
B	Paper 0	Pen 100	Line 80 20 60 80
C	Paper 100	Pen 0	Line 20 80 80 60
(D)	Paper 0	Pen 100	Line 20 80 80 60

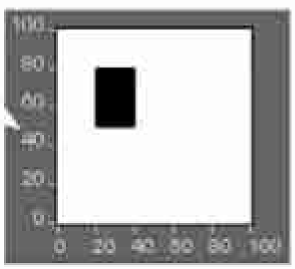


RESULTS:
U.S. percent correct................46.6
OECD percent correct.............48.3
Item difficulty: Level 2
Problem Type: System analysis and design

Question 6: DESIGN BY NUMBERS X412Q03 - 0 1 2 9

The following shows an example of the "Repeat" command.

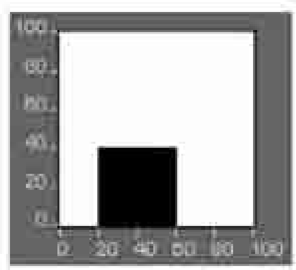
```
Paper 0
Pen 100
Repeat A 50 80
{
 Line 20 A 40 A
}
```



The command "Repeat A 50 80" tells the program to repeat the actions in brackets { }, for successive values of A from A=50 to A=80.

Write commands to generate the following graphic:

```
Paper 0
Pen 100
Repeat A 0 40
{
Line 20 A 60 A
}
```



RESULTS:
U.S. percent correct................31.4
OECD percent correct.............39.6
Item difficulty: Level 2
Problem Type: System analysis and design

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

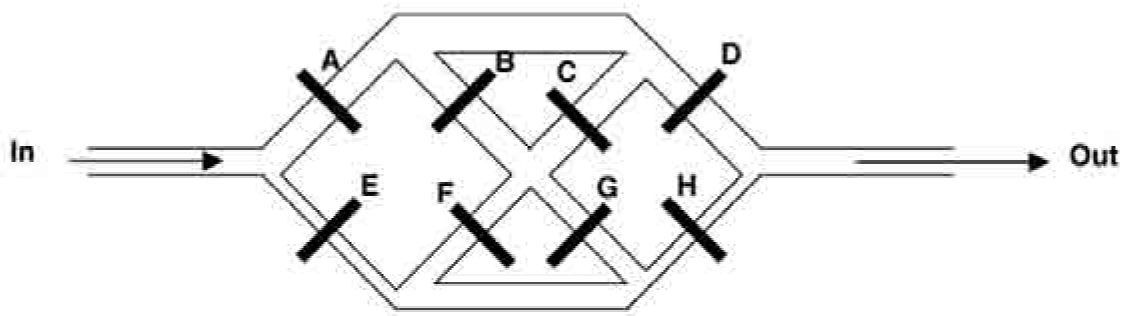
Exhibit 7. Problem-solving sample item 2: 2003

Irrigation

Below is a diagram of a system of irrigation channels for watering sections of crops. The gates A to H can be opened and closed to let the water go where it is needed. When a gate is closed no water can pass through it.

This is a problem about finding a gate which is stuck closed, preventing water from flowing through the system of channels.

Figure 1: A system of irrigation channels



Michael notices that the water is not always going where it is supposed to.
He thinks that one of the gates is stuck closed, so that when it is switched to "open", it does not open.

Question 17: IRRIGATION

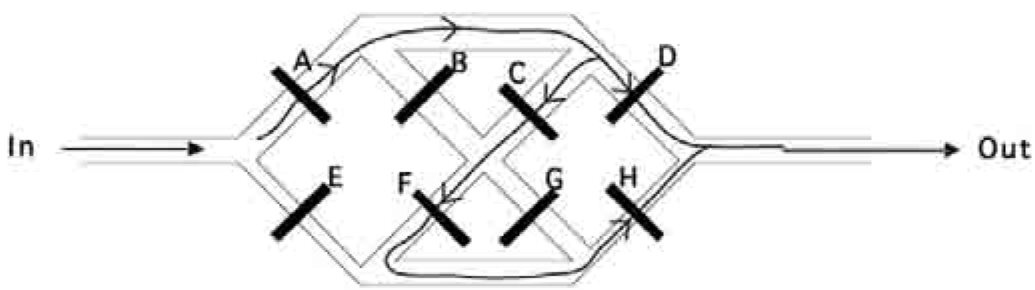
X603Q01 - 0 1 9

Michael uses the settings given in Table 1 to test the gates.

Table 1: Gate Settings

A	B	C	D	E	F	G	H
Open	Closed	Open	Open	Closed	Open	Closed	Open

With the gate settings as given in Table 1, **on the diagram below** draw all the possible paths for the flow of water. Assume that all gates are working according to the settings.



RESULTS:
U.S. percent correct...............58.2
OECD percent correct............62.9
Item difficulty: Level 1
Problem Type: Trouble Shooting

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Exhibit 7. Problem-solving sample item 2: 2003—Continued

Irrigation

Question 18: IRRIGATION

X603Q02

Michael finds that, when the gates have the Table 1 settings, no water flows through, indicating that at least one of the gates set to "open" is stuck closed.

Decide for each problem case below whether the water will flow through all the way. Circle "Yes" or "No" in each case.

Problem Case	Will water flow through all the way?
Gate **A** is stuck closed. All other gates are working properly as set in Table 1.	Yes / (No)
Gate **D** is stuck closed. All other gates are working properly as set in Table 1.	(Yes) / No
Gate **F** is stuck closed. All other gates are working properly as set in Table 1.	(Yes) / No

RESULTS:
U.S. percent correct 44.6
OECD percent correct 51.3
Item difficulty: Level 2
Problem Type: Trouble Shooting

Question 19: IRRIGATION

X603Q03 - 0 1 9

Michael wants to be able to test whether **gate D** is stuck closed.

In the following table, show settings for the gates to test whether **gate D** is stuck closed when it is set to "open".

Settings for gates (each one "open" or "closed")

A	B	C	D	E	F	G	H
open	closed	closed	open	closed	closed	closed	closed

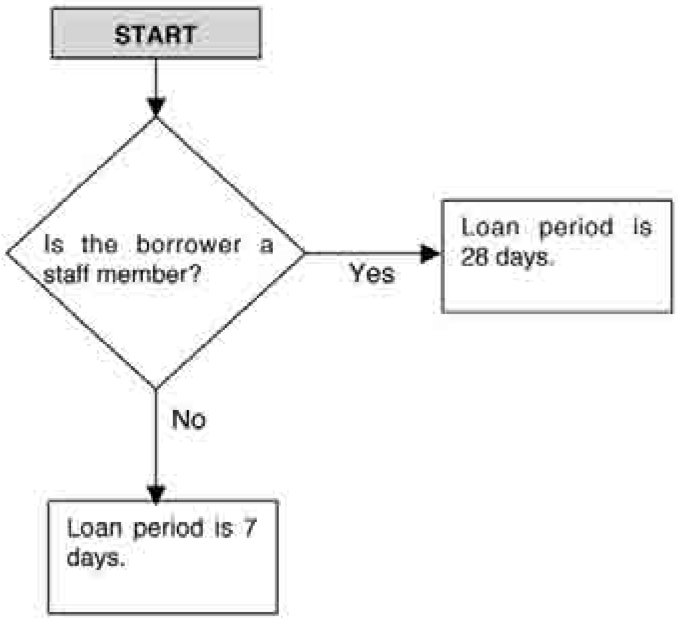
RESULTS:
U.S. percent correct 51.5
OECD percent correct 54.4
Item difficulty: Level 2
Problem Type: Trouble Shooting

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Exhibit 8. Problem-solving sample item 3: 2003

Library System

The **John Hobson High School** library has a simple system for lending books: for staff members the loan period is 28 days, and for students the loan period is 7 days. The following is a decision tree diagram showing this simple system:



The **Greenwood High School** library has a similar, but more complicated, lending system:

- All publications classified as "Reserved" have a loan period of 2 days.
- For books (not including magazines) that are **not** on the reserved list, the loan period is 28 days for staff, and 14 days for students.
- For magazines that are **not** on the reserved list, the loan period is 7 days for everyone.
- Persons with any overdue items are not allowed to borrow anything.

Question 13: LIBRARY SYSTEM

X402Q01

You are a student at **Greenwood High School**, and you do not have any overdue items from the library. You want to borrow a book that is **not** on the reserved list. How long can you borrow the book for?

Answer: ....14........... days.

RESULTS:

U.S. percent correct..............75.3
OECD percent correct............74.8
Item difficulty: Level 1
Problem Type: System analysis and design

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

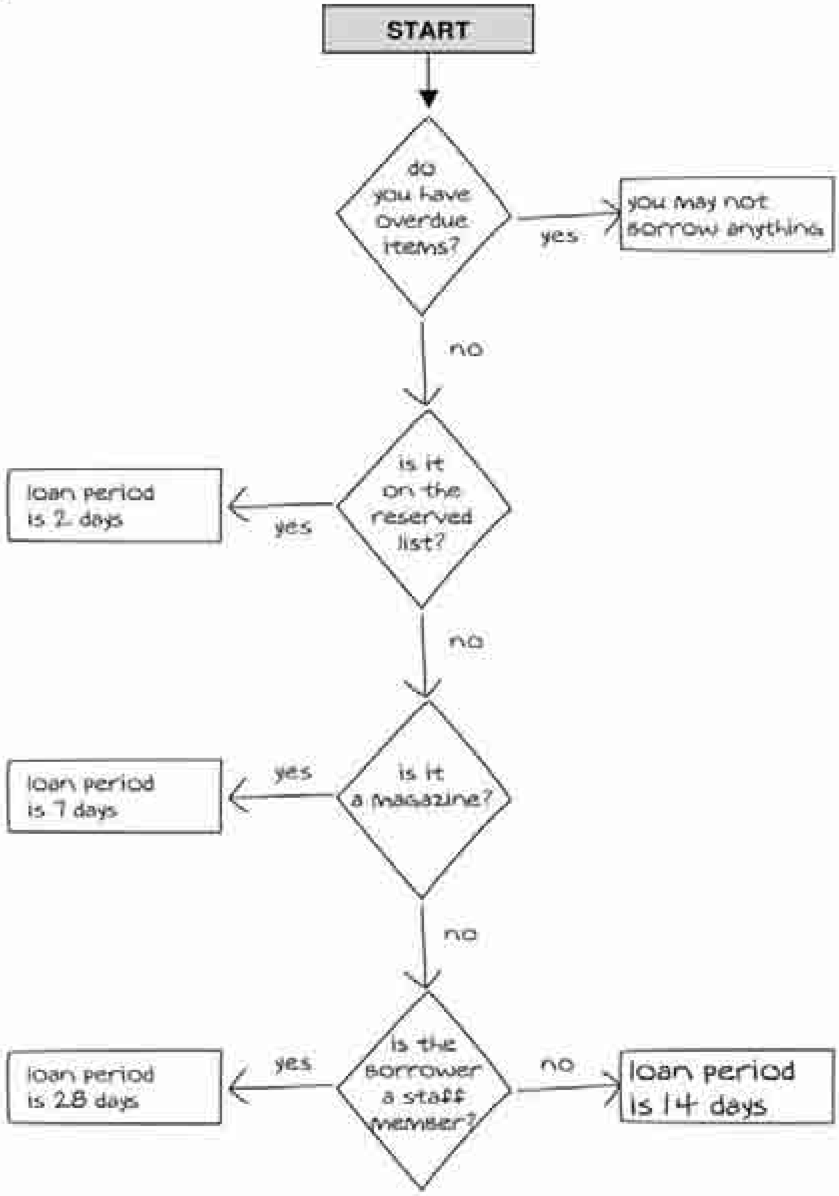
Exhibit 8. Problem-solving sample item 3: 2003—Continued

Library System

Question 14: LIBRARY SYSTEM

X402Q02 - 01 02 11 12 21 22 23 31 99

Develop a decision tree diagram for the **Greenwood High School Library** system so that an automated checking system can be designed to deal with book and magazine loans at the library. Your checking system should be as efficient as possible (i.e. it should have the least number of checking steps). Note that each checking step should have only **two** outcomes and the outcomes should be labeled appropriately (e.g. "Yes" and "No").



RESULTS:

U.S. percent correct................13.5
OECD percent correct............14.3
Item difficulty: Level 3
Problem Type: System analysis and design

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Problem-solving scores are reported on a scale with a mean of 500 and standard deviation of 100. Fifteen-year-old students in the United States had an average score of 477 on the problem-solving scale, lower than the OECD average score of 500 (table 3, table B-12). U.S. students scored lower in problem solving than their peers in 25 of the other 38 countries (22 OECD and 3 non-OECD countries). Eight countries (3 OECD—Greece, Mexico, and Turkey—and 5 non-OECD countries) reported lower scores compared to the United States in problem solving. Three OECD country scores (and two non-OECD country scores) were not measurably different from the U.S. average score in problem solving.

On average, U.S. high achievers for problem solving (those scoring in the top 10 percent in the United States) were outperformed by their OECD counterparts (figure 7, table B-13). To be in the top 10 percent of students in the United States, students needed at least a score of 604, while they needed a score of 446 or better in Tunisia but 675 or better in Japan. Low performers in the United States (those in the bottom 10 percent) scored 347 or lower, which was lower than the cutoff score of 368 or lower for the OECD average. There was approximately a 256 point score difference, or two and a half standard deviations, between the cutoff scores for the top 10 percent (604) and the bottom 10 percent (347) of 15-year-old students for problem solving in the United States.

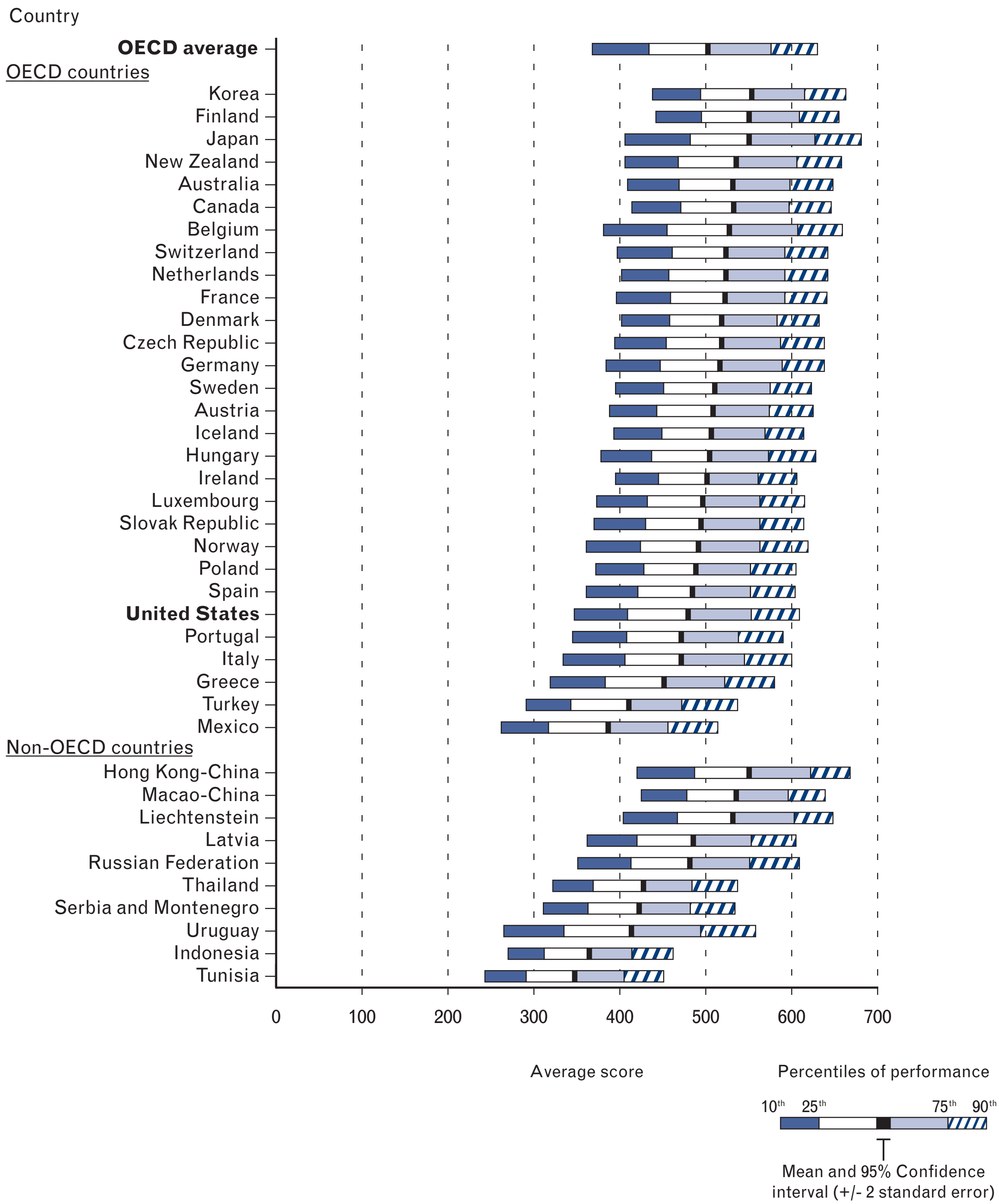
Table 3. Average scores of 15-year-old students on the problem-solving scale, by country: 2003

Country	
OECD average	**500**
OECD countries	
Korea	550
Finland	548
Japan	547
New Zealand	533
Australia	530
Canada	529
Belgium	525
Switzerland	521
Netherlands	520
France	519
Denmark	517
Czech Republic	516
Germany	513
Sweden	509
Austria	506
Iceland	505
Hungary	501
Ireland	498
Luxembourg	494
Slovak Republic	492
Norway	490
Poland	487
Spain	482
United States	**477**
Portugal	470
Italy	470
Greece	449
Turkey	408
Mexico	384
Non-OECD countries	
Hong Kong-China	548
Macao-China	532
Liechtenstein	529
Latvia	483
Russian Federation	479
Thailand	425
Serbia and Montenegro	420
Uruguay	411
Indonesia	361
Tunisia	345

▣ Average is significantly higher than the U.S. average
□ Average is not significantly different than the U.S. average
■ Average is significantly lower than the U.S. average

NOTE: Statistical comparisons between the U.S. average and the Organization for Economic Cooperation and Development (OECD) average take into account the contribution of the U.S. average toward the OECD average. The OECD average is the average of the national averages of the OECD member countries with data available. Because the Program for International Student Assessment (PISA) is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. Due to low response rates, data for the United Kingdom are not discussed in this report.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Figure 7. Distribution of problem-solving scores of 15-year-old students, by country: 2003



NOTE: The Organization for Economic Cooperation and Development (OECD) average is the average of the national averages of the OECD member countries with data available. Because the Program for International Student Assessment (PISA) is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. Due to low response rates, data for the United Kingdom are not discussed in this report.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Of the 38 other participating countries, 22 countries (including 16 OECD countries) had less variation (as measured by standard deviation) in performance in problem solving than the United States, while 3 countries (Belgium, Japan, and Uruguay) showed greater variation in performance (table B-14). The U.S. variation in performance was not measurably different from the OECD average variation.

Along with scale scores, PISA 2003 also uses three proficiency levels (levels 1 through 3, with level 3 being the highest level of proficiency) to describe student performance in problem solving. An additional level (below level 1) encompasses students whose skills cannot be described using these proficiency levels (exhibit 9). The proficiency levels describe what students at each level can do and allow comparisons of the percentages of students in each country who performed at different levels in problem solving (see appendix A for more information about how levels were set).

Exhibit 9. Description of proficiency levels for problem solving: 2003

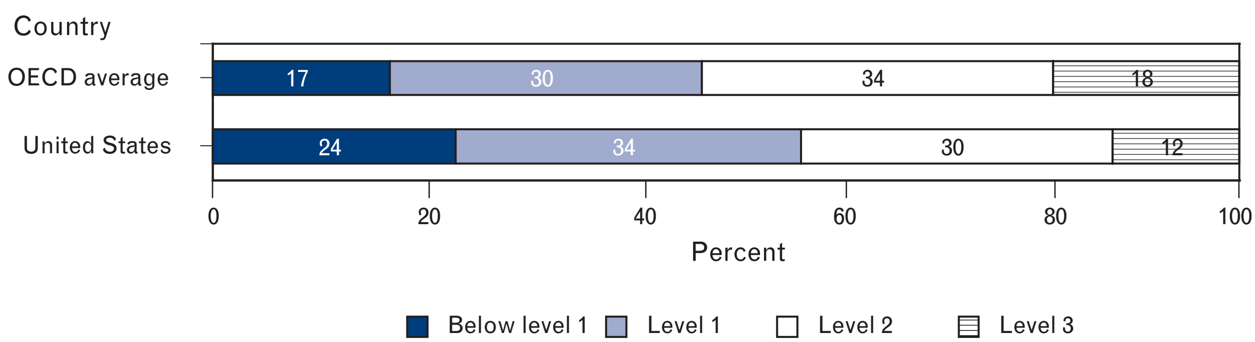
Proficiency level	Task descriptions
Level 1	At Level 1 students can solve problems where they have to deal with a single data source containing discrete, well-defined information. They understand the nature of a problem and consistently locate and retrieve information related to the major features of the problem. Level 1 students may be able to transform the information in the problem to present the problem differently (e.g., take information from a table to create a drawing or graph). Also, students may be able to apply information to check a limited number of well-defined conditions within the problem. However, Level 1 students are generally incapable of dealing with multi-faceted problems involving more than one data source or requiring the student to reason with the information provided.
Level 2	At Level 2 students use reasoning and analytic processes and solve problems requiring decision-making skills. Level 2 students apply various types of reasoning (inductive and deductive reasoning, reasoning about causes and effects, or combinatorial reasoning, that is, systematically comparing all possible variations in well-described situations) to analyze situations and to solve problems that require students to make a decision among well-defined alternatives. To analyze a system or make decisions, Level 2 students combine and synthesize information from a variety of sources. Students may need to combine various forms of representations (e.g., a formalized language, numerical information, and graphical information), handle unfamiliar representations (e.g., statements in a proto-programming language or flow diagrams related to a mechanical or structural arrangement of components), or draw inferences based on two or more sources of information.
Level 3	At Level 3 students do not only analyze a system and make decisions, they also represent the underlying relationships in a problem and relate these to the solution. Level 3 students approach problems systematically, construct their own representations and verify that their solution satisfies all requirements of the problem. These students communicate their solutions to others using written statements and other representations.

NOTE: In order to reach a particular proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into problem-solving levels according to their scores. Exact cut point scores are as follows: below level 1 (*a score less than or equal to 404.06*); level 1 (*a score greater than 404.06 and less than or equal to 498.08*); level 2 (*a score greater than 498.08 and less than or equal to 592.10*); level 3 (*a score greater than 592.10*).
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

The U.S. average score of 477 on the problem-solving scale placed it at level 1, while the OECD average score was at level 2 (table B-12, exhibit 9). The cutoff score of 604 for U.S. high performers (those in the top 10 percent in the United States) equated to a level 3 score, while the U.S. cutoff score of 347 for low performers (those in the bottom 10 percent) was below level 1 (table B-13, exhibit 9).

Twenty-four percent of U.S. students scored below level 1, 34 percent at level 1, 30 percent at level 2, and 12 percent at level 3 (figure 8, table B-15). The United States had greater percentages of students below level 1 and at level 1 than the OECD average percentages. The United States also had a lower percentage of students at levels 2 and 3 than the OECD average percentages. Four countries (Finland, Hong Kong-China, Japan, and Korea) had 30 percent or more of their students performing at level 3 in problem solving, compared with 12 percent for the United States and 18 percent for the OECD average.

Figure 8. Percentage distribution of 15-year-old students in the OECD countries and the United States on the problem-solving scale, by proficiency level: 2003



NOTE: In order to reach a particular proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into problem-solving levels according to their scores. Exact cut point scores are as follows: below level 1 *(a score less than or equal to 404.06)*; level 1 *(a score greater than 404.06 and less than or equal to 498.08)*; level 2 *(a score greater than 498.08 and less than or equal to 592.10)*; level 3 *(a score greater than 592.10).* The Organization for Economic Cooperation and Development (OECD) average is the average of the national averages of the OECD member countries with data available. Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

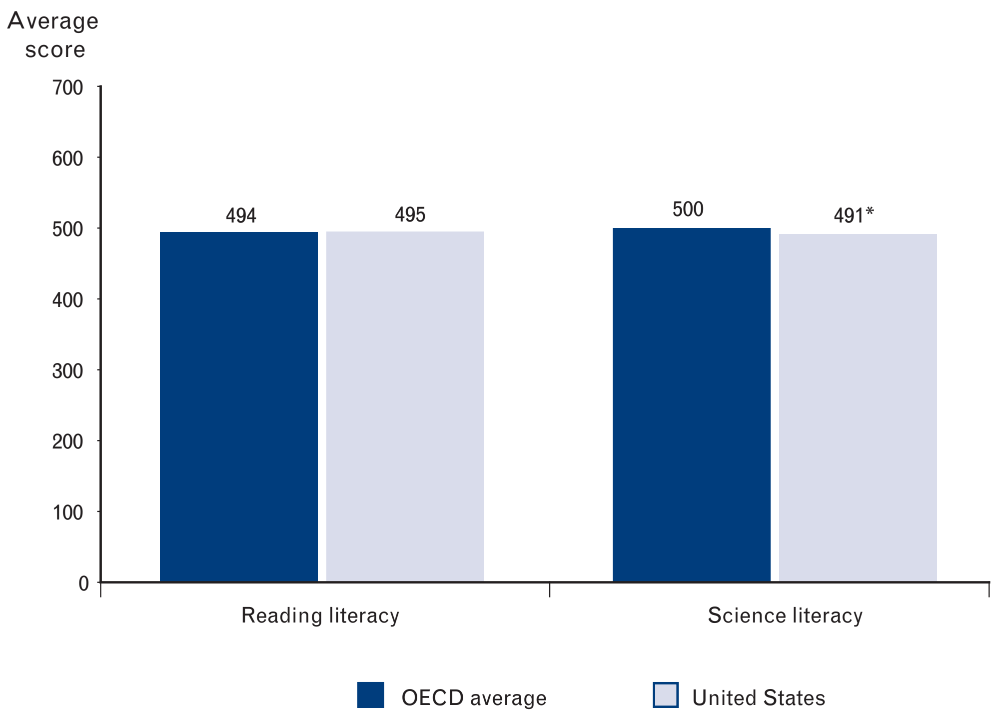
U.S. Performance in Reading Literacy and Science Literacy

Of the 41 countries that participated in PISA 2003, 32 also participated in PISA 2000. Changes in reading literacy and science literacy are reported for 29 of these 32 countries.[8]

In 2003, the average U.S. score in reading literacy was 495, not measurably different from the OECD average of 494 (figure 9, table B-16). Eleven countries (including 9 OECD countries) among the other 38 countries outperformed the United States in reading literacy in 2003.

There was no measurable change in either the U.S. reading literacy score from 2000 to 2003 or the U.S. position compared to the OECD average, although scores in 12 other countries did change (table B-16).[9] Four countries saw their average reading literacy scores increase (two non-OECD countries, Latvia and Liechtenstein, and two OECD countries, Luxembourg and Poland). The United States outperformed all four of these countries in 2000; in 2003, scores for Latvia and Poland were not measurably different from the U.S. scores in reading literacy, while Liechtenstein outscored the United States in 2003. Despite an increase in Luxembourg's average reading literacy score, the United States outperformed it in 2000 and 2003.

Figure 9. Average reading literacy and science literacy scores of 15-year-old students in the OECD countries and the United States: 2003



* Average is significantly different from OECD average.
NOTE: The Organization for Economic Cooperation and Development (OECD) average is the average of the national averages of the OECD member countries with data available.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

[8] Due to low response rates, data for the Netherlands were not discussed for PISA 2000; data for PISA 2003 for the United Kingdom are also not discussed due to low response rates; data for Brazil were not available at the time of production for this report.

[9] Large standard errors for the United States in 2000 may account at least in part for the fact that U.S. reading literacy and science literacy scores were not measurably different from 2000 to 2003 and that the scores were not different from the OECD averages in 2000.

Eight countries' scores (including seven OECD countries) were lower in 2003 than 2000 in reading literacy. Decreases in two of these eight countries' scores resulted in a change relative to the United States. Japan, which outperformed the United States in reading literacy in 2000, was not measurably different in 2003, while Spain, which did not perform measurably differently in 2000, performed worse than the United States in 2003.

In 2003, the U.S. average score in science literacy was 491, lower than the OECD average of 500 (figure 9, table B-17). Eighteen countries (including 15 OECD countries) outscored the United States in science in 2003.

There was no measurable difference between the U.S. average science literacy score of 499 in 2000 and 491 in 2003, although the relative position of the United States compared to the OECD average did change (the U.S. science literacy score in 2000 was not measurably different from the OECD average, while in 2003 the U.S. score was below the OECD average). Seventeen countries showed changes in their scores from 2000 to 2003—5 countries (all OECD countries) had lower scores in 2003 than in 2000 and 12 countries (including 9 OECD countries) had higher scores (table B-17). The OECD average score in science literacy was 500 in 2000 and 2003.

Of the 12 countries whose science literacy scores improved between 2000 and 2003, 8 also improved their performance relative to the United States. Belgium, the Czech Republic, France, Germany, Liechtenstein, and Switzerland did not perform differently from the United States in 2000 but outscored the United States in 2003. Latvia and the Russian Federation scored below the U.S. average in 2000 but were not measurably different in 2003. Of the five countries whose science literacy scores decreased between 2000 and 2003, two (Canada and Korea) continued to outperform the United States, one (Norway) was not measurably different in either year, one (Mexico) performed below the U.S. average in both years, and one (Austria) went from outscoring the United States to not being measurably different from the United States.

Differences in Performance by Selected Student Characteristics

This section provides information about how students with various characteristics (males and females, students of different races and from different socioeconomic backgrounds) performed on PISA 2003. Because PISA 2003's emphasis was on mathematics literacy and problem solving, the focus in this section is on performance in these areas.[10] This report does not address possible changes in performance for these groups from 2000 to 2003.

When considering these results, it is important to bear in mind that there need not be a cause-and-effect relationship between being a member of a group and achievement in PISA 2003. Student performance can be affected by a complex mix of educational and other factors that are not examined here.

Sex

Fifteen-year-old females in the United States scored 480 on the combined mathematics literacy scale, which was lower than the average male score of 486 (figure 10, table B-18). Males also outperformed females in 25 other countries (20 OECD countries and 5 non-OECD countries), a pattern evident in the OECD average scores of 494 for females and 506 for males. Iceland was the only country in which females scored higher in mathematics literacy than males.

Within the United States, greater percentages of male students performed at level 6 (the highest level) than female students in mathematics literacy, but larger percentages of females were not seen at lower levels (below level 1 and levels 1 through 5, table B-19). In other words, differences in the overall scores between males and females in the United States were due at least in part to the fact that a greater percentage of males were found among the highest performers, not to a greater percentage of females found among the lowest performers.

On average across the OECD countries, males outperformed females on each of the four mathematics literacy subscales (table B-20). In the United States, differences between males and females were evident only on the *space and shape* subscale.

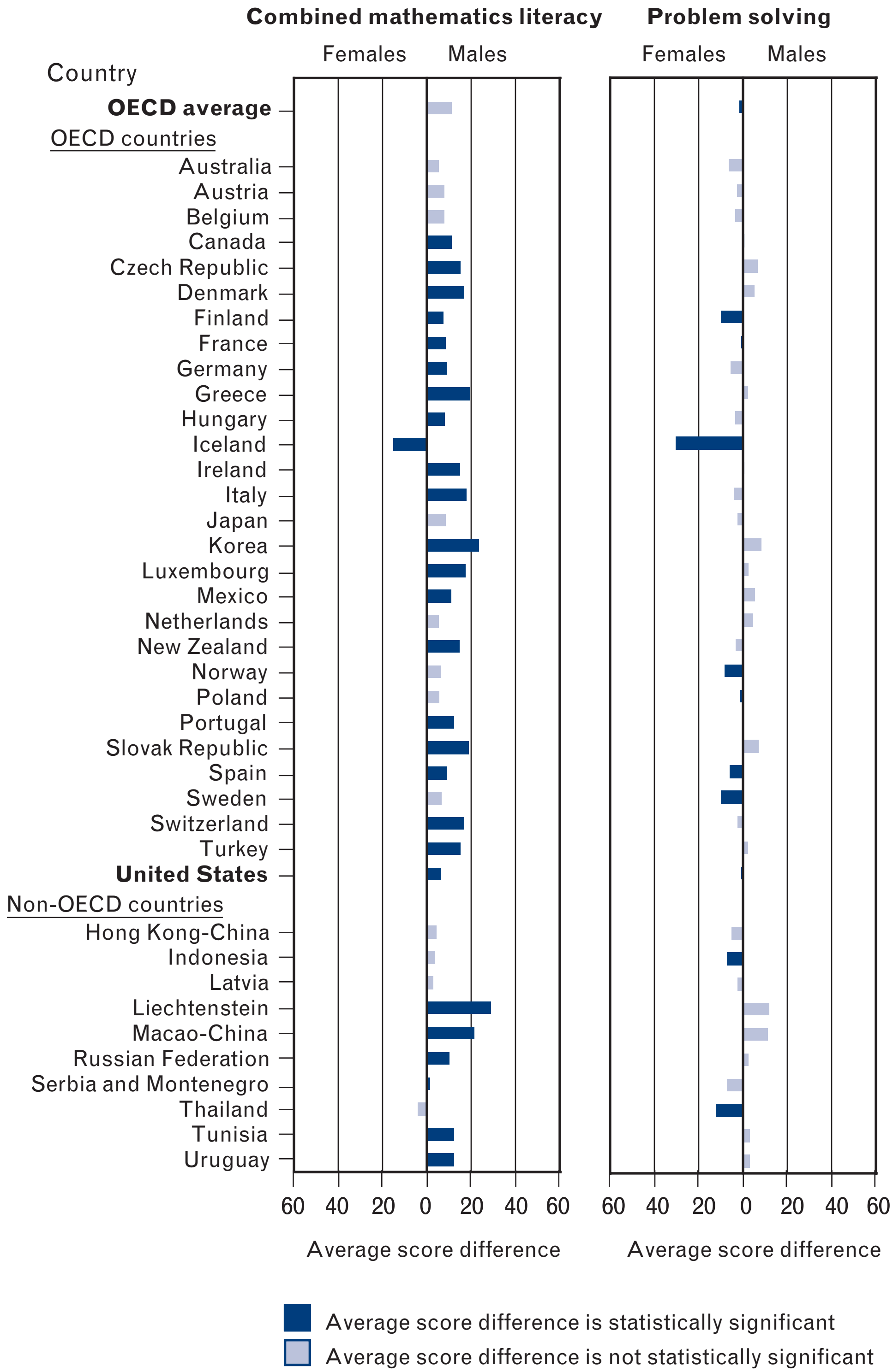
In the majority of the PISA 2003 countries (32 out of 39 countries), including the United States, there were no measurable differences in problem-solving scores by sex (figure 10, table B-21). However, females outscored their male peers in problem solving in six of the remaining seven participating countries (including four OECD countries), as well as at the OECD average. Males outscored females in problem solving in Macao-China.

As in 2000, females in the United States and nearly every other participating country outscored males in reading literacy in 2003 (table B-22). Only Liechtenstein showed no statistical difference between males and females in 2003, although there was a difference in favor of females in 2000.

There was no measurable difference between the performance of U.S. males and females in science literacy in PISA 2000 or PISA 2003, and scores for neither group changed between 2000 and 2003. Thirteen countries showed differences between males and females in 2003 (12 OECD countries and the Russian Federation). Eleven of the 13 countries showed differences in favor of males, but in Finland and Iceland females outperformed males.

[10] Information on performance in reading literacy and science literacy by sex and race/ethnicity is provided, however.

Figure 10. Differences in average scores of 15-year-old students on the combined mathematics literacy scale and in problem solving, by sex and country: 2003



NOTE: Each bar above represents the average score difference between males and females on combined mathematics literacy and problem solving. The Organization for Economic Cooperation and Development (OECD) average is the average of the national averages of the OECD member countries with data available. Because the Program for International Student Assessment (PISA) is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. Due to low response rates, data for the United Kingdom are not discussed in this report.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Socioeconomic Status

The measure of student socioeconomic status (SES) used in PISA 2003 is based on the occupational status of the student's father or mother (whichever was higher) as reported by the student. Parental occupation was coded based on the International Standard Classification of Occupations (ISCO) (International Labor Organization 1990). Occupational codes were in turn mapped onto an internationally comparable index of occupational status, the International Socioeconomic Index (ISEI), developed by Ganzeboom, De Graaf, and Treiman (1992). Using the index, students were assigned numbers ranging from about 16 to 90 based on their parents' occupations, so that they were arrayed on a continuum from low to high socioeconomic status, rather than placed into discrete categories. Typical occupations among parents of 15-year-olds with between 16 and 35 points on the ISEI scale include small-scale farmer, metalworker, mechanic, taxi or truck driver, and waiter/waitress. Between 35 and 53 index points, the most common occupations are bookkeeping, sales, small business management, and nursing. As the required skills increase, so does the status of the occupation. Between 54 and 70 points, typical occupations are marketing management, teaching, civil engineering, and accountant. Finally, between 71 and 90 points, the top international quarter of the index, occupations include medicine, university teaching, and law (OECD 2001).

The average ISEI index score for the United States in 2003 was 55, higher than that of all but two countries (Norway and Iceland) (table B-23). Low ISEI students in the United States were also comparatively better off in terms of socioeconomic status than most of their OECD peers. U.S. students with low ISEI (those in the bottom 25 percent in the United States) had an average index value of 33, which was higher than the index values for low ISEI students in 35 of the other 38 PISA 2003 countries (including 25 OECD countries). Two countries (Japan and Norway) reported higher average index values for low ISEI students compared to the United States.

Within the United States, students with low ISEI values were outperformed in mathematics literacy by their peers with higher ISEI values (table B-24). Moreover, U.S. students with low ISEI values were outperformed by their peers with low ISEI values in 22 of the 39 PISA 2003 countries (including 18 OECD countries) for mathematics literacy. Students with the highest ISEI background in the United States (those in the top quarter) were outperformed by high ISEI students from 20 other countries (including 19 OECD countries) in mathematics literacy.

The overall linkage of ISEI to mathematics literacy and problem solving can be examined by the specific change in score on the combined mathematics literacy scale in response to a one standard deviation change in the ISEI index score for each country. A greater increase in the average achievement score in a country implies a stronger relationship between socioeconomic status and performance in that country.

For example, in the United States, a one standard deviation change in the ISEI index was associated with an average difference of 30 points on the combined mathematics literacy and 31 points on the problem-solving scale (table B-25). In Macao-China, socioeconomic background differences in achievement were at a minimum—one standard deviation's difference on the ISEI index was associated with a 10 point difference on the combined mathematics literacy scale and a 12 point difference on the problem-solving scale. By contrast, among students in Hungary, a one standard deviation change in ISEI score was associated with about a 41 point difference in both mathematics literacy and problem-solving achievement scores. Twelve countries (including six OECD countries) had a weaker relationship between ISEI and problem-solving performance than the United States, while three countries (Belgium, Germany, and Hungary) had a stronger one. Belgium, Germany, and Hungary also had stronger relationships between ISEI and mathematical literacy than the United States, as did the Czech Republic and Poland. Eleven countries (including 6 OECD countries) had weaker relationships.

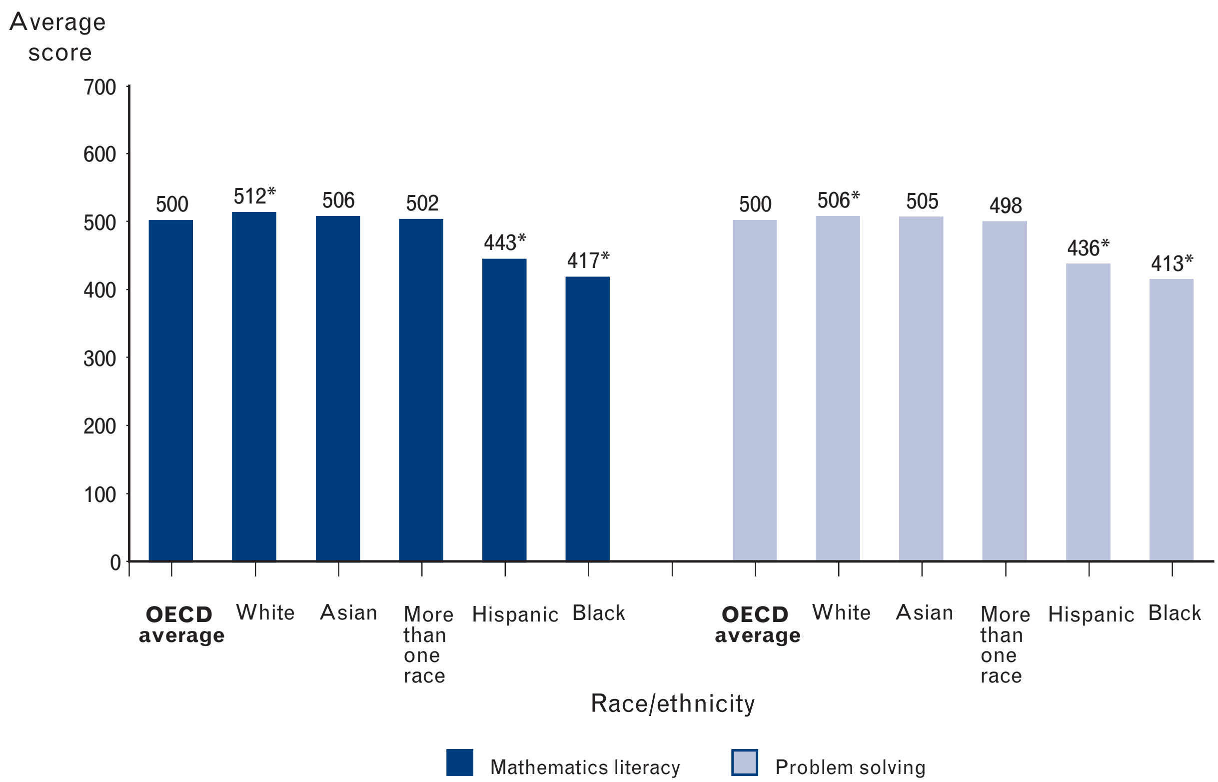
Race/Ethnicity

Racial and ethnic groups vary between countries, so it is not possible to compare their performance across countries on international assessments. Thus, this section refers only to 2003 findings for the United States. Throughout this section, "White" refers to White, non-Hispanic students, "Black" to Black, non-Hispanic students, "Asian" to Asian, non-Hispanic students, and "Hispanic" to Hispanic students of any race. Results for two groups (American Indian or Alaska Native and Hawaiian or Other Pacific Islander) are not shown separately because small sample sizes did not allow for accurate estimates.

In both mathematics literacy and problem solving, Blacks and Hispanics scored lower, on average, than Whites, Asians, and students of more than one race (figure 11, table B-26). Hispanic students, in turn, outscored Black students. This pattern of performance on PISA 2003 by race/ethnicity is similar to that found in PISA 2000 and on the National Assessment of Educational Progress (NAEP) (Braswell, Daane, and Grigg 2003; Lemke et al. 2001).

In both mathematics literacy and problem solving, the average scores for Blacks and Hispanics were below the respective OECD average scores, while scores for Whites were above the OECD average scores. Students who were White, Asian, and of more than one race scored at level 3 in mathematics literacy, compared to level 2 for Hispanic students and level 1 for Black students (figure 11, exhibit 5). In problem solving, average scores for Whites and Asians placed them in level 2, while Black, Hispanic, and students of more than one race scored at level 1 (figure 11, exhibit 9).

Figure 11. Average scores of U.S. 15-year-old students on the combined mathematics literacy scale and in problem solving, by race/ethnicity: 2003



* Average is significantly different from OECD average.
NOTE: Reporting standards not met for American Indian/Alaska Native and Native Hawaiian/Other Pacific Islander. Black includes African American and Hispanic includes Latino. Racial categories exclude Hispanic origin.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

For Further Information

This report provides selected findings from PISA 2003 from a U.S. perspective. Readers may be interested in exploring other aspects of PISA's results. Additional findings are presented in the OECD report on PISA 2003 and further results will be published in a series of OECD thematic reports on PISA 2003. Data with which researchers can conduct their own analyses are also available at http://www.pisa.oecd.org.

References

Adams, R. (Ed.). (forthcoming). *PISA 2003 Technical Report.* Paris: Organization for Economic Cooperation and Development.

Adams, R. (Ed.). (2002). *PISA 2000 Technical Report*. Paris: Organization for Economic Cooperation and Development.

Binkley, M., Afflerbach, P., and Kelly, D. (forthcoming). *A Content Comparison of the NAEP and PISA Reading Assessments* (NCES 2005–110). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Binkley, M., and Kelly, D. (2003). *A Content Comparison of the NAEP and PIRLS Fourth-Grade Reading Assessments* (NCES 2003–10). U.S. Department of Education. Washington, DC: National Center for Education Statistics Working Paper.

Braswell, J.S., Daane, M.C., and Grigg, W.S. (2003). *The Nation's Report Card: Mathematics Highlights 2003* (NCES 2004–451). U.S. Department of Education. National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Dossey, J., O'Sullivan, C., and McCrone, S. (forthcoming). *Problem Solving in International Comparative Assessments* (NCES 2005–107). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Ferraro, D., Czuprynski, J., and Williams, T. (forthcoming). *U.S. 2003 PISA Nonresponse Bias Analysis.* (2005–102). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Ganzeboom, H.B.G., De Graaf, P., Treiman, D.J. (with De Leeuw, J.). (1992). A Standard International Socio-Economic Index of Occupational Status. *Social Science Research*, *21*(1): 1-56.

Ganzeboom, H.B.G., and Treiman, D.J. (1996). Internationally Comparable Measures of Occupational Status for the 1988 International Standard Classification of Occupations. *Social Science Research, 25*(3): 201-239.

International Labor Organization. (1990). ISCO-88: International Standard Classification of Occupations. Geneva: Author.

Lemke, M., Calsyn, C., Lippman, L., Jocelyn, L., Kastberg, D., Liu, Y.Y., Roey, S., Williams, T., Kruger, T., Bairu, G. (2001). *Outcomes of Learning: Results from the 2000 Program for International Student Assessment of 15-Year-Olds in Reading, Mathematics, and Science Literacy* (NCES 2002–115). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Neidorf, T.S., Binkley, M., Gattis, K., and Nohara, D. (forthcoming). *A Content Comparison of the National Assessment of Educational Progress (NAEP), Trends in International Mathematics and Science Study (TIMSS), and Program for International Student Assessment (PISA) 2003 Mathematics Assessments.* (NCES 2005–112). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Neidorf, T.S., Binkley, M., and Stephens, M. (forthcoming). *A Content Comparison of the National Assessment of Educational Progress (NAEP) 2000 and Trends in International Mathematics and Science Study (TIMSS) 2003 Science Assessments* (NCES 2005–106). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Nohara, D. (2001). *A Comparison of the National Assessment of Educational Progress (NAEP), the Third International Mathematics and Science Study-Repeat (TIMSS-R), and the Programme for International Student Assessment (PISA)* (NCES 2001–07). U.S. Department of Education. Washington, DC: National Center for Education Statistics Working Paper.

Organization for Economic Cooperation and Development (OECD). (1999). *Measuring Student Knowledge and Skills: A New Framework for Assessment*. Paris: Author.

Organization for Economic Cooperation and Development (OECD). (2000). *Measuring Student Knowledge and Skills: The PISA 2000 Assessment of Reading, Mathematical and Scientific Literacy*. Paris: Author.

Organization for Economic Cooperation and Development (OECD). (2001). *Knowledge and Skills for Life: First Results from the OECD Programme for International Student Assessment*. Paris: Author.

Organization for Economic Cooperation and Development (OECD). (2002). *Sample Tasks for the PISA 2000 Assessment: Reading, Mathematical and Scientific Literacy*. Paris: Author.

Organization for Economic Cooperation and Development (OECD). (2003). *The PISA 2003 Assessment Framework: Mathematics, Reading, Science and Problem Solving Knowledge and Skills*. Paris: Author.

Organization for Economic Cooperation and Development (OECD). (2004). *Learning for Tomorrow's World — First Results From PISA 2003*. Paris: Author.

Organization for Economic Cooperation and Development (OECD). (2004). *Problem Solving for Tomorrow's World — First Measures of Cross-Curricular Skills From PISA 2003*. Paris: Author.

Raudenbush, S. W. and Bryk, A. S. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods (2nd ed.)*. Newbury Park, CA: Sage Publications.

Steen, L. A. (Ed.). (1990). *On the Shoulders of Giants: New Approaches to Numeracy*. Washington, DC: National Academy Press.

Westat. (2000). *WesVar 4.0 User's Guide*. Rockville, MD: Author.

Wilson, M. and Xie, Y. (2004). *Report on the Imperial Versus Metric Study*. BEAR Research Report, Berkeley, CA: University of California. Available at http://bear.berkeley.edu/pub.html.

Appendix A: Technical Notes

The Program for International Student Assessment (PISA) is a system of international assessments that measures 15-year-olds' capabilities in reading literacy, mathematics literacy, and science literacy every three years. PISA was first implemented in 2000 and is carried out by the Organization for Economic Cooperation and Development (OECD). In addition to the major subject areas, PISA also measures general or cross-curricular competencies such as learning strategies. In this second cycle, PISA 2003, mathematics literacy was the major focus, along with the new cross-curricular cognitive domain of problem solving. This appendix describes features of the PISA 2003 survey methodology, including sample design, test design, scoring, data reliability, and analysis variables. For further details about the assessment and any of the topics discussed here, see the OECD's *PISA 2003 Technical Report* (Adams forthcoming) and the *PISA 2000 Technical Report* (Adams 2002).

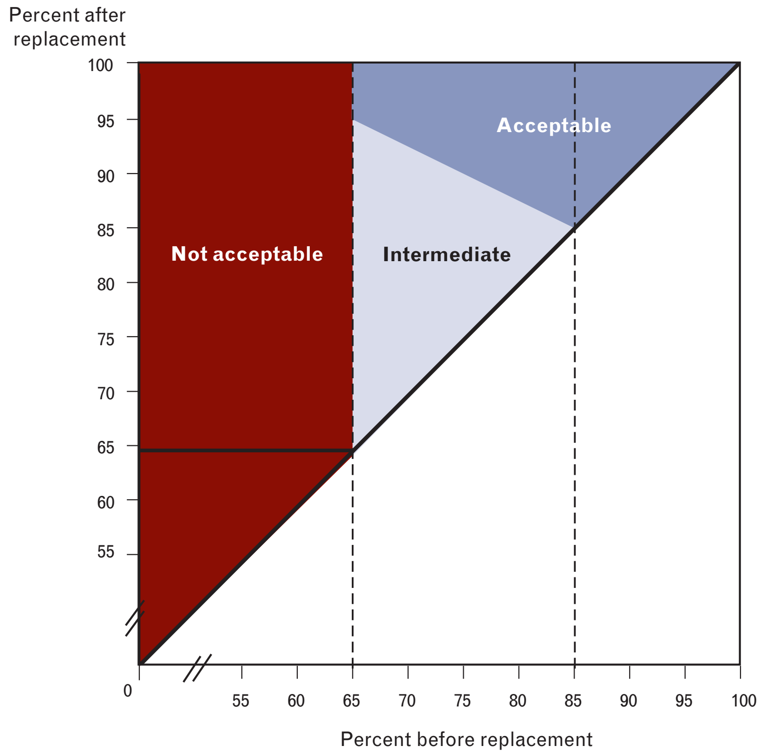
Sampling, Data Collection, and Response Rate Requirements

To provide valid estimates of student achievement and characteristics, the sample of PISA students had to be selected in a way that represented the full population of 15-year-old students in each country. The international desired population in each country consisted of 15-year-olds attending both publicly and privately controlled educational institutions in grades 7 and higher. A minimum of 4,500 students from a minimum of 150 schools was required. Within schools, a sample of 35 students was to be selected in an equal probability sample unless fewer than 35 students aged 15 were available (in which case all students were selected). International standards required that students be sampled based on an age definition of 15 years and 3 months to 16 years and 2 months at the beginning of the testing period. The testing period was required not to exceed 42 days between March 1, 2003, and August 31, 2003. Each country collected its own data, following international guidelines and specifications.

A minimum response rate target of 85 percent was required for initially selected educational institutions. In instances in which the initial response rate of educational institutions was between 65 and 85 percent, an acceptable school response rate could still be achieved through the use of replacement schools. Replacement schools were to be selected at the time of sample selection.

Three school response rate zones—acceptable, intermediate, and not acceptable—were defined (figure A-1). "Acceptable" meant that the country's data would be included in all international comparisons. "Not Acceptable" meant that the country's data would be a candidate for not being reported in international comparisons unless considerable evidence was presented that nonresponse bias was minor. "Intermediate" meant that a decision on whether or not to include the country's data in comparisons would be made while taking into account a variety of factors, such as student response rates, quality control, closeness of the response rates to the acceptable level, etc. For the purposes of calculating response rates, schools with less than 50 percent of students responding were considered nonresponding and their students were excluded from the student response rates. If the student response rates within such schools were at least 25 percent, these schools and students were included in the PISA 2003 database. Schools with student response rates below 25 percent were not used in any type of analysis nor are the data for these students or schools available in the PISA 2003 database. Note that schools with student response rates above 25 percent were included in the nonresponse bias analyses described in this report.

Figure A-1. School response rate requirements for PISA 2003



NOTE: A minimum response target of 85 percent was required for initially selected educational institutions. In instances in which the initial response rate of educational institutions was between 65 and 85 percent, an acceptable school response rate could still be achieved through the use of replacement schools.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

PISA 2003 also required a minimum participation rate of 80 percent of sampled students from original and replacement schools within each country. A student was considered to be a participant if he or she participated in the first testing session or a follow-up or makeup testing session.

Exclusion guidelines allowed for 0.5 percent at the school level for approved reasons (for example, remote regions or very small schools), and 2 percent for special education schools. Overall estimated student exclusions to be under 5 percent. PISA's intent was to be as inclusive as possible. No accommodations were offered in the United States for PISA. A special one-hour booklet with lower difficulty items, which was scaled with the regular PISA booklets, was used in six countries for schools that would otherwise have been excluded. Special booklets were used in Austria, Belgium, the Czech Republic, Hungary, the Netherlands, and the Slovak Republic. Within schools, exclusion decisions were made by staff members who were knowledgeable about students with Individualized Education Programs (IEPs) or students who were limited English proficient, using the following international guidelines on possible student exclusions:

- **Functionally disabled students.** These were students who were permanently physically disabled in such a way that they could not perform in the testing situation. Functionally disabled students who could respond were to be included in the testing. Any sampled student who was temporarily disabled such that s/he could not participate in the assessment was considered absent from the assessment.

- **Students with mental or emotional disabilities.** These were students who were considered in the professional opinion of the school principal or by other qualified staff members to be intellectually disabled or who had been psychologically tested as such. This included students who were emotionally or mentally unable to follow even the general instructions of the test. Students were not to be excluded solely because of poor academic performance or normal disciplinary problems.
- **Students with limited proficiency in the test language.** These were students who had received less than one year of instruction in the language of the test. Generally, these were students who were unable to read or speak the language of the test (English in the United States) and would be unable to overcome the language barrier in the test situation.

Quality monitors from the PISA Consortium visited schools in every country to ensure testing procedures were carried out in a consistent manner across countries.

Sampling, Data Collection, and Response Rates in the United States

The 2003 PISA school sample was drawn for the United States in November 2002. The sample design for this school sample was developed to retain some of the properties of the 2000 PISA U.S. school sample, and to follow international requirements as given in the PISA sampling manual. Unlike the 2000 PISA sample, which had a three-stage design, the U.S. sample for 2003 was a two-stage sampling process with the first stage a sample of schools, and the second stage a sample of students within schools. For PISA in 2000, the U.S. school sample had the selection of a sample of geographic Primary Sampling Units (PSUs) as the first stage of selection. The sample was not clustered at the geographic level for PISA 2003. This change was made in an effort to reduce the design effects observed in the 2000 data and to spread the respondent burden across school districts as much as possible.

The sample design for PISA was a stratified systematic sample, with sampling probabilities proportional to measures of size. The PISA sample had no explicit stratification and no oversampling of subgroups. The frame was implicitly stratified (i.e., sorted for sampling) by five categorical stratification variables: grade span of the school (five levels), type of school (public or private), region of the country[11] (Northeast, Central, West, Southeast), type of location relative to populous areas (eight levels), minority status (above or below 15 percent). The last sort key within the implicit stratification was by estimated enrollment of 15-year-olds based on grade enrollments.

At the same time that the PISA sample was selected, replacement schools were identified following the PISA guidelines by assigning the two schools neighboring the sampled school on the frame as replacements. There were several constraints on the assignment of substitutes. One sampled school was not allowed to substitute for another, and a given school could not be assigned to substitute for more than one sampled school. Furthermore, substitutes were required to be in the same implicit stratum as the sampled school. If the sampled school was the first or last school in the stratum, then the second school following or preceding the sampled school was identified as the substitute. One was designated a first replacement and the other a second replace-

[11]The Northeast region consists of Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. The Central region consists of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Wisconsin, and South Dakota. The West region consists of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oklahoma, Oregon, Texas, Utah, Washington, and Wyoming. The Southeast region consists of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia.

ment. If an original school refused to participate, the first replacement was then contacted. If that school also refused to participate, the second school was then contacted.

The U.S. PISA school sample consisted of 420 schools. This number was increased from the international minimum requirement of 150 to offset school nonresponse, reduce design effects, and include additional students in a metric-imperial experiment (described below).

The schools were selected with probability proportionate to the school's estimated enrollment of 15-year-olds from the 2003 NAEP school frame with 2000-2001 school data. The data for public schools were from the Common Core of Data (CCD), and the data for private schools were from the Private School Survey (PSS). Any school containing at least one 7th- through 12th-grade class as of the school year 2000–01 was included on the school sampling frame. Participating schools provided lists of 15-year-old students, and a sample of 35 students was selected within each school in an equal probability sample. The overall sample design for the United States was intended to approximate a self-weighting sample of students as much as possible, with each 15-year-old student having an equal probability of being selected.

In the United States, for a variety of reasons reported by school administrators (such as increased testing requirements at the national, state, and local levels, concerns about timing of the PISA assessment and loss of learning time), many schools in the original sample declined to participate. As it was clear that the United States would not meet the minimum response rate standards, in order to improve response rates and better accommodate school schedules, a second testing window was opened from September to November 2003 with the agreement of the PISA Consortium. For the fall data collection, the school sample included only original schools from the sample that had refused to participate in the spring but indicated a willingness to participate in a fall assessment. Substitute schools were not included in the fall sample because their participation would have had little effect on raising the final response rate. In order to achieve a comparable sample of students in spring and fall, the age definition for students tested in the fall was adjusted such that all students tested were the same age.

Of the 420 sampled schools, 382 were eligible (some did not have any 15-year-olds enrolled) and 179 agreed to participate in the spring of 2003. An additional 70 original schools participated in the fall assessment for a total of 249 participating original schools. The school response rate (including spring and fall assessments) before replacement was 65 percent (weighted and unweighted), placing the United States in the "intermediate" response rate category. The weighted school response rate before replacement is given by the formula:

$$\text{weighted school response rate before replacement} = \frac{\sum_{i \in Y} W_i E_i}{\sum_{i \in (Y \cup N)} W_i E_i},$$

where Y denotes the set of responding original sample schools with age-eligible students, N denotes the set of eligible nonresponding original sample schools, W_i denotes the base weight for school i, $W_i = 1/P_i$, where P_i denotes the school selection probability for school i, and E_i denotes the enrollment size of age-eligible students, as indicated on the sampling frame.

In addition to the 249 participating original schools, 13 replacement schools also participated in the spring for a total of 262 participating schools.

A total of 7,598 students were sampled for the assessment. Of these students, 261 were deemed ineligible because of their enrolled grades, birthdays, or other reasons, and were removed from the sample. Of the eligible 7,337 sampled students, an additional 534 students were excluded using the criteria described above, for a weighted exclusion rate of 7 percent.

Of the 6,803 remaining sampled students, a total of 5,456 students participated in the assessment in the United States, but 114 of these came from schools which had less than 50 percent student participation. Schools which had less than 50 percent student participation were classified as school nonrespondents, and these students (114 participating students and 187 nonparticipating students) were therefore excluded for the purposes of calculating student response rates. Thus, although data for 5,456 students are included in the database, student response rates were calculated by subtracting the 114 students from the 5,456 for a total of 5,342 participating students. The denominator for the student response rate is 6,502, which consists of 7,598 sampled students minus the following students: 261 ineligible, 534 excluded, 114 responding students from nonresponding schools, and 187 nonresponding students from nonresponding schools. An overall weighted student response of 83 percent was achieved (82 percent unweighted).

Two separate bias analyses were conducted in the United States to address potential problems in the data due to school nonresponse and possible achievement differences between students in spring and fall testing windows.

The analysis of school nonresponse was conducted in two parts, examining first the original sample of schools (spring and fall participants) and then the final sample of schools (including replacements), treating as nonrespondents those schools from whom a final response was not received (Ferraro, Czuprynski and Williams forthcoming). Schools with 25 to 49 percent student response rates were treated as respondents in the nonresponse bias analysis, since their data are included in the PISA database. Schools with student response rates less than 25 percent were treated as nonrespondents in the analysis and were not included in the PISA database.

In order to compare PISA respondents and nonrespondents, it was necessary to match the sample of schools back to the sample frame to detect as many characteristics as possible that might provide information about the presence of nonresponse bias. Comparing frame characteristics for respondents and nonrespondents is not always a good measure of nonresponse bias if the characteristics are unrelated or weakly related to more substantive items in the survey; however, this was the only approach available given that no comparable school or student level achievement data were available. Frame characteristics were taken from the 2000–01 Common Core of Data (CCD) for public schools and from the 2000–01 Private School Survey (PSS) for private schools. For categorical variables, response rates by characteristics were calculated. The hypothesis of independence between the characteristics and response status was tested using a Rao-Scott modified Chi-square statistic. For continuous variables, summary means were calculated. The 95 percent confidence interval for the difference between the mean for respondents and the overall mean was tested to see whether or not it included zero. In addition to these tests, logistic regression models were set up to identify whether any of the frame characteristics were significant in predicting response status. All analyses were performed using WesVar and replicate weights to properly account for the complex sample design. The JK2 method was used to create the weights. The school base weights used in these analyses did not include a nonresponse adjustment factor. The base weight for each original school was the reciprocal of its selection probability. The base weight for each replacement school was equal to the base weight of the original school it replaced.

Characteristics available for public and private schools included: public/private affiliation, community type, region, number of age-eligible students enrolled, total number of students, and percentage of various racial/ethnic groups (percentage Asian or Pacific Islander; Black, non-Hispanic; Hispanic; American Indian or Alaska Native; White, non-Hispanic). Percentage of students eligible for free or reduced-price lunch was also available for public schools only (however, this variable was missing for 50 of the 359 public schools). For the original sample of schools, two of these variables showed a relationship to response status in tests of independence and in the multivariate logistic regression model: region (specifically, schools in the Central region were less likely to respond) and percentage of Asian or Pacific Islander students (responding schools had fewer of these students than the original sample schools). Using the same analytic procedure for the final sample (including replacement schools), tests of independence again showed that responding schools were more likely to be in the West. Responding schools were also more likely to have fewer Asian or Pacific Islander students and more Black, non-Hispanic students. However, the only variable found to be significant in the logistic regression model predicting response was the percentage of Asian or Pacific Islander students (again, responding schools were likely to have fewer Asian or Pacific Islander students).

While the implications of these analyses for the direction of any resulting bias achievement are not entirely clear, an attempt was made to minimize any bias by incorporating the variables in question into the adjustment for school nonresponse that was a component of the sampling weights.

One other country, the United Kingdom, also fell below the acceptable range for school response rates, although response rate problems were largely limited to England (Scotland and Northern Ireland also participated). In that case, however, the PISA Consortium was unable to make adjustments for any potential bias, and data for the United Kingdom are therefore annotated and are not included in the main text or figures. Data for one additional participating PISA 2003 country, Brazil, were not available in time for production of this report.

The other U.S. bias analysis aimed to address the question of whether there was a "session" effect between students tested in the spring and fall, in order to provide evidence for the acceptability of combining data from both sessions for the United States. Despite PISA's focus on an age sample, concern remained that students tested at the beginning of the school year might perform worse than their peers tested at the end of the previous school year.

The approach taken was to investigate session effects in a multilevel model, since these were school-level effects—all students within a school were in either the spring or the fall sessions. Two similar two-level models were estimated. In each, student achievement in PISA was modeled as a function of various school characteristics (in particular those on the sample frame known to be related to willingness to participate in the original testing window, including public/private status, number of age-eligible students, region, and location) and time of testing (spring/fall) and, in one model, the student characteristic grade level. In the simpler of the student-level models no predictors of achievement were included. In the second model, student grade level was included as a predictor of achievement to allow for the possibility that the school means predicted in the school-level model were affected by differences in the spring/fall distribution of students across grades. That is, the school-level model was predicting mean school achievement adjusted for grade-level differences. The two models proposed were estimated with HLM (Raudenbush and Bryk 2002). Neither model showed evidence of a statistically significant session effect. On this basis, and on the basis of the adjustments made to the sampling weights based on the nonresponse bias analysis, the PISA Consortium concluded that the data for the United States was adequate to generalize to the U.S. 15-year-old population and should be included in the international report and database.

Table A-1 provides summary information on the samples of all countries. A more detailed presentation can be found in the OECD's *PISA 2003 Technical Report* (Adams forthcoming).

Test Development

The development of the PISA 2003 assessment instruments was an interactive process among the PISA Consortium, various expert committees, and OECD members. The assessment was developed by international experts and PISA Consortium test developers, and items were reviewed by representatives of each country for possible bias and relevance to PISA's goals. The intention was to reflect the national, cultural, and linguistic variety among OECD countries. The assessments included material selected from among items submitted by participating countries as well as items that were developed by the Consortium's test developers.

The final assessment consisted of 85 mathematics items, 35 science items, 19 problem solving items, and 32 reading items allocated to 13 test booklets. In the United States, an additional 4 test booklets were included in PISA 2003 in order to investigate the possible effects of the use of metric units on U.S. student performance, for a total of 17 booklets (see description that follows). Each booklet was made up of 4 test clusters. There were 7 mathematics clusters (M_1 - M_7), 2 science clusters (S_1 - S_2), 2 problem solving clusters (P_1 - P_2) and 2 reading clusters (R_1 - R_2). The clusters were allocated in a rotated design to the 13 booklets. Each cluster contained approximately 12 test items, equivalent to 30 minutes of test material. Each student took one booklet, with about 2 hours worth of testing material. Approximately one-third of the mathematics literacy items were multiple choice and complex multiple choice, one-third were closed or short response types in which students wrote an answer which was simply either correct or incorrect, and about one-third were open constructed responses for which students wrote answers which were marked by trained scorers based upon an international scoring guide. In PISA 2003, every student answered mathematics items. Problem solving, science, and reading items were spread throughout other booklets. For more information on assessment design, see the OECD's *PISA 2003 Technical Report* (Adams forthcoming).

In order to examine similarities and differences between national and international assessments, NCES has sponsored a number of comparative studies of assessment frameworks and items. In October 2003 a study of the NAEP, TIMSS, and PISA 2003 mathematics assessments was undertaken. The aim of the study was to provide information that would be useful in interpreting and comparing the results from the three assessments, based on an in-depth look at the con-

Table A-1. Coverage of target population, student and school samples, and participation rates in the Program for International Student Assessment (PISA), by country: 2003

Country	Total population of 15-year-olds (number)	Percent: Coverage of 15-year-old population	Percent: Coverage of national desired population	Percent: Overall student exclusion rate
OECD countries				
Australia	268,164	87.9	97.8	2.2
Austria	94,515	90.9	98.4	1.6
Belgium	120,802	92.6	98.5	1.5
Canada	398,865	82.8	93.2	6.8
Czech Republic	130,679	92.7	98.8	1.2
Denmark	59,156	87.5	94.7	5.3
Finland	61,107	94.7	96.6	3.4
France	809,053	90.8	96.6	3.4
Germany	951,800	92.9	98.1	1.9
Greece[1]	111,286	94.5	96.8	3.2
Hungary	129,138	82.9	96.1	3.9
Iceland	4,168	94.2	97.4	2.6
Ireland	61,535	89.1	95.7	4.3
Italy	561,304	85.8	98.1	1.9
Japan	1,365,471	90.8	99.0	1.0
Korea, Republic of	606,722	87.9	99.1	0.9
Luxembourg	4,204	97.1	98.4	1.6
Mexico	2,192,452	48.9	95.7	4.3
Netherlands	194,216	95.2	98.1	1.9
New Zealand	55,440	87.7	94.9	5.1
Norway	56,060	94.2	96.6	3.4
Poland	589,506	90.7	96.1	3.9
Portugal	109,149	88.7	97.7	2.3
Slovak Republic	84,242	91.5	97.0	3.0
Spain	454,064	75.8	92.7	7.3
Sweden	109,482	97.8	95.8	4.2
Switzerland	83,247	103.9	95.6	4.4
Turkey	1,351,492	35.6	99.3	0.7
United States	3,979,116	79.1	92.7	7.3
Non-OECD countries				
Hong Kong-China	75,000	96.6	99.0	1.0
Indonesia[2]	4,281,895	46.0	99.7	0.3
Latvia	37,544	89.6	95.1	4.9
Liechtenstein	402	84.1	98.5	1.5
Macao-China	8,318	78.7	99.8	0.2
Russian Federation	2,496,216	86.3	98.3	1.7
Serbia and Montenegro[3]	98,729	69.5	94.3	5.7
Thailand	927,070	68.7	98.9	1.1
Tunisia[4]	164,758	91.6	99.6	0.4
Uruguay	53,948	62.6	99.6	0.4
United Kingdom[5]	768,180	90.9	94.6	5.4

See notes at end of table.

Table A-1. Coverage of target population, student and school samples, and participation rates in the Program for International Student Assessment (PISA), by country: 2003—Continued

Country	Percent				
	Weighted school participation rate before replacement	Weighted school participation rate after replacement	Weighted student participation rate after replacement	Number of participating schools after replacement	Number of participating students
OECD countries					
Australia	86.3	90.4	83.3	314	12,425
Austria	99.3	99.3	83.6	192	4,597
Belgium	83.4	95.6	92.5	282	8,796
Canada	80.0	84.4	83.9	1,066	27,953
Czech Republic	91.4	99.1	89.0	259	6,320
Denmark	84.6	98.3	89.9	205	4,218
Finland	97.4	100.0	92.8	197	5,796
France	88.7	89.2	88.1	163	4,300
Germany	98.1	98.8	92.2	213	4,600
Greece[1]	80.6	95.8	95.4	171	4,627
Hungary	97.3	99.4	92.9	252	4,765
Iceland	99.9	99.9	85.4	129	3,350
Ireland	90.2	92.8	82.6	143	3,880
Italy	97.5	100.0	92.5	406	11,639
Japan	87.1	95.9	95.1	144	4,707
Korea, Republic of	95.9	100.0	98.8	149	5,444
Luxembourg	99.9	99.9	96.2	29	3,923
Mexico	94.0	95.5	92.3	1,102	29,983
Netherlands	82.6	87.9	88.3	153	3,992
New Zealand	91.1	97.6	85.7	171	4,511
Norway	87.9	90.4	87.9	180	4,064
Poland	95.1	98.1	82.0	163	4,383
Portugal	99.3	99.3	87.9	152	4,608
Slovak Republic	78.9	99.1	91.9	281	7,346
Spain	98.4	100.0	90.6	383	10,791
Sweden	99.1	99.1	92.6	185	4,624
Switzerland	97.3	98.5	94.7	444	8,420
Turkey	93.3	100.0	96.9	159	4,855
United States	64.9	68.1	82.7	262	5,456
Non-OECD countries					
Hong Kong-China	81.9	95.9	90.2	145	4,478
Indonesia[2]	100.0	100.0	98.1	344	10,761
Latvia	95.3	95.3	93.9	157	4,627
Liechtenstein	100.0	100.0	98.2	12	332
Macao-China	100.0	100.0	98.0	39	1,250
Russian Federation	99.5	100.0	95.7	211	5,974
Serbia and Montenegro[3]	100.0	100.0	91.4	149	4,405
Thailand	91.5	100.0	97.8	179	5,236
Tunisia[4]	100.0	100.0	96.3	149	4,721
Uruguay	93.2	97.1	90.8	239	5,835
United Kingdom[5]	64.3	77.4	77.9	361	9,535

[1]Fifteen-year-olds in primary school in Greece were originally excluded from the assessment. Changes in the target population definition to 15-year-olds in grades 7 and above required Greece to adjust its data to reflect the fact that 15-year-olds in primary school would no longer be considered part of the target population.
[2]Indonesia excluded 4 provinces and close to 5 percent of its eligible population for security reasons. There were 4,137,103 15-year-olds in the total population, but the 4 provinces were already excluded. Therefore, the 144,792 noted as being excluded in these provinces was added to this number to get 4,281,895 15-year-olds. The number of enrolled 15-year-olds was noted as 2,968,756 so 144,792 was also added to this.
[3]Serbia and Montenegro excluded Kosovo; however, there were no estimates for the number of 15-year-olds, so this does not appear as an exclusion.
[4]Tunisia noted late in the process that one French school needed to be excluded because of French (rather than Arabic) language. The school had 33 eligible students.
[5]Due to low response rates, data for the United Kingdom are not discussed in this report.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

tent of the respective frameworks and items. The results showed that PISA used far fewer multiple choice items and had a much stronger content focus on the "data" area (which often deals with using charts and graphs), which fits with PISA's emphasis on using materials with a real-world context. For more results from the study, see *A Content Comparison of the NAEP, TIMSS, and PISA 2003 Mathematics Assessments* (Nohara forthcoming). An earlier study compared NAEP 2000, PISA 2000, and TIMSS 1999 mathematics and science items. That study found that PISA items required multistep reasoning more often than TIMSS or NAEP and that PISA mathematics and science literacy items more often involved the interpretation of charts and graphs or other "real life" material (Nohara 2001).

In addition to the cognitive assessment, students also received a 30-minute questionnaire designed to provide information about their backgrounds, attitudes, and experiences in school. Principals in schools were PISA was administered also received a 20-30 minute questionnaire about their schools. Results from the school survey are not discussed in this report but are available at http://www.pisa.oecd.org.

Translation and the Metric-Imperial Study

Source versions of all instruments (assessment booklets, questionnaires, and manuals) were prepared in English and French and translated into the primary language or languages of instruction in each nation. PISA recommended that countries prepare and consolidate independent translations from both source versions, and provided precise translation guidelines that included a description of the features each item was measuring and statistical analysis from the field trial. In cases where one source language was used, independent translations were required and discrepancies reconciled. In addition, it was sometimes necessary to adapt the instrument for cultural purposes, even in nations such as the United States that use English as the primary language of instruction. For example, words such as "lift" might be adapted to "elevator" for the United States. The PISA Consortium verified the national translation and adaptation of all instrumentation. Copies of printed materials were sent to the PISA Consortium for a final optical check prior to data collection.

As noted, in the United States, an additional 4 test booklets were included in PISA 2003 that used adapted versions of 27 mathematics items. These items in their original format used metric units of measurement, such as meters, liters, etc. To investigate the possible effects of the use of metric units on U.S. student performance, the items were adapted to use "imperial" forms with familiar units such as feet, gallons, and degrees Fahrenheit. Differential item analysis showed that U.S. students were not disadvantaged by the use of metric units in PISA 2003. The few discrepancies that were observed are possibly due to (1) differences in the nature of the two systems (e.g., decimal vs. duodecimal, or no equivalent wording of the units), and (2) difficulties in the modification process (e.g., no comparable scoring guides for some incorrect approaches to an item). For more information, see Wilson and Xie (2004).

Test Administration and Quality Assurance

PISA 2003 emphasized the use of standardized procedures in all countries. Each country collected its own data, based on comprehensive manuals and trainings provided by the PISA Consortium to explain the survey's implementation, including precise instructions for the work of school coordinators and scripts for test administrators for use in testing sessions. Test administration in the United States was carried out by professional staff trained according to the international guidelines. School staff were asked only to assist with listings of students, identifying space for testing in the school, and specifying any parental consent procedures needed for sampled students. Use of calculators was at the discretion of participating countries; in the United States, this choice was left to schools based on school, district, or state policy. Students were asked at the end of their test booklets if they had used a calculator and if so, what type. Approximately 12 percent of U.S. students did not respond. Of the responding students, 91 percent of U.S. students reported using a calculator. Students who reported using a calculator had a mean score of 498 on the combined mathematics literacy scale compared to 461 for those who reported not using a calculator.

Members of the PISA Consortium visited all national centers to review data collection procedures, and members of the PISA Consortium also visited a randomly selected subsample of approximately 10 percent of the educational institutions to ensure that procedures were being carried out in accordance with international guidelines. For a detailed description of the quality assurance procedures, see the OECD's *PISA 2003 Technical Report* (Adams forthcoming).

Scoring

At least one-third of the PISA assessment was devoted to items requiring constructed responses. The process of scoring these items was an important step in ensuring the quality and comparability of the PISA data. Detailed guidelines were developed for the scoring guides themselves, training materials to recruit scorers, and workshop materials used for the training of national scorers. Prior to the national training, the PISA Consortium organized training sessions to present the material and train the scoring coordinators from the participating countries, who trained the national scorers.

For each test item, the scoring guide described the intent of the question and how to code the students' responses to each item. This description included the credit labels—full credit, partial credit, or no credit—attached to the possible categories of response. Also included was a system of double-digit coding for some mathematics and science items where the first digit represented the score, and the second digit represented different strategies or approaches that students used to solve the problem. The second digit generated national profiles of student strategies and misconceptions. In addition, the scoring guides included real examples of students' responses accompanied by a rationale for their classification for purposes of clarity and illustration.

To examine the consistency of this marking process in more detail within each country and to estimate the magnitude of the variance components associated with the use of markers, the PISA Consortium conducted an interscorer reliability study on a subsample of assessment booklets. Homogeneity analysis was applied to the national sets of multiple scoring and compared with the results of the field trial. A full description of this process and the results can be found in the *PISA 2003 Technical Report* published by the OECD (Adams forthcoming).

Data Entry and Cleaning

Responsibility for data entry was taken by the national project manager from each nation. The data collected for PISA 2003 were entered into data files with a common international format, as specified in the *PISA 2003 Data Entry Manual*. Data entry was facilitated by the use of a common software available to all participating nations (KeyQuest). The software facilitated the checking and correction of data by providing various data consistency checks. The data were then sent to the Australian Council for

Educational Research (ACER) for cleaning. ACER's role in this instance was to check that the international data structure was followed, check the identification system within and between files, correct single case problems manually, and apply standard cleaning procedures to questionnaire files. Results of the data cleaning process were documented and shared with the national project managers and included specific questions when required. The national project manager then provided ACER with revisions to coding or solutions for anomalies. ACER then compiled background univariate statistics and preliminary classical and Rasch Item Analysis. Detailed information on the entire data entry and cleaning process can be found in the forthcoming PISA 2003 technical report.

Weighting

Students included in the final PISA sample for a given country were not all equally representative of the full student population, even though random samplings of schools and students were used to select the sample. The use of sampling weights is necessary for the computation of statistically sound, nationally representative estimates. Survey weights help adjust for intentional over- or under-sampling of certain sectors of the population, school or student nonresponse, or errors in estimating size of a school at the time of sampling. Survey weighting for PISA 2003 was carried out by Westat, as part of the PISA Consortium.

The internationally defined weighting specifications for PISA required that each assessed student's sampling weight be the product of the inverse of the school's probability of selection, an adjustment for school-level nonresponse, the inverse of the student's probability of selection, and an adjustment for student-level nonresponse. All PISA analyses were conducted using these adjusted sampling weights. The base weight for each replacement school was equal to the base weight of the original school it replaced.

Scaling and Plausible Values

PISA used Item Response Theory (IRT) methods to produce scale scores that summarized the achievement results. PISA 2003 utilized a mixed coefficients multinomial logit IRT model. This model is similar in principle to the more familiar two-parameter IRT model. With this method, the performance of a sample of students in a subject area or sub area can be summarized on a simple scale or a series of scales, even when different students are administered different items. Because of the reporting requirements for PISA and the large number of background variables associated with the assessment, PISA used these IRT procedures to produce accurate results for groups of students while limiting the testing burden on individual students. Furthermore, these procedures provided data that could be readily used in secondary analyses. IRT scaling provides estimates of item parameters (e.g., difficulty, discrimination) that define the relationship between the item and the underlying variable measured by the test. Parameters of the IRT model are estimated for each test question, with an overall scale being established as well as scales for each predefined content area specified in the assessment framework. For example, PISA 2003 had five scales describing mathematics (a combined score and subscale scores in four domains) and one each for reading, problem solving, and science.

The reading literacy and science literacy reporting scales used for PISA 2000 and PISA 2003 are directly comparable. The value of 500, for example, has the same meaning as it did in PISA 2000—that is, the mean score in 2000 of the sampled students in the 27 OECD countries that participated in PISA 2000.

This is not the case, however, for mathematics literacy. Mathematics literacy, as the major domain, was the subject of major development work for PISA 2003, and the PISA 2003 mathematics literacy assessment was much more comprehensive than the PISA 2000 mathematics assessment—the PISA 2000 assessment covered just two (*space and shape*, and *change and relationships*) of the four areas that are covered in PISA 2003. Because of this broadening in the assessment it was deemed inappropriate to report the PISA 2003 mathematics literacy scores on the same scale as the PISA 2000 mathematics scores.

The PISA 2000 and PISA 2003 assessments of mathematics, reading and science literacy are linked assessments. That is, the sets of items used to assess each of mathematics, reading and science literacy in PISA 2000 and the sets of items used to assess each of mathematics, reading and science literacy in PISA 2003 include a subset of items common to both sets. For mathematics there were 20 items that were used in both assessments, in reading there were 28 items used in both assessments and for science 25 items were used in both assessments. These common items are referred to as link items.

To establish common reporting metrics for PISA 2000 and PISA 2003 the difficulty of link items (items used in 2000 and 2003) was compared. Items were calibrated using 2003 data only, and then 2000 items were re-calibrated using the 2003 parameters. Adjustments were then made to ability estimate to account for booklet effects seen in 2000. The comparison of the item difficulties on the two occasions was used to determine a score transformation that allows the reporting of the data from the two assessments on a common scale. The change in the difficulty of each of the individual link items is used in determining the transformation and as a consequence the sample of link items that has been chosen will influence the choice of transformation. This means that if an alternative set of link items had been chosen the resulting transformation would be slightly different. The consequence is an uncertainty in the transformation due to the sampling of the link items, just as there is an uncertainty in values such as country means due to the use of a sample of students. The section on statistical testing below describes how this uncertainty has been accounted for in making comparisons over time.

Plausible Values

During the scaling phase, plausible values were used to characterize scale scores for students participating in the assessment. To keep student burden to a minimum, PISA administered few assessment items to each student—too few to produce accurate content-related scale scores for each student. To account for this, PISA generated five possible scale scores for each student that represented selections from the distribution of scale scores of students with similar backgrounds who answered the assessment items the same way. The plausible values technology is one way to ensure that the estimates of the average performance of student populations and the estimates of variability in those estimates are more accurate than those determined through traditional procedures, which estimate a single score for each student. During the construction of plausible values, careful quality control steps ensured that the subpopulation estimates based on these plausible values were accurate.

It is important to recognize that plausible values are not test scores for individuals and they should not be treated as such. Plausible values are randomly drawn from the distribution of scores that could be reasonably assigned to each individual. As such, the plausible values contain random error variance components and are not optimal as scores for individuals. The PISA student file contains many plausible values, five for each of the PISA 2003 cognitive scales (combined mathematics literacy scale, four mathematics literacy subscales, reading literacy, science literacy, and problem solving). If an analysis is to be undertaken with one of these cognitive scales, then (ideally) the analysis should be undertaken five times, once with each of the five relevant plausible value variables. The results of these five analyses are averaged and then significance tests that adjust for variation between the five sets of results are computed.

PISA uses the plausible value methodology to represent what the true performance of an individual might have been, had it been observed, using a small number of random draws from an empirically derived distribution of score values based on the student's observed responses to assessment items and on background variables. Each random draw from the distribution is considered a representative value from the distribution of potential scale scores for all students in the sample who have similar characteristics and identical patterns of item responses. The draws from the distribution are different from one another to quantify the degree of precision (the width of the spread) in the underlying distribution of possible scale scores that could have caused the observed performance. The PISA plausible values function like point estimates of scale scores for many purposes, but they are unlike true point estimates in several respects. They differ from one another for any particular student, and the amount of difference quantifies the spread in the underlying distribution of possible scale scores for that student. Because of the plausible values approach, secondary researchers can use the PISA data to carry out a wide range of analyses.

Levels

While the basic form of measurement in PISA describes student literacy in each country in terms of a range of scale scores, PISA also treats proficiency in mathematics literacy in terms of six described levels, and proficiency in problem solving in three described levels. In both cases, increasing levels represent tasks of increasing complexity. As a result, the findings are reported in terms of percentages of the population proficient at handling tasks of different levels of difficulty.

Each of the five mathematics literacy scales—the combined score and the four subscale scores—is divided into six levels based on the type of knowledge and skills students need to demonstrate at a particular level. A seventh level (below level 1) is made up of students whose abilities could not be accurately described based on their responses. Exact cut point scores are as follows: below level 1 (a score less than or equal to 357.77); level 1 (a score greater than 357.77 and less than or equal to 420.07); level 2 (a score greater than 420.07 and less than or equal to 482.38); level 3 (a score greater than 482.38 and less than or equal to 544.68); level 4 (a score greater than 544.68 and less than or equal to 606.99); level 5 (a score greater than 606.99 and less than or equal to 669.30); level 6 (a score greater than 669.30. The tasks that represent each level of performance for the specific mathematics processes on the combined mathematics literacy scale are described in exhibit 5. Exhibit A-1 describes the kind of tasks that represent each level of performance on the mathematics subscales.

The problem-solving scale is divided into three levels based on the type of knowledge and skills students must demonstrate at a particular level. A fourth level (below level 1) is made up of students whose abilities could not be accurately described based on their responses. In order to reach a particular

Exhibit A-1. Description of proficiency levels for mathematics literacy subscales: 2003

Proficiency level	Task descriptions: Space and shape	Task descriptions: Quantity
Level 1 Level 2	Students at Level 1 or 2 can work with a single mathematical representation where the mathematical content is direct and clearly presented, use mathematical thinking in familiar contexts, identify geometric patterns, and apply basic geometric concepts.	Students at Level 1 or 2 can interpret simple tables, carry out basic arithmetic calculations, work with simple quantitative models, interpret a simple quantitative model (e.g., a proportional relationship), and apply the model using basic arithmetic calculations.
Level 3	Students at Level 3 can begin to use visual and spatial reasoning, begin linking different representations, use elementary problem solving (devising simple strategies), apply simple algorithms, and interpret textual descriptions of unfamiliar geometric situations.	Students at Level 3 can use simple problem solving strategies, interpret tables to locate information, carry out well-described calculations, interpret a text description of a sequential calculation process, correctly implement the process, and use basic problem-solving procedures.
Level 4	Students at Level 4 can use more advanced and flexible reasoning, link and integrate different representations, use multi-step processes, use well-developed spatial visualization and interpretation, and use reasoning about numeric relationships in geometric problems.	Students at Level 4 can work effectively with simple models of complex situations, use reasoning skills, insight and interpretation with different representations, use a variety of calculation skills to solve problems, and accurately apply a given numeric algorithm involving a number.
Level 5	Students at Level 5 have the ability to make or work with assumptions, use insight, interpretation and linking of different representations, and can carry out multiple and sequential processes. They can also use well-developed spatial reasoning.	Students at Level 5 have the ability to work effectively with increasingly complex situations and models and have well-developed reasoning skills. They can also use insight and interpretation of different representations and carry out multiple sequential problems.
Level 6	Students at Level 6 can manipulate complex and multiple representations, link different information, use significant insight and reflection, make generalizations, communicate the solution and explanation of a problem in unstructured form, and interpret complex textual descriptions and relate these to other problems.	Students at Level 6 can conceptualize and work with complex mathematical processes and relationships, use advanced thinking and reasoning skills to link multiple contexts, use sequential calculation processes, and conceptualize complex mathematical processes.

See notes at end of exhibit.

Exhibit A-1. Description of proficiency levels for mathematics literacy subscales: 2003—Continued

	Task descriptions	
Proficiency level	Change and relationships	Uncertainty
Level 1 Level 2	Students at Level 1 or 2 can work with simple algorithms, formula, and procedures, link text with single representations, begin to interpret and use elementary reasoning, and interpret text to produce a simple mathematical model in an applied context.	Students at Level 1 or 2 can understand and use basic probabilistic ideas in familiar experimental contexts, locate statistical information presented in familiar graphical form, and understand basic probability concepts in the context of a simple and familiar experiment.
Level 3	Students at Level 3 can work with related representations (text, graph, table and simple algebra) including some interpretation and reasoning, interpret unfamiliar graphical representations of real-world situations, and link and connect multiple related representations.	Students at Level 3 can interpret information and data, link different information sources, use basic reasoning with simple probability concepts, interpret tabular information, use insight into aspects of data presentation, and link data to suitable chart types.
Level 4	Students at Level 4 can understand and work with multiple representations, including explicitly mathematical models of real-world situations, carry out a sequence of calculations involving percentage or proportion, and show insight into three-dimensional geometric problems.	Students at Level 4 can use basic statistical and probability concepts combined with logical reasoning in less familiar contexts, use argumentation based on interpretation of data, interpret text, including in an unfamiliar (scientific) context, and translate text description into mathematics problems.
Level 5	Students at Level 5 have quite advanced use of algebraic and other formal mathematical expressions and models and have the ability to link formal mathematical representations to complex real-world situations. They can also solve complex and multi-step problems.	Students at Level 5 can apply statistical knowledge in situations that are somewhat structured and where the mathematical representation is partially apparent and use reasoning and insight to interpret given information.
Level 6	Students at Level 6 can use significant insight, well-developed reasoning skills and explicit technical knowledge to solve problems and to begin to generalize mathematical solutions to complex real-world problems and can interpret complex mathematical information in the context of a problem.	Students at Level 6 can use high-level thinking and reasoning skills in statistical or probabilistic contexts to create mathematical representations of real-world situations, use insight, reflection and argumentation to communicate arguments and explanations, and interpret and reflect.

NOTE: In order to reach a particular proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into mathematics literacy levels according to their scores. Exact cut point scores are as follows: below level 1 (*a score less than or equal to 357.77*); level 1 (*a score greater than 357.77 and less than or equal to 420.07*); level 2 (*a score greater than 420.07 and less than or equal to 482.38*); level 3 (*a score greater than 482.38 and less than or equal to 544.68*); level 4 (*a score greater than 544.68 and less than or equal to 606.99*); level 5 (a *score greater than 606.99 and less than or equal to 669.3*); level 6 (*a score greater than 669.3*).
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into problem-solving levels according to their scores. Exact cut point scores are as follows: below level 1 (a score less than or equal to 404.06); level 1 (a score greater than 404.06 and less than or equal to 498.08); level 2 (a score greater than 498.08 and less than or equal to 592.10); level 3 (a score greater than 592.10).

All students within a level are expected to answer at least half of the items from that level correctly. Students at the bottom of a level have a 62 percent chance of success on the easiest items from that level and a 42 percent chance of success on the hardest items from that level (overall response probability was 62). Students at the top of a level are able to provide the correct answers to about 70 percent of all items from that level, have a 62 percent chance of success on the hardest items from that level, and have a 78 percent chance of success on the easiest items from that level. Students just below the top of a level would score less than 50 percent on an assessment of the next higher level. Students at a particular level not only demonstrate the knowledge and skills associated with that level but also the proficiencies defined by lower levels. Thus, all students proficient at level 3 are also proficient at levels 1 and 2. Patterns of responses for students below level 1 suggest they are unable to answer at least half of the items in level 1 correctly.

Data Limitations

As with any study, there are limitations to PISA 2003 that researchers should take into consideration. Estimates produced using data from PISA 2003 are subject to two types of error, nonsampling and sampling errors. Nonsampling errors can be due to errors made in the collection and processing of data. Sampling errors can occur because the data were collected from a sample rather than a complete census of the population.

Nonsampling Errors

Nonsampling error is a term used to describe variations in the estimates that may be caused by population coverage limitations, nonresponse bias, and measurement error, as well as data collection, processing, and reporting procedures. For example, the sampling frame was limited to regular public and private schools in the 50 states and the District of Columbia. The sources of nonsampling errors are typically problems like unit and item nonresponse, the differences in respondents' interpretations of the meaning of the questions, response differences related to the particular time the survey was conducted, and mistakes in data preparation. Some of these issues (particularly unit nonresponse) are discussed above in the section on U.S. sampling and data collection.

Missing Data

There are four kinds of missing data. "Nonresponse" data occurs when a respondent was expected to answer an item but no response is given. Responses that are "missing or invalid" occur in multiple-choice items where an invalid response is given. The code is not used for open-ended questions. An item is "not applicable" when it is not possible for the respondent to answer the question. Finally, items that are "not reached" are consecutive missing values starting from the end of each test session. All four kinds of missing data are coded differently in the PISA 2003 database.

Missing background data are not included in the analyses for this report and are not imputed. In general, item response rates for variables discussed in this report were over the NCES standard of 85 percent to report without notation (table A-2). The one case in which more than 15 percent of the student responses were missing (for New Zealand for student report of parent occupation, with an item response rate of 84 percent) is flagged in the supporting statistical data tables in appendix B.

In general, it is difficult to identify and estimate either the amount of nonsampling error or the bias caused by this error. In PISA 2003, efforts were made to prevent such errors from occurring and to compensate for them when possible. For example, the design phase entailed a field test that evaluated items as well as the implementation procedures for the survey. It should also be recognized that most background information was obtained from students' self-reports, which are subject to respondent bias. One potential source of respondent bias in this survey was social desirability bias, for example, if students reported that they were good at mathematics.

Sampling Errors

Sampling errors occur when the discrepancy between a population characteristic and the sample estimate arises because not all members of the reference population are sampled for the survey. The size of the sample relative to the population and the variability of the population characteristics both influence the magnitude of sampling error. The particular sample of 15-year-old students from the 2002–03 school year was just one of many possible samples that could have been selected. Therefore, estimates produced from the PISA 2003 sample may differ from estimates that would have been produced had another sample of 15-year-old students been drawn. This type of variability was called sampling error because it arises from using a sample of 15-year-old students in 2002, rather than all 15-year-old students in that year.

The standard error is a measure of the variability due to sampling when estimating a statistic. The approach used for calculating sampling variances in PISA was the Balanced Repeated Replication (BRR), or Balanced Half-Samples (Fay's method). Standard errors can be used as a measure for the precision expected from a particular sample.

Standard errors for all of the estimates are included in appendix B to this report. These standard errors can be used to produce confidence intervals. There is a 95 percent chance that the true average lies within the range of 1.96 times the standard errors above or below the estimated score. For example, it was estimated that 15.5 percent of U.S. students scored at level 1 on the combined mathematics literacy scale, and this statistic had a standard error of 0.81. Therefore, it can be stated with 95 percent confidence that the actual percentage of U.S. students at level 1 for the total population in 2003 was between 13.9 and 17.1 percent (1.96 x 0.81 = 1.59; confidence interval = 15.5 +/- 1.59).

Descriptions of Background Variables

Full PISA 2003 student and school questionnaires are available at http://nces.ed.gov/surveys/pisa or http://www.pisa.oecd.org.

Socioeconomic Status

The measure of student socioeconomic status used in PISA 2003 is based on the occupational status of the student's father and/or mother (whichever is higher) as reported by the student. Parental occupation was coded to 4 digits based on the International Standard Classification of Occupations (ISCO). Occupational codes were in turn mapped onto an internationally comparable index of occupational status, the International Socioeconomic Index (ISEI), developed by Ganzeboom, De Graaf, and Treiman (1992). Using the index, students were assigned numbers ranging from about 16 to 90 based on their parents' occupations, so that they were arrayed on a continuum from low to high socioeconomic status, rather than placed into discrete categories. The range of ISEI scores given for the 1988 ISCO occupations listed in Ganzeboom and Treiman (1996) goes from 16, the lowest (agricultural laborer), to 90, the highest (judge). Typical occupations among

Table A-2. Response rates of 15-year-old students for selected background variables, by country: 2003

Country	Selected background variable: Sex	Socioeconomic status (ISEI)	Race/ ethnicity	Type of mathematics class
OECD countries				
Australia	100	95	†	†
Austria	100	96	†	†
Belgium	100	94	†	†
Canada	97	93	†	†
Czech Republic	100	96	†	†
Denmark	100	97	†	†
Finland	100	99	†	†
France	100	96	†	†
Germany	99	91	†	†
Greece	100	94	†	†
Hungary	100	94	†	†
Iceland	100	98	†	†
Ireland	100	96	†	†
Italy	100	98	†	†
Japan	100	89	†	†
Korea, Republic of	100	98	†	†
Luxembourg	100	96	†	†
Mexico	100	95	†	†
Netherlands	100	93	†	†
New Zealand	100	84	†	†
Norway	100	97	†	†
Poland	100	98	†	†
Portugal	100	97	†	†
Slovak Republic	100	96	†	†
Spain	100	96	†	†
Sweden	100	97	†	†
Switzerland	100	97	†	†
Turkey	100	88	†	†
United States	100	94	97	95
Non-OECD countries				
Hong Kong-China	100	96	†	†
Indonesia	100	91	†	†
Latvia	100	97	†	†
Liechtenstein	100	97	†	†
Macao-China	100	97	†	†
Russian Federation	100	98	†	†
Serbia and Montenegro	100	94	†	†
Thailand	100	95	†	†
Tunisia	100	95	†	†
Uruguay	100	90	†	†
United Kingdom[1]	100	94	†	†

† Not applicable.

[1]Due to low response rates, data for the United Kingdom are not discussed in this report.

NOTE: Cases where more than 15 percent of the student responses are missing are flagged in the supporting statistical data tables in appendix B. For more information about the variables, see the Description of Variables section in appendix B. The overall percentage refers to the sample estimate for the overall 15-year-old student population. The International Socioeconomic Index (ISEI) is an internationally comparable index of occupational status, with a range of approximately 16 to 90, developed by Ganzeboom, De Graaf, and Treiman (1992).

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

parents of 15-year-olds with between 16 and 35 points on the ISEI scale include small-scale farmer, metalworker, mechanic, taxi or truck driver, and waiter/waitress. Between 35 and 53 index points, the most common occupations are bookkeeping, sales, small business management, and nursing. As the required skills increase, so does the status of the occupation. Between 54 and 70 points, typical occupations are marketing management, teaching, civil engineering, and accountant. Finally, between 71 and 90 points, the top international quarter of the index, occupations include medicine, university teaching, and law (OECD 2001).

Race/Ethnicity

In the United States, students' race/ethnicity was obtained through student responses to a two-part question. Students were asked first whether they were Hispanic or Latino, and then asked whether they were members of the following racial groups: American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, or White. Multiple responses to the race classification question were allowed. Results are shown separately for Asians, Blacks, Hispanics, Whites, and students who selected more than one race. Students identifying themselves as Hispanic and also other races were included in the Hispanic group, rather than in a racial group.

Confidentiality and Disclosure Limitations

The PISA 2003 data are hierarchical and include school data and student data from the participating schools. Confidentiality analyses for the United States were designed to provide reasonable assurance that public use data files issued by the PISA Consortium would not allow identification of individual U.S. schools or students when compared against public data collections. Disclosure limitation included the identification and masking of potential disclosure-risk PISA schools and adding an additional measure of uncertainty of school and student identification through random swapping of data elements within the student and school files.

Statistical Procedures

Tests of Significance

Comparisons made in the text of this report have been tested for statistical significance. For example, in the commonly made comparison of country averages against the average of the United States, tests of statistical significance were used to establish whether or not the observed differences from the U.S. average were statistically significant.

The estimation of the standard errors that are required in order to undertake the tests of significance is complicated by the complex sample and assessment designs which both generate error variance. Together they mandate a set of statistically complex procedures in order to estimate the correct standard errors. As a consequence, the estimated standard errors contain a sampling variance component estimated by Balanced Repeated Replication (BRR)—the Fay method of BRR; and, where the assessments are concerned, there is an additional imputation variance component arising from the assessment design. Details on the BRR procedures used can be found in the *WesVar 4.0 User's Guide* (Westat 2000).

In almost all instances, the tests for significance used were standard t tests. These fell into two categories according to the nature of the comparison being made: comparisons of independent and non-independent samples. In PISA, country samples are independent. To determine whether the average scores for two countries are different we test the null hypothesis:

$$H_0 : \hat{\mu}_{(country1)} - \hat{\mu}_{(country2)} = 0$$

To test this hypothesis, the two observed values and their respective standard errors are needed to perform a *t* test. The standard error on the estimate for some statistic θ is:

$$\sigma_{(\hat{\theta}_i - \hat{\theta}_j)} = \sqrt{\sigma^2_{(\hat{\theta}_i)} + \sigma^2_{(\hat{\theta}_j)}}$$

Thus, in simple comparisons of independent averages, such as the average score of country 1 with that of country 2, the following formula was used to compute the t-statistic:

$$t = est_1 - est_2 / SQRT[(se_1)^2 + (se_2)^2]$$

where est_1 and est_2 are the estimates being compared (e.g., averages of country 1 and country 2) and se_1 and se_2 are the corresponding standard errors of these averages.

This test may also be used for comparisons within a particular country if the categorical variable used to define the groups being compared was used as an explicit stratification variable; however, there was no explicit stratification used in the United States sample.

The second type of comparison used in this report occurred when comparing differences of non-subset, non-independent groups. When this occurs, the correlation and related covariance between the groups must be taken into account, such as when comparing a country mean with the OECD mean which includes that particular country, or when comparing the average scores of males versus females within the United States.

How are scores like those for $\hat{\mu}_{(boys)}$ and $\hat{\mu}_{(girls)}$ correlated? Suppose that in the school sample, a coeducational school attended by low achievers is replaced by a coeducational school attended by high achievers. The country mean will increase slightly, as well as the males' and the females' means. If such a school replacement process is continued, $\hat{\mu}_{(boys)}$ and $\hat{\mu}_{(girls)}$ will likely increase in a similar pattern. Indeed, a coeducational school attended by high achieving males is usually also attended by high achieving females. Therefore, the covariance between $\hat{\mu}_{(boys)}$ and $\hat{\mu}_{(girls)}$ will be positive.

What does the covariance between the two variables, i.e., $\hat{\mu}_{(boys)}$, $\hat{\mu}_{(girls)}$, tell us? A positive covariance means that if $\hat{\mu}_{(boys)}$ increases then $\hat{\mu}_{(girls)}$ will also increase. A covariance equal or close to 0 means that $\hat{\mu}_{(boys)}$ can increase or decrease with $\hat{\mu}_{(girls)}$ remaining unchanged. Finally, a negative covariance means that if $\hat{\mu}_{(boys)}$ increases, then $\hat{\mu}_{(girls)}$ will decrease, and inversely.

Next, to determine whether the females' performance differs from the males' performance, for example, as for all statistical analyses, a null hypothesis has to be tested. In this particular example, it will consist of computing the difference between the males' performance mean and the females' performance mean (or the inverse). The null hypothesis will be:

$$H_0 : \hat{\mu}_{(boys)} - \hat{\mu}_{(girls)} = 0.$$

The variance of the observed difference is needed to test this null hypothesis. The variance of a difference is equal to the sum of the variances of the two initial variables minus two times the covariance between the two initial variables. A sampling distribution has the same characteristics as any distribution, except that units consist of sample estimates and not observations. Therefore, the sampling variance of a difference is equal to the sum of the two initial sampling variances minus two times the covariance between the two sampling distributions on the estimates.

$$\sigma^2_{(\hat{\mu}_X - \hat{\mu}_Y)} = \sigma^2_{(\hat{\mu}_X)} + \sigma^2_{(\hat{\mu}_Y)} - 2cov(\hat{\mu}_X, \hat{\mu}_Y)$$

The estimation of the covariance between, for instance, $\hat{\mu}_{(boys)}$ and $\hat{\mu}_{(girls)}$ requires the selection of several samples and then the analysis of the variation of $\hat{\mu}_{(boys)}$ in conjunction with $\hat{\mu}_{(girls)}$. Such a procedure is, of course, unrealistic. Therefore, as for any computation of a standard error in PISA, replication methods using the supplied replicate weights are used to estimate the standard error on a difference. Use of the replicate weights implicitly incorporates the covariance between the two estimates into the estimate of the standard error on the difference.

To test such comparisons, the following formula was used to compute the t statistic:

$$t = \text{est}_{grp1} - \text{est}_{grp2} / \text{se}(\text{est}_{grp1} - \text{est}_{grp2})$$

Est_{grp1} and est_{grp2} are the non-independent groups estimates being compared;
se ($\text{est}_{grp1} - \text{est}_{grp2}$) is the standard error of the difference calculated using Balanced Repeated Replication (BRR) to account for any covariance between the estimates for the two non-independent groups.

A third type of comparison (addition of a standard error term to the standard *t* test shown above for simple comparisons of independent averages) was also used when analyzing change in performance over time. The uncertainty that results from the link item sampling (described in the scaling section above) is referred to as linking error and this error must be taken into account when making certain comparisons between PISA 2000 and PISA 2003 results. Just as with the error that is introduced through the process of sampling students, the exact magnitude of this linking error cannot be determined. We can, however, estimate the likely range of magnitudes for this error and take this error into account when interpreting PISA results. As with sampling errors, the likely range of magnitude for the errors is represented as a standard error. The standard error of linking for reading is 3.74, the standard error of linking for science is 3.02, and the standard error for mathematics (*space and shape* scale) is 6.01 and mathematics (*change and relationships* scale) is 4.84.

In PISA, in each of the three subject matter areas, a common transformation was estimated from the link items, and this transformation was applied to all participating countries. It follows that any uncertainty that was introduced through the linking is common to all students and all countries. Thus, for example, suppose the *unknown* linking error (between PISA 2000 and PISA 2003) in reading literacy resulted in an over-estimation of student scores by two points on the PISA 2000 scale. It follows that every student's score will be over-estimated by two score points. This over-estimation will have effects on certain, but not all, summary statistics computed from the PISA 2003 data. For example, consider the following:

- each country's mean will be over-estimated by an amount equal to the link error, (in our example this is two score points);
- the mean performance of any subgroup will be over-estimated by an amount equal to the link error (in our example this is two score points);
- the standard deviation of student scores will not be affected because the over-estimation of each student by a common error does not change the standard deviation;
- the difference between the mean scores of two countries in PISA 2003 will not be influenced because the over-estimation of each student by a common error will have distorted each country's mean by the same amount;
- the difference between the mean scores of two groups (e.g., males and females) in PISA 2003 will not be influenced, because the over-estimation of each student by a common error will have distorted each group's mean by the same amount;

- the difference between the performance of a group of students (e.g., a country) between PISA 2000 and PISA 2003 will be influenced because each student's score in PISA 2003 will be influenced by the error; and
- a change in the difference in performance between two groups from PISA 2000 to PISA 2003 will not be influenced. This is because neither of the components of this comparison, which are differences in scores in 2000 and 2003 respectively, is influenced by a common error that is added to all student scores in PISA 2003.

In general terms, the linking error need only be considered when comparisons are being made between PISA 2000 and PISA 2003 results, and then usually only when group means are being compared. Because the linking error need only be used in a limited range of situations we have chosen not to report the linking error in the tables included in this report. The general formula is given by:

$t = est_1 - est_2 / SQRT[(se_1)^2 + (se_2)^2 + (se_{linking})^2]$

The most obvious example of a situation where there is a need to use linking error is in the comparison of the mean performance for a country between PISA 2000 and PISA 2003. For example, let us consider a comparison between 2000 and 2003 of the performance of Italy in reading. The mean performance of Italy in 2000 was 487 with a standard error of 2.9, while in 2003 the mean was 476 with a standard error of 3.0. The standardized difference in the Italian mean is 1.97, which is computed as follows:

$$1.97 = (487 - 476) \Big/ \sqrt{2.9^2 + 3.0^2 + 3.7^2}$$

and is statistically significant.

In the U.S. report on PISA 2000, a Bonferroni adjustment was used in all multiple comparisons of countries. This was not the case in 2003, which may result in some differences in how 2000 results are reported in 2003. This may also result in some differences between the PISA 2003 U.S. and OECD reports (which uses a Bonferroni adjustment for multiple comparisons of country averages). The discontinuation of the use of the Bonferroni adjustment for multiple comparisons was made in order to avoid the possibility that comparisons of achievement between countries could be interpreted differently depending on the numbers of countries compared.

Appendix B: Reference Tables

Table B-1. Percentage distribution of 15-year-old students, by grade and country: 2003

Country	7th		8th		9th		10th	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**0.5**	**0.04**	**4.7**	**0.11**	**35.9**	**0.25**	**52.7**	**0.26**
OECD countries								
Australia	#	†	‡	†	8.3	0.40	72.3	0.70
Austria	‡	†	5.1	0.91	43.1	1.47	51.3	1.55
Belgium	‡	†	3.7	0.34	29.5	0.67	65.2	0.64
Canada	0.6	0.15	2.5	0.26	13.7	0.46	82.0	0.58
Czech Republic	‡	†	2.8	0.34	44.7	1.14	52.4	1.14
Denmark	‡	†	9.1	0.58	86.9	0.85	3.8	0.65
Finland	‡	†	12.4	0.51	87.3	0.51	#	†
France	‡	†	5.4	0.57	34.9	1.17	57.3	1.11
Germany	1.7	0.27	15.0	0.79	59.8	0.74	23.2	0.57
Greece	‡	†	2.1	0.37	6.6	0.99	76.1	1.41
Hungary	1.1	0.21	5.0	0.47	65.1	0.71	28.8	0.62
Iceland	#	†	#	†	#	†	100.0	†
Ireland	#	†	2.8	0.32	60.9	1.31	16.7	1.35
Italy	‡	†	1.4	0.36	14.2	0.60	80.0	0.82
Japan	#	†	#	†	#	†	100.0	†
Korea, Republic of	#	†	#	†	1.6	0.23	98.3	0.23
Luxembourg	#	†	14.9	0.22	55.8	0.25	29.3	0.18
Mexico	3.6	0.49	11.0	0.96	40.8	2.38	43.7	2.81
Netherlands	‡	†	4.4	0.56	45.6	1.14	49.3	1.31
New Zealand	#	†	‡	†	6.8	0.48	89.2	0.51
Norway	#	†	#	†	‡	†	98.7	0.25
Poland	0.7	0.16	3.1	0.32	95.7	0.42	‡	†
Portugal	4.2	0.64	10.6	0.90	20.3	1.62	64.3	2.39
Slovak Republic	0.6	0.22	0.9	0.23	37.1	1.56	60.9	1.54
Spain	#	†	3.2	0.36	27.0	0.85	69.7	1.01
Sweden	#	†	2.4	0.21	93.0	0.97	4.6	0.93
Switzerland	0.7	0.16	16.9	1.01	62.7	2.06	19.3	2.50
Turkey	‡	†	4.4	1.60	3.2	0.67	52.1	2.18
United States	‡	†	2.4	0.61	29.7	1.42	60.6	1.35
Non-OECD countries								
Hong Kong-China	5.1	0.37	10.7	0.80	25.7	0.95	58.4	0.98
Indonesia	2.4	0.35	12.7	0.80	48.8	1.69	34.5	1.91
Latvia	1.0	0.16	16.1	0.86	73.1	2.08	5.9	0.56
Liechtenstein	‡	†	20.4	1.00	71.3	0.94	‡	†
Macao-China	12.3	0.50	25.9	0.72	36.8	0.74	24.7	0.60
Russian Federation	‡	†	2.6	0.34	28.7	1.92	67.2	2.18
Serbia and Montenegro	#	†	#	†	97.6	0.35	2.4	0.35
Thailand	‡	†	1.1	0.39	44.1	1.20	53.3	1.24
Tunisia	15.4	0.55	22.0	0.70	25.1	0.86	34.5	1.38
Uruguay	5.7	0.62	9.7	0.84	18.2	1.23	59.4	1.74
United Kingdom[1]	#	†	#	†	#	†	33.8	1.10

See notes at end of table.

Table B-1. Percentage distribution of 15-year-old students, by grade and country: 2003—Continued

Country	11th		12th		Grade not reported	
	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**6.0**	**0.13**	**0.1**	**0.00**	**#**	**†**
OECD countries						
Australia	19.2	0.67	‡	†	#	†
Austria	#	†	#	†	‡	†
Belgium	0.8	0.09	#	†	‡	†
Canada	1.2	0.12	#	†	#	†
Czech Republic	#	†	#	†	#	†
Denmark	#	†	#	†	#	†
Finland	#	†	#	†	#	†
France	2.2	0.30	#	†	#	†
Germany	‡	†	#	†	‡	†
Greece	15.0	0.90	#	†	#	†
Hungary	#	†	#	†	#	†
Iceland	#	†	#	†	#	†
Ireland	19.6	1.36	#	†	#	†
Italy	4.3	0.48	#	†	#	†
Japan	#	†	#	†	#	†
Korea, Republic of	0.1	†	#	†	#	†
Luxembourg	‡	†	#	†	#	†
Mexico	0.9	0.49	#	†	#	†
Netherlands	‡	†	#	†	#	†
New Zealand	3.7	0.24	#	†	‡	†
Norway	‡	†	#	†	#	†
Poland	#	†	#	†	#	†
Portugal	0.6	†	#	†	#	†
Slovak Republic	0.5	0.22	#	†	#	†
Spain	#	†	#	†	#	†
Sweden	#	†	#	†	#	†
Switzerland	0.2	†	#	†	‡	†
Turkey	39.2	2.37	‡	†	#	†
United States	7.0	0.89	#	†	#	†
Non-OECD countries						
Hong Kong-China	‡	†	#	†	#	†
Indonesia	1.6	0.21	‡	†	#	†
Latvia	‡	†	#	†	3.7	2.49
Liechtenstein	#	†	#	†	#	†
Macao-China	‡	†	#	†	#	†
Russian Federation	1.1	0.18	#	†	#	†
Se						

Table B-2. Percentage distribution and average combined mathematics literacy scores of U.S. 15-year-old students, by type of mathematics class: 2003

Type of class	Percent	s.e.	Average	s.e
Pre-algebra or general mathematics	8.7	0.80	419.5	4.97
Algebra I	28.6	1.01	442.1	3.28
Geometry	31.1	1.18	498.4	3.47
Algebra II	20.7	1.01	537.2	3.67
Precalculus or calculus	3.1	0.39	595.6	7.53
Other	7.7	0.68	482.8	8.57

NOTE: Type of class refers to the mathematics class in which the student was enrolled at time of the assessment. Detail may not sum to totals because of rounding. s.e. means standard error.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-3. Average mathematics literacy scores and subscale scores of 15-year-old students, by country: 2003

Country	Combined mathematics literacy		Mathematics subscales: Space and shape		Change and relationships		Quantity		Uncertainty	
	Average	s.e.	Average	s.e.	Average	s.e.	Average	s.e.	Average	s.e.
OECD average	**500.0**	**0.63**	**496.3**	**0.65**	**498.8**	**0.70**	**500.7**	**0.63**	**502.0**	**0.61**
OECD countries										
Australia	524.3	2.15	520.6	2.33	525.3	2.30	516.9	2.06	530.9	2.21
Austria	505.6	3.27	515.2	3.48	499.8	3.60	513.2	3.00	493.8	3.13
Belgium	529.3	2.29	529.6	2.26	535.3	2.45	529.6	2.31	525.7	2.21
Canada	532.5	1.82	517.8	1.81	536.7	1.93	528.1	1.85	541.6	1.83
Czech Republic	516.5	3.55	527.4	4.12	514.8	3.50	528.0	3.54	500.3	3.11
Denmark	514.3	2.74	512.4	2.76	509.3	2.99	515.6	2.64	515.6	2.78
Finland	544.3	1.87	539.0	2.04	543.1	2.19	548.5	1.83	544.8	2.09
France	510.8	2.50	507.6	2.98	519.7	2.62	506.9	2.49	506.1	2.39
Germany	503.0	3.32	499.6	3.28	507.2	3.73	513.8	3.37	492.5	3.29
Greece	444.9	3.90	437.1	3.80	435.6	4.31	445.9	3.97	458.4	3.53
Hungary	490.0	2.84	479.1	3.34	494.6	3.10	496.3	2.72	489.0	2.63
Iceland	515.1	1.42	503.5	1.46	509.5	1.43	513.3	1.50	527.8	1.50
Ireland	502.8	2.45	476.2	2.43	506.0	2.45	501.7	2.48	517.2	2.65
Italy	465.6	3.08	470.3	3.14	452.1	3.21	474.8	3.38	462.6	3.03
Japan	534.1	4.02	553.2	4.31	536.1	4.33	526.6	3.79	527.9	3.88
Korea, Republic of	542.2	3.24	551.7	3.80	547.6	3.52	537.2	2.97	538.3	3.03
Luxembourg	493.2	0.97	488.2	1.35	487.0	1.15	501.5	1.06	492.1	1.06
Mexico	385.2	3.64	381.7	3.20	364.1	4.14	393.8	3.94	389.8	3.26
Netherlands	537.8	3.13	526.1	2.87	551.4	3.12	528.3	3.09	549.3	2.99
New Zealand	523.5	2.26	524.9	2.34	525.7	2.37	511.1	2.22	532.2	2.30
Norway	495.2	2.38	482.7	2.54	487.7	2.64	494.2	2.22	512.8	2.59
Poland	490.2	2.50	490.3	2.66	484.3	2.70	491.8	2.47	493.5	2.35
Portugal	466.0	3.40	450.2	3.43	467.9	3.95	465.4	3.51	470.6	3.41
Slovak Republic	498.2	3.35	505.4	4.01	494.4	3.48	512.5	3.43	475.8	3.21
Spain	485.1	2.41	476.5	2.59	480.7	2.80	492.3	2.53	489.0	2.42
Sweden	509.0	2.56	498.3	2.56	505.1	2.94	513.6	2.49	510.8	2.72
Switzerland	526.6	3.38	539.5	3.50	522.7	3.65	532.6	3.08	516.5	3.28
Turkey	423.4	6.74	417.4	6.35	422.8	7.57	413.2	6.78	442.6	6.21
United States	482.9	2.95	472.0	2.78	485.5	3.03	476.4	3.18	491.5	2.97
Non-OECD countries										
Hong Kong-China	550.4	4.54	558.4	4.85	539.7	4.68	545.2	4.19	558.3	4.56
Indonesia	360.2	3.91	360.8	3.70	333.9	4.58	357.5	4.28	384.5	2.86
Latvia	483.4	3.69	486.4	4.04	487.2	4.36	481.7	3.60	473.8	3.28
Liechtenstein	535.8	4.12	538.2	4.58	539.5	3.67	533.5	4.12	523.4	3.68
Macao-China	527.3	2.89	527.9	3.29	518.8	3.53	533.0	2.99	531.6	3.21
Russian Federation	468.4	4.20	474.3	4.69	476.8	4.64	472.4	4.04	436.5	4.02
Serbia and Montenegro	436.9	3.75	432.5	3.91	419.0	3.97	456.3	3.79	427.9	3.49
Thailand	417.0	3.00	423.9	3.35	405.0	3.39	414.8	3.15	422.7	2.53
Tunisia	358.7	2.54	358.9	2.56	336.6	2.78	364.4	2.79	363.3	2.30
Uruguay	422.2	3.29	412.0	2.98	417.0	3.60	429.7	3.22	418.6	3.11
United Kingdom[1]	508.3	2.43	496.0	2.50	512.9	2.54	498.5	2.52	520.1	2.41

[1]Due to low response rates, data for the United Kingdom are not discussed in this report.
NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-4. Combined mathematics literacy scores of 15-year-old students, by percentiles and country: 2003

Country	5th percentile		10th percentile		25th percentile		50th percentile	
	Score	s.e.	Score	s.e.	Score	s.e.	Score	s.e.
OECD average	**331.7**	**1.30**	**369.0**	**1.11**	**432.4**	**0.93**	**501.1**	**0.26**
OECD countries								
Australia	364.3	4.44	398.6	3.43	459.8	2.75	527.5	0.68
Austria	353.4	6.64	384.4	4.44	439.4	4.02	506.2	0.91
Belgium	333.8	6.53	380.7	4.61	456.2	3.44	537.1	1.48
Canada	386.2	3.05	419.3	2.54	473.9	2.19	534.0	0.62
Czech Republic	358.0	6.25	391.7	5.72	449.4	4.55	516.8	1.46
Denmark	360.7	4.39	395.8	4.53	453.2	3.67	516.1	1.54
Finland	406.4	3.83	438.0	2.77	488.2	2.21	543.7	0.88
France	352.3	5.96	388.7	5.56	449.1	3.74	514.2	0.86
Germany	324.0	6.08	363.0	5.65	432.2	4.66	509.2	0.97
Greece	287.6	5.39	323.5	5.13	382.4	4.57	446.1	21.6
Hungary	335.3	5.62	369.6	4.23	426.1	3.01	490.0	0.94
Iceland	362.4	4.05	396.1	2.74	454.2	2.81	518.2	1.30
Ireland	360.4	4.68	393.1	3.21	445.0	3.38	503.5	0.72
Italy	307.2	6.39	342.4	5.86	400.5	4.34	466.1	1.11
Japan	360.9	8.24	401.7	6.26	467.2	5.37	539.5	1.66
Korea, Republic of	387.8	4.61	422.8	4.46	479.3	3.74	544.1	1.69
Luxembourg	338.5	3.87	372.7	2.69	430.2	2.15	495.2	0.52
Mexico	247.1	5.39	276.1	4.70	326.6	4.32	384.7	1.14
Netherlands	385.2	6.86	415.4	5.84	470.9	5.44	539.6	1.51
New Zealand	358.5	4.07	394.3	3.89	455.2	2.91	525.3	1.38
Norway	343.5	3.96	375.9	3.42	432.9	2.87	495.3	1.30
Poland	343.4	5.78	376.0	3.62	428.2	3.13	489.7	1.18
Portugal	320.9	6.26	351.9	5.25	406.0	4.96	467.2	2.40
Slovak Republic	342.4	6.91	378.5	5.81	435.6	4.57	498.3	1.28
Spain	335.0	5.13	368.6	3.54	426.2	2.98	487.1	1.12
Sweden	352.7	5.29	387.1	4.38	446.1	3.02	509.6	1.69
Switzerland	358.7	4.80	395.7	4.16	460.8	3.57	529.7	0.97
Turkey	269.7	5.76	300.2	5.01	350.8	5.26	414.5	1.75
United States	323.0	4.88	356.5	4.55	418.0	3.69	483.5	1.36
Non-OECD countries								
Hong Kong-China	373.8	11.05	417.0	8.02	484.8	6.91	559.5	1.49
Indonesia	233.2	5.22	260.5	4.81	306.0	3.49	356.9	2.06
Latvia	339.2	5.90	370.8	5.14	423.5	3.90	484.1	1.19
Liechtenstein	361.9	19.68	408.0	9.77	469.9	7.58	539.2	6.71
Macao-China	382.3	8.76	414.5	5.97	467.2	4.41	529.0	1.66
Russian Federation	318.5	5.46	350.8	4.96	405.8	4.83	467.1	1.29
Serbia and Montenegro	298.9	4.37	328.6	4.47	378.6	3.96	436.6	2.56
Thailand	289.9	3.95	316.3	3.10	360.5	2.92	411.9	1.96
Tunisia	228.6	3.80	256.3	3.51	303.0	2.55	355.5	0.77
Uruguay	255.3	4.30	291.3	3.80	353.3	4.07	425.0	1.71
United Kingdom[1]	356.1	4.92	387.8	4.05	444.1	3.18	509.8	0.99

See notes at end of table.

Table B-4. Combined mathematics literacy scores of 15-year-old students, by percentiles and country: 2003—Continued

Country	75th percentile		90th percentile		95th percentile	
	Score	s.e.	Score	s.e.	Score	s.e.
OECD average	**570.5**	**0.70**	**628.3**	**0.74**	**660.2**	**0.95**
OECD countries						
Australia	591.6	2.50	644.7	3.04	675.7	3.53
Austria	571.4	4.18	626.2	3.96	658.2	4.96
Belgium	611.2	2.49	664.4	2.35	693.4	2.38
Canada	593.3	2.13	644.2	2.58	672.7	3.39
Czech Republic	584.4	3.98	641.0	4.35	671.9	4.89
Denmark	578.2	3.14	631.5	3.65	662.0	4.73
Finland	602.6	2.32	651.7	2.83	680.2	3.13
France	575.2	3.01	627.7	3.58	656.2	3.46
Germany	578.3	3.48	632.3	3.50	661.7	3.64
Greece	507.9	4.28	565.9	5.25	597.8	5.10
Hungary	555.9	3.90	610.7	4.71	643.8	4.59
Iceland	578.4	1.95	629.2	3.02	657.9	3.77
Ireland	561.9	3.01	613.9	3.59	641.0	3.30
Italy	530.2	3.01	589.1	3.63	623.2	3.74
Japan	605.1	4.36	659.6	6.14	690.2	6.58
Korea, Republic of	606.1	4.22	659.2	5.37	690.2	6.83
Luxembourg	557.2	1.91	611.4	3.20	641.4	2.72
Mexico	443.6	4.46	497.1	4.69	526.9	5.65
Netherlands	608.3	3.84	656.5	3.21	683.5	3.43
New Zealand	593.0	2.21	650.0	3.20	682.3	2.91
Norway	560.0	3.32	613.6	3.56	644.7	3.92
Poland	552.8	2.87	607.4	3.34	639.9	3.50
Portugal	526.1	3.52	579.9	3.29	609.9	3.72
Slovak Republic	564.6	3.78	619.1	3.49	648.4	4.07
Spain	546.4	3.12	597.4	3.50	626.0	3.70
Sweden	575.6	3.19	630.5	3.82	661.9	4.80
Switzerland	595.0	4.89	652.1	5.23	684.0	6.84
Turkey	484.9	8.53	559.7	14.23	613.6	22.75
United States	549.7	3.36	607.4	3.87	638.0	5.14
Non-OECD countries						
Hong Kong-China	621.8	3.74	671.8	4.10	699.5	3.97
Indonesia	411.5	4.77	465.8	6.50	498.8	7.69
Latvia	543.5	4.72	596.4	4.43	626.3	4.97
Liechtenstein	608.6	7.91	655.3	9.53	686.4	16.38
Macao-China	587.3	4.01	639.1	5.48	668.4	8.28
Russian Federation	530.1	4.95	588.1	5.28	622.4	6.10
Serbia and Montenegro	493.1	4.78	546.4	5.05	579.2	5.29
Thailand	469.3	3.75	526.0	4.70	560.0	6.43
Tunisia	411.6	3.59	465.8	4.78	501.4	6.80
Uruguay	490.7	3.77	550.0	4.36	583.4	4.67
United Kingdom[1]	572.6	3.18	628.7	3.55	659.3	4.79

[1]Due to low response rates, data for the United Kingdom are not discussed in this report.
NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-5. Standard deviations of 15-year-old students' combined mathematics literacy scores, by country: 2003

Country	Standard deviation	s.e.
OECD average	**100.0**	**0.41**
OECD countries		
Australia	95.4	1.50
Austria	93.1	1.67
Belgium	109.9	1.78
Canada	87.1	0.97
Czech Republic	95.9	1.87
Denmark	91.3	1.44
Finland	83.7	1.08
France	91.7	1.80
Germany	102.6	1.77
Greece	93.8	1.76
Hungary	93.5	1.96
Iceland	90.4	1.21
Ireland	85.3	1.26
Italy	95.7	1.87
Japan	100.5	2.75
Korea, Republic of	92.4	2.14
Luxembourg	91.9	0.95
Mexico	85.4	1.85
Netherlands	92.5	2.33
New Zealand	98.3	1.17
Norway	92.0	1.15
Poland	90.2	1.34
Portugal	87.6	1.66
Slovak Republic	93.3	2.32
Spain	88.5	1.26
Sweden	94.7	1.79
Switzerland	98.4	2.05
Turkey	104.7	5.34
United States	95.2	1.29
Non-OECD countries		
Hong Kong-China	100.2	3.01
Indonesia	80.5	2.06
Latvia	87.9	1.66
Liechtenstein	99.1	4.43
Macao-China	86.9	2.41
Russian Federation	92.3	1.93
Serbia and Montenegro	84.7	1.55
Thailand	82.0	1.79
Tunisia	82.0	1.95
Uruguay	99.7	1.60
United Kingdom[1]	92.3	1.35

[1]Due to low response rates, data for the United Kingdom are not discussed in this report.
NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-6. Percentage distribution of 15-year-old students scoring at each proficiency level on the combined mathematics literacy scale, by country: 2003

Country	Below level 1		Level 1		Level 2		Level 3	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	8.2	**0.17**	13.2	**0.16**	21.1	**0.15**	23.7	**0.18**
OECD countries								
Australia	4.3	0.45	10.0	0.51	18.6	0.62	24.0	0.71
Austria	5.6	0.70	13.2	0.84	21.6	0.90	24.9	1.14
Belgium	7.2	0.56	9.3	0.49	15.9	0.65	20.1	0.71
Canada	2.4	0.26	7.7	0.36	18.3	0.61	26.2	0.67
Czech Republic	5.0	0.69	11.6	0.90	20.1	0.96	24.3	0.95
Denmark	4.7	0.50	10.7	0.62	20.6	0.89	26.2	0.88
Finland	1.5	0.23	5.3	0.38	16.0	0.57	27.7	0.65
France	5.6	0.68	11.0	0.77	20.2	0.82	25.9	0.99
Germany	9.2	0.84	12.4	0.81	19.0	1.05	22.6	0.82
Greece	17.8	1.21	21.2	1.15	26.3	1.04	20.2	1.01
Hungary	7.8	0.80	15.2	0.81	23.8	1.05	24.3	0.93
Iceland	4.5	0.40	10.5	0.55	20.2	1.02	26.1	0.88
Ireland	4.7	0.57	12.1	0.84	23.6	0.83	28.0	0.82
Italy	13.2	1.19	18.7	0.93	24.7	1.03	22.9	0.84
Japan	4.7	0.65	8.6	0.72	16.3	0.80	22.4	1.02
Korea, Republic of	2.5	0.32	7.1	0.65	16.6	0.80	24.1	0.98
Luxembourg	7.4	0.41	14.3	0.65	22.9	0.87	25.9	0.79
Mexico	38.1	1.71	27.9	1.02	20.8	0.87	10.1	0.84
Netherlands	2.6	0.65	8.4	0.95	18.0	1.11	23.0	1.14
New Zealand	4.9	0.44	10.1	0.63	19.2	0.71	23.2	0.90
Norway	6.9	0.50	13.9	0.82	23.7	1.16	25.2	1.01
Poland	6.8	0.61	15.2	0.76	24.8	0.75	25.3	0.94
Portugal	11.3	1.11	18.8	0.99	27.1	0.99	24.0	1.03
Slovak Republic	6.7	0.85	13.2	0.86	23.5	0.88	24.9	1.08
Spain	8.1	0.66	14.9	0.87	24.7	0.78	26.7	1.02
Sweden	5.6	0.52	11.7	0.60	21.7	0.84	25.5	0.95
Switzerland	4.9	0.45	9.6	0.57	17.5	0.80	24.3	0.98
Turkey	27.7	2.01	24.6	1.33	22.1	1.12	13.5	1.27
United States	10.2	0.80	15.5	0.81	23.9	0.80	23.8	0.79
Non-OECD countries								
Hong Kong-China	3.9	0.72	6.5	0.64	13.9	1.00	20.0	1.25
Indonesia	50.5	2.08	27.6	1.05	14.8	1.07	5.5	0.71
Latvia	7.6	0.86	16.1	1.08	25.5	1.17	26.3	1.15
Liechtenstein	4.8	1.33	7.5	1.66	17.3	2.78	21.6	2.54
Macao-China	2.3	0.60	8.8	1.34	19.6	1.40	26.8	1.77
Russian Federation	11.4	1.03	18.8	1.09	26.4	1.13	23.1	1.02
Serbia and Montenegro	17.6	1.35	24.5	1.08	28.6	1.16	18.9	1.11
Thailand	23.8	1.28	30.2	1.25	25.4	1.12	13.7	0.85
Tunisia	51.1	1.37	26.9	0.95	14.7	0.75	5.7	0.61
Uruguay	26.3	1.30	21.8	0.80	24.2	0.89	16.8	0.68
United Kingdom[1]	5.2	0.54	12.5	0.67	21.2	1.20	25.6	0.88

See notes at end of table.

Table B-6. Percentage distribution of 15-year-old students scoring at each proficiency level on the combined mathematics literacy scale, by country: 2003—Continued

Country	Level 4		Level 5		Level 6	
	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**19.1**	**0.17**	**10.6**	**0.13**	**4.0**	**0.10**
OECD countries						
Australia	23.3	0.64	14.0	0.53	5.8	0.45
Austria	20.5	0.84	10.5	0.85	3.7	0.52
Belgium	21.0	0.62	17.5	0.69	9.0	0.48
Canada	25.1	0.60	14.8	0.55	5.5	0.45
Czech Republic	20.8	0.87	12.9	0.80	5.3	0.53
Denmark	21.9	0.83	11.8	0.86	4.1	0.50
Finland	26.1	0.89	16.7	0.64	6.7	0.46
France	22.1	0.97	11.6	0.72	3.5	0.40
Germany	20.6	1.02	12.2	0.87	4.1	0.48
Greece	10.6	0.87	3.4	0.53	0.6	0.17
Hungary	18.2	0.90	8.2	0.73	2.5	0.42
Iceland	23.2	0.81	11.7	0.61	3.7	0.36
Ireland	20.2	1.06	9.1	0.76	2.2	0.33
Italy	13.4	0.73	5.5	0.43	1.5	0.19
Japan	23.6	1.24	16.1	0.96	8.2	1.14
Korea, Republic of	25.0	1.08	16.7	0.81	8.1	0.93
Luxembourg	18.7	0.85	8.5	0.59	2.4	0.31
Mexico	2.7	0.39	0.4	0.10	#	†
Netherlands	22.6	1.34	18.2	1.09	7.3	0.58
New Zealand	21.9	0.80	14.1	0.60	6.6	0.44
Norway	18.9	1.00	8.7	0.57	2.7	0.35
Poland	17.7	0.89	7.8	0.49	2.3	0.31
Portugal	13.4	0.94	4.6	0.47	0.8	0.16
Slovak Republic	18.9	0.82	9.8	0.68	2.9	0.38
Spain	17.7	0.65	6.5	0.62	1.4	0.25
Sweden	19.8	0.81	11.6	0.57	4.1	0.49
Switzerland	22.5	0.72	14.2	1.05	7.0	0.90
Turkey	6.8	1.05	3.1	0.82	2.4	1.02
United States	16.6	0.73	8.0	0.53	2.0	0.36
Non-OECD countries						
Hong Kong-China	25.0	1.17	20.2	1.00	10.5	0.94
Indonesia	1.4	0.39	0.2	0.09	#	†
Latvia	16.6	1.17	6.3	0.70	1.6	0.36
Liechtenstein	23.2	3.09	18.3	3.22	7.3	1.73
Macao-China	23.7	1.71	13.8	1.55	4.8	0.96
Russian Federation	13.2	0.92	5.4	0.58	1.6	0.38
Serbia and Montenegro	8.1	0.88	2.1	0.41	0.2	0.10
Thailand	5.3	0.53	1.5	0.31	0.2	0.10
Tunisia	1.4	0.30	0.2	0.12	#	†
Uruguay	8.2	0.65	2.3	0.33	0.5	0.17
United Kingdom[1]	20.6	0.73	11.0	0.73	3.9	0.43

† Not applicable.
# Rounds to zero.
[1]Due to low response rates, data for the United Kingdom are not discussed in this report.
NOTE: In order to reach a particular proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into mathematics literacy levels according to their scores. Exact cut point scores are as follows: below level 1 (*a score less than or equal to 357.77*); level 1 (*a score greater than 357.77 and less than or equal to 420.07*); level 2 (*a score greater than 420.07 and less than or equal to 482.38*); level 3 (*a score greater than 482.38 and less than or equal to 544.68*); level 4 (*a score greater than 544.68 and less than or equal to 606.99*); level 5 (*a score greater than 606.99 and less than or equal to 669.3*); level 6 (*a score greater than 669.3*). The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error. Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-7. Percentage distribution of 15-year-old students scoring at each proficiency level on the mathematics literacy quantity subscale, by country: 2003

Country	Below level 1		Level 1		Level 2		Level 3	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**8.8**	**0.18**	**12.5**	**0.15**	**20.1**	**0.15**	**23.7**	**0.21**
OECD countries								
Australia	5.5	0.44	11.0	0.47	19.0	0.76	24.3	0.90
Austria	3.7	0.49	11.2	0.88	20.9	1.00	27.2	1.06
Belgium	7.2	0.57	8.9	0.53	15.1	0.52	20.6	0.62
Canada	3.8	0.29	8.8	0.37	18.1	0.64	25.2	0.64
Czech Republic	4.7	0.72	9.7	0.86	17.2	0.89	23.5	0.95
Denmark	4.7	0.59	10.4	0.58	19.9	0.79	26.3	0.90
Finland	1.4	0.21	5.0	0.53	14.6	0.66	26.9	0.69
France	6.7	0.74	11.1	0.82	20.4	0.98	25.4	1.15
Germany	8.5	0.70	10.4	0.83	17.5	0.90	22.0	1.08
Greece	19.0	1.21	19.8	0.88	25.1	0.89	20.0	0.92
Hungary	7.8	0.73	13.5	0.84	21.6	0.90	25.2	0.89
Iceland	6.2	0.43	10.9	0.63	19.1	1.09	24.3	1.00
Ireland	5.6	0.57	12.3	0.85	23.0	1.00	26.9	1.06
Italy	13.7	1.06	16.1	0.74	22.0	0.76	22.4	0.82
Japan	5.7	0.73	9.2	0.78	16.6	0.81	23.1	1.12
Korea, Republic of	2.6	0.31	7.2	0.70	17.0	0.84	25.2	0.84
Luxembourg	6.5	0.44	12.4	0.78	21.8	0.99	26.2	1.35
Mexico	35.5	1.80	25.0	1.23	21.4	1.12	12.4	0.77
Netherlands	4.1	0.71	10.1	0.96	18.3	1.22	23.0	1.22
New Zealand	6.4	0.55	11.9	0.70	20.1	0.71	23.6	0.78
Norway	7.7	0.54	13.8	0.74	22.8	0.93	25.4	1.06
Poland	7.1	0.68	13.5	0.70	24.2	0.96	27.1	0.87
Portugal	12.9	1.22	18.3	1.06	25.2	0.80	23.4	1.22
Slovak Republic	5.6	0.75	10.6	0.77	20.0	0.80	26.1	0.89
Spain	8.9	0.66	13.2	0.88	22.5	0.78	25.0	0.66
Sweden	4.4	0.45	10.3	0.60	21.4	0.81	27.3	1.00
Switzerland	4.2	0.38	8.6	0.60	16.0	0.81	24.2	1.03
Turkey	32.1	2.07	23.1	1.03	20.2	1.07	12.6	1.06
United States	13.7	1.00	15.6	0.76	22.0	0.70	21.9	0.78
Non-OECD countries								
Hong Kong-China	4.1	0.70	7.0	0.67	13.7	1.24	21.5	1.33
Indonesia	51.5	1.92	24.7	0.93	14.9	1.03	6.1	0.64
Latvia	7.4	0.87	15.5	1.20	26.4	1.13	27.7	1.21
Liechtenstein	4.0	1.37	7.6	1.36	16.5	2.88	24.1	2.90
Macao-China	2.4	0.62	8.1	1.29	17.8	1.37	25.8	1.71
Russian Federation	11.1	1.05	16.8	1.01	25.8	0.87	24.6	1.03
Serbia and Montenegro	13.6	1.11	20.6	1.15	27.1	1.15	22.1	1.13
Thailand	27.7	1.39	26.4	1.21	23.3	0.91	13.7	0.84
Tunisia	49.0	1.31	25.2	0.99	16.1	0.91	7.0	0.59
Uruguay	25.6	1.11	19.5	0.82	22.1	0.81	18.1	1.17
United Kingdom[1]	8.3	0.64	13.7	0.67	20.7	0.96	24.2	0.68

See notes at end of table.

Table B-7. Percentage distribution of 15-year-old students scoring at each proficiency level on the mathematics literacy quantity subscale, by country: 2003—Continued

Country	Level 4		Level 5		Level 6	
	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**19.9**	**0.17**	**11.0**	**0.11**	**4.0**	**0.09**
OECD countries						
Australia	22.4	0.64	12.5	0.57	5.2	0.37
Austria	23.1	0.99	11.2	0.81	2.8	0.45
Belgium	22.3	0.59	17.5	0.61	8.5	0.45
Canada	23.7	0.52	14.4	0.52	6.0	0.35
Czech Republic	23.1	0.89	15.0	0.74	6.7	0.62
Denmark	22.7	0.89	12.0	0.71	4.0	0.42
Finland	27.3	0.89	17.9	0.65	7.0	0.44
France	21.9	0.84	11.0	0.71	3.5	0.34
Germany	22.0	1.20	14.1	0.98	5.5	0.43
Greece	11.0	0.80	4.1	0.56	1.0	0.29
Hungary	19.7	0.80	9.7	0.67	2.5	0.31
Iceland	22.5	0.83	12.7	0.68	4.2	0.52
Ireland	20.6	0.84	9.5	0.62	2.2	0.36
Italy	15.2	0.82	7.7	0.49	2.8	0.27
Japan	23.6	1.03	15.1	0.84	6.7	0.85
Korea, Republic of	26.0	0.98	15.6	0.86	6.4	0.79
Luxembourg	21.0	0.82	9.4	0.59	2.7	0.29
Mexico	4.6	0.48	1.0	0.21	0.1	0.06
Netherlands	21.9	1.11	15.9	1.03	6.7	0.58
New Zealand	21.2	0.76	11.9	0.61	5.0	0.33
Norway	18.8	0.91	8.9	0.58	2.6	0.31
Poland	18.7	0.82	7.6	0.62	1.8	0.28
Portugal	13.8	0.78	5.2	0.42	1.2	0.22
Slovak Republic	21.9	0.83	12.3	0.76	3.6	0.44
Spain	18.8	0.77	8.8	0.60	2.6	0.25
Sweden	21.6	0.87	11.1	0.77	3.9	0.56
Switzerland	24.6	0.80	15.7	0.95	6.7	0.88
Turkey	6.5	1.01	3.2	0.71	2.3	0.92
United States	16.0	0.67	8.1	0.67	2.8	0.36
Non-OECD countries						
Hong Kong-China	25.8	1.21	18.7	0.95	9.2	0.71
Indonesia	2.1	0.49	0.6	0.19	0.1	0.05
Latvia	16.3	1.12	5.5	0.59	1.2	0.27
Liechtenstein	24.8	2.63	17.1	2.44	6.0	1.49
Macao-China	25.3	1.76	15.6	1.50	5.1	1.06
Russian Federation	14.8	0.99	5.6	0.64	1.4	0.27
Serbia and Montenegro	12.3	0.99	3.7	0.60	0.7	0.18
Thailand	6.3	0.56	2.0	0.38	0.6	0.20
Tunisia	2.2	0.36	0.4	0.17	0.1	0.05
Uruguay	10.0	0.71	3.7	0.40	0.9	0.16
United Kingdom[1]	19.2	0.73	10.1	0.80	3.8	0.47

[1]Due to low response rates, data for the United Kingdom are not discussed in this report.

NOTE: In order to reach a particular proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into mathematics literacy levels according to their scores. Exact cut point scores are as follows: below level 1 (*a score less than or equal to 357.77*); level 1 (*a score greater than 357.77 and less than or equal to 420.07*); level 2 (*a score greater than 420.07 and less than or equal to 482.38*); level 3 (*a score greater than 482.38 and less than or equal to 544.68*); level 4 (*a score greater than 544.68 and less than or equal to 606.99*); level 5 (*a score greater than 606.99 and less than or equal to 669.3*); level 6 (*a score greater than 669.3*). The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error. Detail may not sum to totals because of rounding.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-8. Percentage distribution of 15-year-old students scoring at each proficiency level on the mathematics literacy space and shape subscale, by country: 2003

Country	Below level 1		Level 1		Level 2		Level 3	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**10.6**	**0.19**	**14.2**	**0.16**	**20.4**	**0.14**	**21.5**	**0.16**
OECD countries								
Australia	6.1	0.50	10.8	0.59	18.4	0.52	23.0	0.66
Austria	8.0	0.74	12.0	0.79	18.6	0.82	21.4	0.74
Belgium	6.6	0.53	10.4	0.48	16.7	0.51	20.3	0.70
Canada	4.7	0.36	10.7	0.57	20.4	0.61	25.0	0.51
Czech Republic	8.1	0.88	10.6	0.71	17.0	0.72	19.3	0.71
Denmark	7.1	0.65	11.2	0.74	19.5	0.74	23.8	0.80
Finland	2.5	0.31	7.3	0.47	17.0	0.67	25.5	0.83
France	7.7	0.77	12.0	0.66	19.6	0.85	23.4	1.07
Germany	11.1	0.77	13.3	0.95	18.6	0.86	21.2	0.94
Greece	21.3	1.17	21.7	1.05	24.4	1.02	18.7	0.95
Hungary	13.1	0.99	17.3	0.80	21.8	0.76	20.5	0.72
Iceland	6.5	0.61	12.1	0.66	21.6	0.76	26.0	1.09
Ireland	10.7	0.78	16.9	1.15	25.4	0.87	23.0	1.02
Italy	15.1	0.99	16.8	0.85	22.0	0.66	21.1	0.70
Japan	4.2	0.65	7.4	0.75	13.9	0.70	20.0	0.84
Korea, Republic of	4.8	0.54	8.4	0.57	14.7	0.90	19.7	0.92
Luxembourg	9.5	0.48	15.6	0.62	23.0	0.85	22.6	1.12
Mexico	39.1	1.59	27.8	0.77	20.6	0.95	9.4	0.71
Netherlands	3.7	0.65	10.1	0.78	18.6	1.07	24.9	1.16
New Zealand	5.8	0.50	10.8	0.66	18.1	0.84	21.8	0.77
Norway	11.5	0.65	16.1	0.63	22.2	0.92	22.3	0.79
Poland	10.7	0.81	14.9	0.70	22.0	0.93	22.1	0.88
Portugal	16.4	1.37	21.5	0.78	26.0	0.96	20.2	0.97
Slovak Republic	10.2	0.92	13.4	0.80	19.0	0.83	20.2	0.80
Spain	10.1	0.76	16.7	0.84	25.5	0.77	24.7	0.83
Sweden	7.9	0.63	13.4	0.62	22.1	0.84	24.2	1.02
Switzerland	5.4	0.52	8.6	0.50	15.7	0.85	21.4	0.94
Turkey	28.6	1.87	26.0	1.15	22.3	1.18	12.7	1.11
United States	12.1	0.84	18.2	1.05	24.7	1.09	22.0	0.95
Non-OECD countries								
Hong Kong-China	4.1	0.65	7.0	0.91	13.2	1.20	18.7	0.94
Indonesia	49.7	1.74	25.9	1.22	15.5	1.00	6.6	0.67
Latvia	10.7	0.93	15.1	0.99	22.4	0.92	23.3	1.14
Liechtenstein	5.7	1.37	8.1	1.69	14.9	2.79	21.5	3.52
Macao-China	4.0	0.71	9.8	1.48	17.6	2.03	24.5	2.01
Russian Federation	14.9	1.03	16.5	0.79	21.9	0.88	20.4	0.84
Serbia and Montenegro	21.8	1.33	24.4	1.04	24.5	0.77	16.9	0.97
Thailand	23.4	1.20	26.8	0.95	24.7	1.13	15.4	0.91
Tunisia	49.7	1.28	26.0	1.09	15.5	0.66	6.3	0.51
Uruguay	29.3	1.15	23.3	0.86	22.9	0.94	15.2	0.79
United Kingdom[1]	8.6	0.64	14.1	0.98	21.4	0.78	24.3	0.82

See notes at end of table.

Table B-8. Percentage distribution of 15-year-old students scoring at each proficiency level on the mathematics literacy space and shape subscale, by country: 2003—Continued

Country	Level 4		Level 5		Level 6	
	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**17.2**	**0.15**	**10.4**	**0.11**	**5.8**	**0.10**
OECD countries						
Australia	21.2	0.75	13.2	0.56	7.3	0.55
Austria	19.1	0.88	12.3	0.87	8.5	0.74
Belgium	20.0	0.90	15.7	0.76	10.2	0.47
Canada	21.4	0.49	12.1	0.46	5.6	0.40
Czech Republic	18.9	0.76	14.4	0.80	11.7	0.79
Denmark	20.0	0.74	12.5	0.69	5.9	0.49
Finland	24.6	0.80	15.2	0.59	7.9	0.60
France	20.0	0.84	12.0	0.79	5.1	0.51
Germany	18.4	0.82	11.4	0.71	6.0	0.44
Greece	9.6	0.75	3.6	0.50	0.8	0.26
Hungary	14.8	0.89	8.0	0.74	4.5	0.56
Iceland	20.5	0.76	10.0	0.63	3.3	0.37
Ireland	15.4	0.77	6.8	0.64	1.8	0.24
Italy	14.5	0.61	7.2	0.46	3.3	0.28
Japan	21.9	1.00	18.2	0.94	14.3	1.20
Korea, Republic of	19.9	1.00	16.5	0.82	16.0	1.27
Luxembourg	17.1	0.73	8.5	0.76	3.6	0.37
Mexico	2.5	0.37	0.5	0.13	#	†
Netherlands	21.9	1.10	14.6	0.84	6.2	0.56
New Zealand	20.7	0.90	14.4	0.74	8.5	0.49
Norway	16.4	0.73	8.2	0.51	3.3	0.33
Poland	16.4	0.69	8.8	0.53	5.0	0.52
Portugal	10.9	0.75	4.1	0.44	0.9	0.20
Slovak Republic	17.4	0.84	11.6	0.65	8.2	0.66
Spain	15.3	0.75	6.0	0.48	1.6	0.27
Sweden	18.2	0.79	10.0	0.57	4.2	0.41
Switzerland	21.4	0.89	15.9	0.73	11.7	1.09
Turkey	5.8	1.01	2.5	0.68	2.1	0.94
United States	14.2	0.71	6.5	0.51	2.3	0.33
Non-OECD countries						
Hong Kong-China	21.5	1.15	19.9	0.95	15.6	1.05
Indonesia	1.8	0.38	0.4	0.14	0.1	0.05
Latvia	16.8	0.93	8.2	0.71	3.5	0.51
Liechtenstein	23.2	4.21	16.5	2.59	10.1	1.78
Macao-China	23.2	1.75	13.7	1.27	7.2	0.92
Russian Federation	14.2	0.86	7.7	0.74	4.3	0.63
Serbia and Montenegro	8.6	0.92	2.8	0.46	0.9	0.22
Thailand	7.0	0.62	2.2	0.37	0.5	0.18
Tunisia	2.1	0.37	0.5	0.14	#	†
Uruguay	6.7	0.50	2.2	0.41	0.4	0.14
United Kingdom[1]	17.9	0.61	9.7	0.65	3.9	0.40

† Not applicable.
# Rounds to zero.
[1]Due to low response rates, data for the United Kingdom are not discussed in this report.
NOTE: In order to reach a particular proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into mathematics literacy levels according to their scores. Exact cut point scores are as follows: below level 1 (*a score less than or equal to 357.77*); level 1 (*a score greater than 357.77 and less than or equal to 420.07*); level 2 (*a score greater than 420.07 and less than or equal to 482.38*); level 3 (*a score greater than 482.38 and less than or equal to 544.68*); level 4 (*a score greater than 544.68 and less than or equal to 606.99*); level 5 (*a score greater than 606.99 and less than or equal to 669.3*); level 6 (*a score greater than 669.3*). The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error. Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-9. Percentage distribution of 15-year-old students scoring at each proficiency level on the mathematics literacy change and relationships subscale, by country: 2003

Country	Below level 1		Level 1		Level 2		Level 3	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**10.2**	**0.19**	**13.0**	**0.15**	**19.8**	**0.14**	**22.0**	**0.19**
OECD countries								
Australia	4.8	0.44	9.5	0.53	18.5	0.59	23.8	0.75
Austria	8.6	0.84	14.1	0.95	20.5	0.94	22.5	1.10
Belgium	7.6	0.60	9.7	0.59	14.8	0.63	18.2	0.74
Canada	2.9	0.25	7.6	0.36	17.2	0.57	24.9	0.54
Czech Republic	5.7	0.74	11.8	0.96	20.8	0.88	23.5	0.82
Denmark	6.3	0.61	11.9	0.82	20.4	1.06	24.5	0.85
Finland	2.7	0.32	7.0	0.56	16.1	0.71	24.5	0.94
France	6.4	0.76	9.5	0.71	18.2	0.68	23.9	0.91
Germany	9.5	0.87	12.6	0.74	18.5	0.90	20.6	0.76
Greece	23.3	1.36	19.9	0.94	22.9	0.83	18.0	0.89
Hungary	8.4	0.81	14.5	0.72	22.0	1.16	23.5	0.98
Iceland	6.3	0.44	12.0	0.60	20.2	0.77	24.4	0.79
Ireland	5.1	0.51	11.2	0.86	22.6	0.84	27.0	1.07
Italy	18.2	1.25	19.2	0.84	23.7	0.78	20.4	0.86
Japan	6.4	0.73	8.5	0.72	15.7	0.78	20.6	0.85
Korea, Republic of	3.0	0.40	7.0	0.74	15.7	0.97	22.3	0.93
Luxembourg	10.7	0.60	15.3	0.91	21.5	1.07	22.5	0.88
Mexico	47.2	1.74	24.1	0.85	17.0	0.88	8.6	0.81
Netherlands	1.4	0.37	7.2	0.82	16.4	1.22	22.7	1.13
New Zealand	5.6	0.60	10.2	0.87	17.5	0.69	22.5	0.98
Norway	9.5	0.70	15.1	0.70	22.8	1.05	23.9	0.78
Poland	10.1	0.78	16.1	0.71	23.6	0.81	23.0	0.91
Portugal	13.6	1.28	17.5	1.04	23.8	0.93	22.5	1.05
Slovak Republic	9.7	0.91	14.3	0.86	21.0	0.92	22.4	0.92
Spain	11.3	0.67	14.9	0.96	22.9	0.71	24.0	0.93
Sweden	9.4	0.64	12.6	0.64	19.6	0.87	21.7	0.87
Switzerland	7.6	0.57	10.1	0.58	17.3	1.05	21.3	0.99
Turkey	30.0	2.04	21.1	1.06	20.1	1.16	13.9	1.23
United States	10.4	0.84	14.4	0.65	22.6	0.78	24.3	0.71
Non-OECD countries								
Hong Kong-China	5.6	0.85	8.0	0.78	14.5	1.08	20.6	1.01
Indonesia	59.6	1.78	20.2	0.82	12.3	0.81	5.4	0.63
Latvia	10.6	0.98	14.7	1.08	22.2	1.29	23.5	1.24
Liechtenstein	4.6	1.13	10.0	1.89	15.1	2.43	20.7	3.01
Macao-China	5.2	1.13	12.2	1.32	18.2	1.52	23.4	1.84
Russian Federation	11.8	1.14	16.2	0.86	23.7	1.02	23.5	0.89
Serbia and Montenegro	26.5	1.60	24.1	1.13	23.5	0.93	15.7	0.92
Thailand	31.9	1.61	26.4	1.29	22.0	0.90	12.1	0.84
Tunisia	58.8	1.19	20.4	0.70	12.9	0.67	5.8	0.44
Uruguay	29.8	1.31	19.1	0.79	21.6	1.10	16.5	1.03
United Kingdom[1]	5.7	0.57	11.2	0.85	20.3	0.89	24.6	0.85

See notes at end of table.

Table B-9. Percentage distribution of 15-year-old students scoring at each proficiency level on the mathematics literacy change and relationships subscale, by country: 2003—Continued

Country	Level 4		Level 5		Level 6	
	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**18.5**	**0.20**	**11.1**	**0.13**	**5.3**	**0.11**
OECD countries						
Australia	22.9	0.65	14.0	0.65	6.5	0.57
Austria	18.8	1.03	10.9	0.81	4.6	0.49
Belgium	19.7	0.71	17.5	0.86	12.4	0.52
Canada	24.4	0.56	15.6	0.58	7.3	0.44
Czech Republic	19.4	0.83	12.5	0.71	6.4	0.61
Denmark	20.7	0.84	11.4	0.78	4.6	0.48
Finland	24.1	0.80	16.7	0.66	8.9	0.53
France	22.2	0.81	14.2	0.69	5.6	0.47
Germany	19.6	0.86	13.2	0.76	6.1	0.52
Greece	10.8	0.95	4.0	0.46	1.1	0.19
Hungary	18.4	0.83	9.6	0.74	3.6	0.42
Iceland	21.0	0.80	11.9	0.67	4.2	0.41
Ireland	21.6	0.85	10.2	0.63	2.3	0.35
Italy	11.8	0.84	5.2	0.42	1.5	0.19
Japan	21.1	1.10	16.4	0.79	11.3	1.18
Korea, Republic of	23.6	0.99	17.5	0.91	10.9	1.07
Luxembourg	18.1	1.00	8.5	0.61	3.4	0.36
Mexico	2.6	0.39	0.4	0.13	0.1	0.03
Netherlands	21.8	1.14	19.2	0.89	11.3	0.71
New Zealand	22.2	0.79	14.0	0.68	7.9	0.46
Norway	17.4	0.89	8.3	0.61	2.9	0.39
Poland	16.1	0.84	7.9	0.59	3.3	0.33
Portugal	15.1	0.91	5.8	0.47	1.7	0.25
Slovak Republic	18.1	0.96	10.1	0.74	4.4	0.46
Spain	17.1	0.62	7.7	0.54	2.0	0.24
Sweden	18.3	0.84	11.6	0.53	6.7	0.63
Switzerland	20.9	0.76	13.9	0.82	8.8	0.91
Turkey	7.9	1.15	3.8	0.80	3.2	1.17
United States	17.7	0.82	8.4	0.62	2.2	0.31
Non-OECD countries						
Hong Kong-China	23.0	1.00	18.6	0.98	9.8	0.89
Indonesia	1.9	0.38	0.6	0.19	0.1	0.08
Latvia	17.6	1.16	8.2	0.73	3.2	0.50
Liechtenstein	20.5	3.39	18.6	2.26	10.5	1.65
Macao-China	21.6	1.81	13.8	1.17	5.7	0.97
Russian Federation	15.3	1.09	6.9	0.68	2.6	0.41
Serbia and Montenegro	7.2	0.68	2.5	0.40	0.5	0.13
Thailand	5.3	0.58	1.8	0.38	0.4	0.16
Tunisia	1.8	0.28	0.4	0.14	#	†
Uruguay	8.8	0.75	3.4	0.40	0.9	0.23
United Kingdom[1]	21.4	0.73	11.7	0.72	4.9	0.46

† Not applicable.

\# Rounds to zero.

[1]Due to low response rates, data for the United Kingdom are not discussed in this report.

NOTE: In order to reach a particular proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into mathematics literacy levels according to their scores. Exact cut point scores are as follows: below level 1 (*a score less than or equal to 357.77*); level 1 (*a score greater than 357.77 and less than or equal to 420.07*); level 2 (*a score greater than 420.07 and less than or equal to 482.38*); level 3 (*a score greater than 482.38 and less than or equal to 544.68*); level 4 (*a score greater than 544.68 and less than or equal to 606.99*); level 5 (*a score greater than 606.99 and less than or equal to 669.3*); level 6 (*a score greater than 669.3*). The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error. Detail may not sum to totals because of rounding.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-10. Percentage distribution of 15-year-old students scoring at each proficiency level on the mathematics literacy uncertainty subscale, by country: 2003

Country	Below level 1		Level 1		Level 2		Level 3	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**7.4**	**0.15**	**13.3**	**0.17**	**21.5**	**0.16**	**23.8**	**0.17**
OECD countries								
Australia	4.1	0.40	9.0	0.47	17.5	0.57	23.8	0.59
Austria	7.4	0.74	15.2	0.98	22.9	1.27	24.3	1.11
Belgium	6.2	0.54	11.1	0.54	17.3	0.56	20.4	0.62
Canada	2.0	0.22	6.4	0.37	16.5	0.55	25.6	0.50
Czech Republic	5.2	0.62	14.4	0.85	24.4	1.09	24.2	0.96
Denmark	4.4	0.59	10.4	0.69	20.8	0.78	25.8	0.84
Finland	1.6	0.23	5.5	0.64	15.4	0.65	27.2	0.80
France	6.0	0.68	12.3	0.87	20.9	0.79	25.3	1.03
Germany	8.7	0.80	15.2	0.78	21.8	0.92	22.6	1.01
Greece	12.8	1.13	20.4	1.30	27.3	1.00	23.1	0.91
Hungary	6.0	0.73	15.2	0.93	26.2	1.06	26.5	0.90
Iceland	4.0	0.38	8.9	0.59	18.8	0.69	24.4	1.07
Ireland	3.6	0.45	10.2	0.74	21.2	0.86	26.5	0.93
Italy	13.7	1.05	18.9	0.70	25.6	0.71	22.2	0.88
Japan	4.9	0.61	9.1	0.91	17.5	0.83	23.7	1.08
Korea, Republic of	2.2	0.27	7.2	0.63	17.3	0.83	25.0	0.96
Luxembourg	8.2	0.41	14.6	0.76	22.8	1.05	24.5	1.21
Mexico	35.3	1.66	30.6	1.29	21.3	1.02	9.5	0.84
Netherlands	1.0	0.24	6.7	0.83	17.0	1.00	23.4	1.25
New Zealand	3.9	0.55	9.4	0.77	18.0	1.04	23.3	1.01
Norway	5.7	0.56	11.8	0.79	20.6	0.82	24.4	1.22
Poland	5.2	0.63	13.9	0.88	25.7	1.04	27.4	0.86
Portugal	9.0	1.09	18.4	1.08	27.7	1.01	25.6	1.11
Slovak Republic	8.6	0.99	17.9	0.84	26.8	0.92	24.1	0.93
Spain	7.1	0.64	13.7	0.69	25.5	0.80	26.9	0.78
Sweden	6.4	0.54	11.8	0.72	21.5	0.82	22.9	0.79
Switzerland	6.3	0.49	10.7	0.65	19.1	0.78	24.0	0.88
Turkey	18.6	1.52	25.6	1.37	25.3	1.17	16.6	1.30
United States	9.0	0.76	14.9	0.71	22.3	0.74	23.6	0.75
Non-OECD countries								
Hong Kong-China	3.3	0.65	6.3	0.70	12.5	0.86	19.3	0.89
Indonesia	35.3	1.57	36.7	1.01	20.4	1.08	6.2	0.69
Latvia	8.3	0.76	17.8	1.20	28.1	1.25	25.7	1.20
Liechtenstein	5.2	1.60	9.5	1.95	18.4	2.33	23.0	2.90
Macao-China	2.5	0.57	7.2	1.29	18.9	1.62	27.4	2.03
Russian Federation	19.0	1.40	24.8	1.05	26.3	0.99	18.1	1.04
Serbia and Montenegro	20.1	1.30	27.3	1.12	26.8	1.06	17.4	1.29
Thailand	18.1	1.08	32.8	0.95	29.6	1.04	14.1	0.86
Tunisia	47.9	1.27	32.3	0.96	14.8	0.88	4.2	0.61
Uruguay	27.1	1.27	23.5	1.13	23.5	1.26	16.0	0.77
United Kingdom[1]	3.8	0.42	10.1	0.64	20.4	0.69	25.7	0.76

See notes at end of table.

Table B-10. Percentage distribution of 15-year-old students scoring at each proficiency level on the mathematics literacy uncertainty subscale, by country: 2003—Continued

Country	Level 4		Level 5		Level 6	
	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**19.2**	**0.17**	**10.6**	**0.14**	**4.2**	**0.10**
OECD countries						
Australia	23.0	0.60	15.1	0.52	7.4	0.52
Austria	17.9	1.14	9.3	0.71	3.0	0.41
Belgium	20.8	0.57	15.8	0.53	8.4	0.43
Canada	26.3	0.56	16.4	0.55	6.8	0.47
Czech Republic	19.2	0.87	9.3	0.85	3.3	0.44
Denmark	22.0	0.82	12.6	0.66	4.0	0.43
Finland	27.0	0.87	16.4	0.82	6.8	0.57
France	21.7	0.75	11.0	0.65	2.8	0.28
Germany	19.0	0.94	9.7	0.78	2.9	0.32
Greece	11.8	0.94	4.0	0.59	0.7	0.15
Hungary	17.3	0.91	7.1	0.70	1.6	0.32
Iceland	22.9	0.86	14.8	0.68	6.1	0.50
Ireland	22.0	0.93	12.4	0.72	4.0	0.39
Italy	13.0	0.79	5.1	0.38	1.4	0.16
Japan	23.5	1.35	14.8	0.95	6.6	0.95
Korea, Republic of	25.7	0.95	15.7	0.81	6.7	0.80
Luxembourg	18.2	0.68	8.7	0.60	2.9	0.41
Mexico	2.7	0.43	0.5	0.11	#	†
Netherlands	23.2	1.30	19.1	1.06	9.5	0.78
New Zealand	22.1	0.97	14.6	0.73	8.6	0.54
Norway	20.3	0.84	11.6	0.89	5.6	0.42
Poland	18.7	1.04	7.5	0.75	1.6	0.25
Portugal	14.5	1.00	4.2	0.38	0.6	0.18
Slovak Republic	15.7	0.80	5.6	0.46	1.2	0.23
Spain	18.4	0.71	6.9	0.51	1.5	0.26
Sweden	19.7	0.76	12.1	0.61	5.6	0.54
Switzerland	21.2	0.83	12.9	0.98	5.8	0.74
Turkey	8.0	1.14	3.4	0.77	2.6	1.07
United States	17.4	0.75	9.5	0.70	3.2	0.39
Non-OECD countries						
Hong Kong-China	24.8	1.19	21.1	1.10	12.7	1.12
Indonesia	1.3	0.33	0.1	0.05	#	†
Latvia	14.6	0.92	4.5	0.52	1.0	0.25
Liechtenstein	23.8	2.97	14.9	2.54	5.1	1.37
Macao-China	23.5	1.70	14.9	1.53	5.4	1.02
Russian Federation	8.6	0.76	2.7	0.43	0.5	0.14
Serbia and Montenegro	6.7	0.72	1.5	0.28	0.2	0.14
Thailand	4.3	0.50	1.1	0.25	0.1	0.06
Tunisia	0.8	0.28	#	†	#	†
Uruguay	7.1	0.54	2.4	0.29	0.4	0.13
United Kingdom[1]	22.3	0.65	12.8	0.71	4.8	0.51

† Not applicable.
# Rounds to zero.
[1]Due to low response rates, data for the United Kingdom are not discussed in this report.
NOTE: In order to reach a particular proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into mathematics literacy levels according to their scores. Exact cut point scores are as follows: below level 1 (*a score less than or equal to 357.77*); level 1 (*a score greater than 357.77 and less than or equal to 420.07*); level 2 (*a score greater than 420.07 and less than or equal to 482.38*); level 3 (*a score greater than 482.38 and less than or equal to 544.68*); level 4 (*a score greater than 544.68 and less than or equal to 606.99*); level 5 (*a score greater than 606.99 and less than or equal to 669.3*); level 6 (*a score greater than 669.3*). The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error. Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-11. Average selected mathematics literacy subscale scores of 15-year-old students, by country: 2000 and 2003

Country	Space and shape				Change and relationships			
	2000		2003		2000		2003	
	Average	s.e.	Average	s.e.	Average	s.e.	Average	s.e.
OECD average	**—**	**—**	**498.8**	**0.70**	**—**	**—**	**496.3**	**0.65**
OECD countries								
Australia	519.7	3.14	520.5	2.33	522.2	3.21	525.3	2.30
Austria	510.1	2.85	515.2	3.48	499.3	3.10	499.7	3.60
Belgium	501.9	3.05	529.6	2.26	513.7	3.82	535.3	2.45
Canada	515.3	1.50	517.8	1.81	519.7	1.26	536.7	1.93
Czech Republic	510.1	3.51	528.0	4.17	484.4	2.98	514.1	3.55
Denmark	526.2	2.58	512.4	2.76	499.3	2.70	509.3	2.99
Finland	533.0	2.05	539.0	2.04	529.5	2.12	543.0	2.19
France	501.0	2.69	507.6	2.98	514.5	2.70	519.7	2.62
Germany	485.9	3.10	499.6	3.28	485.1	2.41	507.2	3.73
Greece	450.4	4.35	437.1	3.80	429.9	5.21	435.6	4.31
Hungary	478.4	3.30	479.0	3.34	478.6	4.05	494.6	3.10
Iceland	518.8	2.30	503.5	1.46	507.5	2.79	509.4	1.43
Ireland	473.5	3.23	476.2	2.43	501.1	2.74	505.9	2.45
Italy	454.7	3.61	470.3	3.15	442.8	3.00	452.1	3.21
Japan	564.8	5.06	553.1	4.31	536.2	5.12	536.1	4.33
Korea, Republic of	538.2	3.59	551.7	3.80	530.1	2.55	547.5	3.52
Luxembourg	448.6	3.02	488.2	1.35	423.8	2.63	487.0	1.15
Mexico	399.8	2.62	381.7	3.20	357.6	3.14	364.1	4.14
New Zealand	523.7	4.01	524.9	2.34	527.1	3.04	525.7	2.37
Norway	490.5	3.09	482.6	2.55	493.6	3.05	487.7	2.64
Poland	469.9	5.49	490.3	2.66	451.2	5.66	484.3	2.70
Portugal	439.5	3.54	450.2	3.43	448.5	3.56	467.8	3.96
Spain	472.7	2.57	476.5	2.59	467.8	2.81	480.7	2.80
Sweden	509.8	2.64	498.3	2.57	501.6	2.63	505.0	2.94
Switzerland	538.9	3.58	539.5	3.50	509.6	4.84	522.7	3.65
United States	461.2	4.94	472.0	2.78	485.7	6.02	485.5	3.03
Non-OECD countries								
Latvia	—	—	486.4	4.04	—	—	487.2	4.36
Liechtenstein	—	—	538.2	4.58	—	—	539.5	3.67
Russian Federation	—	—	474.3	4.69	—	—	476.8	4.64
United Kingdom[1]	504.9	2.58	496.0	2.50	519.2	2.21	512.9	2.54

—Not available.
[1]Due to low response rates, data for the United Kingdom are not discussed in this report.
NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2000 and 2003.

Table B-12. Average problem-solving scores of 15-year-old students, by country: 2003

Country	Average	s.e.
OECD average	**500.0**	**0.65**
OECD countries		
Australia	529.9	1.98
Austria	506.1	3.18
Belgium	524.7	2.21
Canada	529.3	1.74
Czech Republic	516.4	3.42
Denmark	516.8	2.54
Finland	547.6	1.86
France	519.2	2.67
Germany	513.5	3.24
Greece	448.5	3.97
Hungary	501.1	2.86
Iceland	504.7	1.38
Ireland	498.5	2.34
Italy	469.5	3.10
Japan	547.3	4.05
Korea, Republic of	550.4	3.06
Luxembourg	493.7	1.37
Mexico	384.4	4.29
Netherlands	520.2	2.95
New Zealand	532.8	2.17
Norway	489.8	2.60
Poland	486.6	2.78
Portugal	469.9	3.87
Slovak Republic	491.8	3.38
Spain	482.3	2.73
Sweden	508.6	2.44
Switzerland	521.3	3.05
Turkey	407.6	6.03
United States	477.4	3.13
Non-OECD countries		
Hong Kong-China	547.9	4.18
Indonesia	361.5	3.29
Latvia	482.5	3.90
Liechtenstein	529.5	3.95
Macao-China	532.4	2.53
Russian Federation	478.6	4.59
Serbia and Montenegro	420.2	3.32
Thailand	425.0	2.72
Tunisia	344.8	2.11
Uruguay	410.7	3.68
United Kingdom[1]	510.2	2.38

[1]Due to low response rates, data for the United Kingdom are not discussed in this report.

NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-13. Problem-solving scores of 15-year-old students, by percentiles and country: 2003

Country	5th percentile		10th percentile		25th percentile		50th percentile	
	Score	s.e.	Score	s.e.	Score	s.e.	Score	s.e.
OECD average	**328.2**	**1.61**	**368.4**	**1.32**	**434.1**	**1.10**	**503.1**	**0.28**
OECD countries								
Australia	370.9	4.07	409.3	3.46	469.5	2.78	535.1	0.70
Austria	356.9	5.14	388.0	4.50	443.0	4.08	508.9	1.30
Belgium	339.4	5.72	381.1	4.66	455.0	3.32	533.6	1.19
Canada	378.8	2.43	414.0	2.78	470.8	2.46	532.1	0.61
Czech Republic	356.5	8.56	394.0	6.17	454.0	4.43	519.0	0.94
Denmark	368.9	5.02	402.3	4.28	458.5	3.06	520.0	1.14
Finland	408.6	4.67	441.6	2.80	494.5	2.48	550.5	1.10
France	358.4	6.09	395.9	4.78	458.6	3.94	523.8	1.65
Germany	350.7	5.91	383.5	5.35	446.9	4.78	520.5	1.20
Greece	283.1	5.57	319.2	5.25	382.7	4.52	450.8	2.25
Hungary	343.0	5.82	377.6	4.05	436.5	3.76	503.9	1.80
Iceland	358.0	5.47	393.4	3.28	449.8	2.22	510.1	1.44
Ireland	364.0	4.48	394.6	3.80	444.9	3.14	500.0	1.06
Italy	288.8	8.75	334.2	6.47	406.1	4.72	475.2	1.53
Japan	362.1	8.27	405.8	6.83	481.4	5.71	555.8	1.56
Korea, Republic of	404.1	4.63	437.9	5.21	493.9	3.85	553.7	1.52
Luxembourg	339.1	3.70	373.4	2.32	432.1	2.44	496.0	1.54
Mexico	226.6	5.44	261.8	5.18	317.2	5.20	384.5	1.93
Netherlands	372.2	5.89	401.5	5.14	456.1	4.89	521.3	1.73
New Zealand	369.8	3.75	405.6	4.23	467.8	3.65	538.0	1.21
Norway	322.3	5.54	360.9	4.64	424.4	3.71	493.6	2.01
Poland	338.0	5.55	372.0	4.07	428.4	3.10	487.8	1.44
Portugal	311.2	7.91	345.3	6.84	408.6	5.65	475.2	2.18
Slovak Republic	336.6	7.13	370.4	5.86	430.1	4.71	494.0	0.79
Spain	321.8	4.78	361.2	4.12	420.9	3.55	486.0	0.93
Sweden	359.8	6.39	395.2	4.41	451.3	3.04	511.4	1.38
Switzerland	358.2	5.73	397.0	4.04	461.3	3.32	526.8	1.87
Turkey	257.2	7.84	290.7	6.58	343.0	5.16	402.3	1.34
United States	312.2	5.63	347.3	4.55	409.7	4.07	479.5	1.71
Non-OECD countries								
Hong Kong-China	376.2	10.52	420.2	7.86	487.0	6.12	557.8	1.64
Indonesia	244.7	4.22	269.9	3.77	311.7	3.60	359.3	1.91
Latvia	326.2	6.97	361.9	6.00	419.9	5.38	484.6	1.04
Liechtenstein	369.0	14.93	404.1	11.09	467.6	6.03	532.8	4.89
Macao-China	394.8	6.41	424.8	5.58	477.8	3.72	535.7	1.69
Russian Federation	314.2	7.73	351.0	6.99	412.7	5.72	480.7	1.69
Serbia and Montenegro	278.7	4.15	310.6	4.40	362.8	3.94	420.2	2.53
Thailand	293.0	3.87	322.4	3.37	369.1	2.64	422.0	2.15
Tunisia	213.0	4.30	242.7	3.10	290.7	2.54	344.4	1.01
Uruguay	223.8	5.69	265.0	5.10	334.5	4.66	413.5	1.69
United Kingdom[1]	352.7	4.40	387.1	3.59	446.1	2.90	513.2	1.03

See notes at end of table.

Table B-13. Problem-solving scores of 15-year-old students, by percentiles and country: 2003—Continued

Country	75th percentile		90th percentile		95th percentile	
	Score	s.e.	Score	s.e.	Score	s.e.
OECD average	**570.9**	**0.82**	**625.0**	**0.75**	**655.6**	**0.82**
OECD countries						
Australia	593.9	2.13	643.5	2.67	671.7	3.40
Austria	569.4	3.98	620.7	4.18	650.9	4.63
Belgium	601.2	2.24	653.4	2.21	682.0	2.77
Canada	591.1	1.89	640.4	2.13	668.8	2.40
Czech Republic	582.2	3.58	633.7	3.87	663.5	4.01
Denmark	578.4	2.76	627.0	3.44	654.9	3.71
Finland	604.0	2.28	649.6	2.33	676.5	3.58
France	585.8	3.05	634.7	3.66	662.3	4.51
Germany	583.1	4.28	631.6	2.66	658.4	3.19
Greece	516.6	4.58	574.5	5.72	607.5	5.60
Hungary	566.7	3.93	622.1	4.31	653.1	5.37
Iceland	564.3	2.03	609.1	2.33	634.4	3.59
Ireland	555.3	2.73	600.7	2.83	624.5	3.21
Italy	540.1	2.95	595.4	3.41	627.2	3.56
Japan	620.9	4.22	675.3	4.56	705.3	6.01
Korea, Republic of	609.9	3.47	658.3	4.21	686.0	5.53
Luxembourg	558.0	2.17	609.8	2.59	639.9	3.40
Mexico	451.5	5.06	509.3	5.69	541.6	6.48
Netherlands	586.7	3.59	636.4	3.34	662.1	3.71
New Zealand	600.9	2.38	652.7	2.49	682.4	2.76
Norway	558.8	3.27	614.8	4.17	645.5	4.38
Poland	547.6	2.97	600.2	3.53	631.7	4.49
Portugal	534.3	3.60	586.3	3.45	614.5	3.54
Slovak Republic	558.0	3.58	609.0	3.84	638.1	4.16
Spain	547.3	3.22	599.4	3.89	629.4	3.31
Sweden	570.8	3.06	619.0	3.82	647.2	3.56
Switzerland	586.9	3.86	636.9	4.60	666.2	5.18
Turkey	466.5	7.69	531.2	11.94	576.7	18.61
United States	547.9	3.29	603.6	3.97	634.8	4.18
Non-OECD countries						
Hong Kong-China	617.4	3.18	663.5	2.93	690.2	3.72
Indonesia	408.6	4.10	456.8	5.51	486.9	5.92
Latvia	547.3	4.57	599.0	4.11	628.4	4.89
Liechtenstein	598.9	9.30	644.1	10.46	671.8	12.04
Macao-China	590.0	4.34	632.9	5.43	658.9	6.54
Russian Federation	546.0	5.12	603.7	5.03	637.2	5.55
Serbia and Montenegro	477.7	4.19	529.9	4.93	559.8	5.08
Thailand	478.5	3.98	531.7	4.01	565.4	5.97
Tunisia	400.0	2.76	445.8	4.11	474.5	4.98
Uruguay	488.4	5.45	552.1	5.04	589.3	5.74
United Kingdom[1]	576.5	3.07	628.9	3.69	659.2	3.98

[1]Due to low response rates, data for the United Kingdom are not discussed in this report.

NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-14. Standard deviations of 15-year-old students' problem-solving scores, by country: 2003

Country	Standard deviation	s.e.
OECD average	**100.0**	**0.44**
OECD countries		
Australia	91.4	1.35
Austria	89.9	1.71
Belgium	104.4	1.57
Canada	88.4	0.93
Czech Republic	92.8	1.92
Denmark	87.3	1.51
Finland	82.0	1.15
France	92.9	2.08
Germany	94.7	1.75
Greece	98.8	1.67
Hungary	94.1	2.03
Iceland	84.8	1.15
Ireland	79.6	1.35
Italy	102.1	2.14
Japan	104.9	2.72
Korea, Republic of	86.4	1.95
Luxembourg	91.6	1.03
Mexico	96.1	2.01
Netherlands	89.4	2.03
New Zealand	95.7	1.24
Norway	98.8	1.65
Poland	90.4	1.68
Portugal	92.4	2.11
Slovak Republic	92.8	2.39
Spain	93.6	1.25
Sweden	88.4	1.58
Switzerland	94.0	1.88
Turkey	96.7	4.43
United States	98.1	1.29
Non-OECD countries		
Hong Kong-China	97.2	2.90
Indonesia	73.2	1.74
Latvia	92.1	1.75
Liechtenstein	92.7	4.20
Macao-China	81.3	2.55
Russian Federation	98.5	2.11
Serbia and Montenegro	85.8	1.56
Thailand	82.0	1.59
Tunisia	79.5	1.42
Uruguay	111.7	1.93
United Kingdom[1]	93.2	1.21

[1]Due to low response rates, data for the United Kingdom are not discussed in this report.

NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-15. Percentage distribution of 15-year-old students scoring at each proficiency level on the problem-solving scale, by country: 2003

Country	Below level 1		Level 1		Level 2		Level 3	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**17.3**	**0.25**	**30.4**	**0.20**	**34.2**	**0.22**	**18.2**	**0.18**
OECD countries								
Australia	9.4	0.59	25.8	0.67	39.1	0.83	25.7	0.84
Austria	13.6	1.00	32.3	1.07	36.8	1.06	17.2	1.16
Belgium	14.0	0.80	23.8	0.88	34.1	0.82	28.1	0.81
Canada	8.5	0.48	27.0	0.70	40.0	0.69	24.5	0.72
Czech Republic	12.1	1.14	29.4	1.20	37.0	1.12	21.5	1.24
Denmark	10.5	0.76	30.2	0.92	39.2	0.90	20.1	0.93
Finland	4.6	0.51	22.1	0.84	43.3	0.82	30.1	0.92
France	11.7	0.95	28.1	1.04	37.5	1.05	22.7	0.99
Germany	14.2	1.00	27.7	1.14	36.4	1.49	21.7	1.39
Greece	32.7	1.53	36.1	1.01	24.3	1.21	7.0	0.80
Hungary	16.1	0.98	31.8	1.40	34.9	1.20	17.2	1.16
Iceland	12.4	0.66	32.5	1.01	40.2	0.97	14.9	0.64
Ireland	12.5	0.91	36.9	1.17	38.3	1.05	12.3	0.76
Italy	24.7	1.32	34.7	1.16	30.0	0.99	10.6	0.66
Japan	9.9	1.00	20.0	0.98	34.5	1.25	35.6	1.58
Korea, Republic of	5.2	0.54	21.6	1.02	40.8	1.11	32.4	1.35
Luxembourg	17.0	0.71	34.1	0.95	34.7	1.04	14.2	0.56
Mexico	58.1	1.86	29.7	1.07	10.9	0.99	1.3	0.24
Netherlands	10.7	1.13	30.5	1.31	35.8	1.41	23.0	1.13
New Zealand	9.9	0.81	25.3	0.85	36.5	1.01	28.3	0.92
Norway	19.4	0.88	32.6	1.15	33.1	0.97	14.9	0.84
Poland	17.5	0.98	37.2	1.02	33.6	1.14	11.7	0.66
Portugal	23.9	1.73	36.5	1.09	31.0	1.36	8.6	0.63
Slovak Republic	17.5	1.40	34.4	1.16	34.0	1.34	14.1	0.96
Spain	20.1	0.87	35.5	1.08	32.9	1.15	11.6	0.83
Sweden	12.0	0.85	32.4	1.12	38.2	1.02	17.4	0.99
Switzerland	11.4	0.74	26.8	1.02	38.7	1.10	23.1	1.42
Turkey	51.2	2.51	32.5	1.58	12.4	1.64	3.9	1.24
United States	23.7	1.12	33.7	0.83	30.3	1.03	12.4	0.78
Non-OECD countries								
Hong Kong-China	8.0	1.05	20.5	0.99	36.5	1.17	35.0	1.39
Indonesia	73.5	1.71	22.9	1.36	3.5	0.64	0.1	0.07
Latvia	20.3	1.48	35.6	1.27	32.5	1.39	11.6	0.96
Liechtenstein	10.2	1.54	26.0	2.35	36.8	3.56	27.1	2.62
Macao-China	6.3	0.82	27.3	1.37	42.1	2.00	24.2	1.59
Russian Federation	22.8	1.69	34.5	1.03	30.6	1.28	12.2	1.02
Serbia and Montenegro	42.6	1.70	39.5	1.16	15.8	1.17	2.1	0.31
Thailand	41.4	1.57	40.5	1.08	15.6	1.10	2.6	0.47
Tunisia	77.1	1.05	20.4	0.82	2.5	0.51	0.1	0.05
Uruguay	47.2	1.58	30.5	1.33	17.5	1.23	4.7	0.54
United Kingdom[1]	13.7	0.75	30.3	1.09	36.6	1.00	19.5	0.97

[1]Due to low response rates, data for the United Kingdom are not discussed in this report.

NOTE: In order to reach a particular proficiency level, a student must have been able to correctly answer a majority of items at that level. Students were classified into problem solving levels according to their scores. Exact cut point scores are as follows: below level 1 *(a score less than or equal to 404.06)*; level 1 *(a score greater than 404.06 and less than or equal to 498.08)*; level 2 *(a score greater than 498.08 and less than or equal to 592.10)*; level 3 *(a score greater than 592.10)*.The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error. Detail may not sum to totals because of rounding.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-16. Average reading literacy scores of 15-year-old students, by country: 2000 and 2003

Country	2000		2003	
	Average	s.e.	Average	s.e.
OECD average	**500.0**	**0.64**	**494.2**	**0.65**
OECD countries				
Australia	528.3	3.52	525.4	2.13
Austria	507.1	2.40	490.7	3.76
Belgium	507.1	3.56	507.9	2.57
Canada	534.3	1.56	527.9	1.75
Czech Republic	491.6	2.37	488.5	3.46
Denmark	496.9	2.35	492.3	2.82
Finland	546.5	2.58	543.5	1.64
France	504.7	2.73	496.2	2.68
Germany	484.0	2.47	491.4	3.39
Greece	473.8	4.97	472.3	4.10
Hungary	480.0	3.95	481.9	2.47
Iceland	506.9	1.45	491.7	1.56
Ireland	526.7	3.24	515.5	2.63
Italy	487.5	2.91	475.7	3.04
Japan	522.2	5.21	498.1	3.92
Korea, Republic of	524.8	2.42	534.1	3.09
Luxembourg	441.3	1.59	479.4	1.48
Mexico	422.0	3.32	399.7	4.09
Netherlands	—	—	513.1	2.85
New Zealand	528.8	2.78	521.6	2.46
Norway	505.3	2.80	499.7	2.78
Poland	479.1	4.46	496.6	2.88
Portugal	470.2	4.52	477.6	3.73
Slovak Republic	—	—	469.2	3.12
Spain	492.6	2.71	480.5	2.60
Sweden	516.3	2.20	514.3	2.42
Switzerland	494.4	4.25	499.1	3.28
Turkey	—	—	441.0	5.79
United States	504.4	7.05	495.2	3.22
Non-OECD countries				
Hong Kong-China	—	—	509.5	3.69
Indonesia	—	—	381.6	3.38
Latvia	458.1	5.27	490.6	3.67
Liechtenstein	482.6	4.12	525.1	3.58
Macao-China	—	—	497.6	2.16
Russian Federation	461.8	4.16	442.2	3.94
Serbia and Montenegro	—	—	411.7	3.56
Thailand	—	—	419.9	2.81
Tunisia	—	—	374.6	2.81
Uruguay	—	—	434.1	3.43
United Kingdom[1]	523.4	2.56	507.0	2.46

—Not available.

[1]Due to low response rates, 2003 data for the United Kingdom are not discussed in this report.

NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2000 and 2003.

Table B-17. Average science literacy scores of 15-year-old students, by country: 2000 and 2003

Country	2000		2003	
	Average	s.e.	Average	s.e.
OECD average	**500.0**	**0.65**	**499.6**	**0.60**
OECD countries				
Australia	527.5	3.47	525.1	2.10
Austria	518.6	2.55	491.0	3.44
Belgium	495.7	4.29	508.8	2.44
Canada	529.4	1.57	518.7	2.02
Czech Republic	511.4	2.43	523.3	3.38
Denmark	481.0	2.81	475.2	2.97
Finland	537.7	2.48	548.2	1.92
France	500.5	3.18	511.2	2.99
Germany	487.1	2.43	502.3	3.64
Greece	460.6	4.89	481.0	3.82
Hungary	496.1	4.17	503.3	2.77
Iceland	495.9	2.17	494.7	1.47
Ireland	513.4	3.18	505.4	2.69
Italy	477.6	3.05	486.5	3.13
Japan	550.4	5.48	547.6	4.14
Korea, Republic of	552.1	2.69	538.4	3.54
Luxembourg	443.1	2.32	482.8	1.50
Mexico	421.5	3.18	404.9	3.49
Netherlands	—	—	524.4	3.15
New Zealand	527.7	2.40	520.9	2.35
Norway	500.3	2.75	484.2	2.87
Poland	483.1	5.12	497.8	2.86
Portugal	459.0	4.00	467.7	3.46
Slovak Republic	—	—	494.9	3.71
Spain	490.9	2.95	487.1	2.61
Sweden	512.1	2.51	506.1	2.72
Switzerland	495.7	4.45	513.0	3.69
Turkey	—	—	434.2	5.89
United States	499.5	7.31	491.3	3.08
Non-OECD countries				
Hong Kong-China	—	—	539.5	4.26
Indonesia	—	—	395.0	3.21
Latvia	460.1	5.62	489.1	3.89
Liechtenstein	476.1	7.09	525.2	4.33
Macao-China	—	—	524.7	3.03
Russian Federation	460.3	4.74	489.3	4.14
Serbia and Montenegro	—	—	436.4	3.50
Thailand	—	—	429.1	2.70
Tunisia	—	—	384.7	2.56
Uruguay	—	—	438.4	2.90
United Kingdom[1]	532.0	2.69	518.4	2.52

—Not available.

[1]Due to low response rates, 2003 data for the United Kingdom are not discussed in this report.

NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2000 and 2003.

Table B-18. Average combined mathematics literacy scores of 15-year-old students, by sex and country: 2003

Country	Male		Female		Male-female score point difference	s.e.
	Average	s.e.	Average	s.e.		
OECD average	**505.5**	**0.76**	**494.4**	**0.76**	**11.1**	**0.81**
OECD countries						
Australia	526.9	3.01	521.5	2.69	5.3	3.75
Austria	509.4	3.95	501.8	3.96	7.6	4.41
Belgium	532.9	3.40	525.4	3.23	7.5	4.81
Canada	540.8	2.05	529.6	1.88	11.2	2.13
Czech Republic	523.8	4.27	508.9	4.37	15.00	5.09
Denmark	522.7	3.38	506.2	2.98	16.6	3.21
Finland	548.0	2.46	540.6	2.11	7.4	2.67
France	515.3	3.55	506.7	2.92	8.5	4.16
Germany	507.9	3.98	498.9	3.93	9.0	4.37
Greece	455.0	4.75	435.6	3.85	19.4	3.63
Hungary	493.7	3.33	485.9	3.31	7.8	3.54
Iceland	507.7	2.28	523.1	2.17	-15.4	3.46
Ireland	510.2	3.01	495.4	3.39	14.8	4.19
Italy	474.9	4.56	457.1	3.84	17.8	5.89
Japan	538.5	5.81	530.1	3.97	8.4	5.90
Korea, Republic of	551.7	4.36	528.3	5.35	23.4	6.77
Luxembourg	501.9	1.86	484.8	1.53	17.2	2.81
Mexico	390.8	4.28	380.0	4.08	10.9	3.94
Netherlands	540.3	4.08	535.2	3.48	5.1	4.29
New Zealand	530.7	2.77	516.2	3.20	14.5	3.90
Norway	498.3	2.85	492.0	2.87	6.2	3.21
Poland	493.0	2.97	487.5	2.95	5.6	3.14
Portugal	472.4	4.18	460.2	3.44	12.2	3.31
Slovak Republic	507.3	3.90	488.6	3.59	18.7	3.65
Spain	489.6	3.38	480.7	2.19	8.9	2.98
Sweden	512.3	2.98	505.8	3.09	6.5	3.27
Switzerland	534.6	4.74	518.0	3.65	16.6	4.87
Turkey	430.2	7.88	415.1	6.68	15.1	6.16
United States	485.9	3.33	479.7	3.24	6.3	2.89
Non-OECD countries						
Hong Kong-China	552.4	6.52	548.3	4.56	4.1	6.65
Indonesia	361.8	3.92	358.5	4.57	3.3	3.39
Latvia	484.8	4.79	482.0	3.56	2.8	3.97
Liechtenstein	549.8	7.23	521.0	6.28	28.8	10.92
Macao-China	538.2	4.82	516.9	3.28	21.3	5.83
Russian Federation	473.5	5.27	463.4	4.21	10.1	4.36
Serbia and Montenegro	437.5	4.24	436.3	4.45	1.2	4.36
Thailand	414.7	3.96	418.8	3.40	-4.0	4.24
Tunisia	364.9	2.74	352.7	2.93	12.2	2.51
Uruguay	428.4	3.95	416.3	3.84	12.1	4.15
United Kingdom[1]	511.8	2.90	505.1	3.88	6.7	4.90

[1]Due to low response rates, 2003 data for the United Kingdom are not discussed in this report.

NOTE: The male-female score point difference is calculated by subtracting the average scores of females from the average scores of males. The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error. Detail may not sum to totals because of rounding.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-19. Percentage distribution of 15-year-old students scoring at each proficiency level on the combined mathematics literacy scale, by sex and country: 2003

Country	Below level 1				Level 1			
	Male		Female		Male		Female	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**8.1**	**0.21**	**8.4**	**0.19**	**12.6**	**0.19**	**13.8**	**0.21**
OECD countries								
Australia	4.6	0.61	4.0	0.53	10.3	0.81	9.7	0.67
Austria	6.1	0.95	5.1	0.72	13.1	0.99	13.3	1.20
Belgium	7.4	0.82	6.9	0.82	9.8	0.87	8.8	0.77
Canada	2.9	0.39	2.0	0.28	7.4	0.48	7.4	0.49
Czech Republic	4.3	0.67	5.7	1.10	10.9	1.07	12.3	1.29
Denmark	3.8	0.57	5.6	0.78	9.6	0.88	11.8	0.93
Finland	1.6	0.33	1.4	0.29	5.8	0.59	4.9	0.56
France	6.1	0.96	5.2	0.73	10.7	1.02	11.3	0.97
Germany	8.9	1.04	9.2	1.05	12.5	0.99	12.1	1.02
Greece	16.4	1.33	19.1	1.53	19.4	1.30	22.8	1.47
Hungary	7.6	0.84	8.0	1.07	14.6	1.04	15.9	1.08
Iceland	6.1	0.62	2.8	0.49	12.1	0.88	8.8	0.79
Ireland	4.2	0.79	5.2	0.74	10.8	1.13	13.5	1.28
Italy	12.5	1.55	13.9	1.70	17.2	1.57	20.1	1.33
Japan	5.2	0.90	4.3	0.74	9.1	0.94	8.1	0.87
Korea, Republic of	2.3	0.42	2.7	0.49	6.2	0.81	8.3	0.99
Luxembourg	6.8	0.64	8.0	0.73	13.2	0.80	15.3	1.13
Mexico	36.2	2.12	39.7	1.87	26.9	1.61	28.8	1.27
Netherlands	2.2	0.70	2.9	0.84	8.0	1.23	8.7	1.18
New Zealand	4.7	0.57	5.2	0.70	9.9	0.81	10.4	1.00
Norway	7.3	0.71	6.5	0.76	13.3	0.90	14.5	1.07
Poland	7.7	0.88	5.9	0.71	14.9	0.92	15.5	1.05
Portugal	12	1.41	10.6	1.21	16.7	1.12	20.6	1.32
Slovak Republic	6.1	0.91	7.4	0.94	12.0	1.07	14.5	1.25
Spain	8.4	0.89	7.8	0.69	14.1	1.11	15.7	0.99
Sweden	5.6	0.63	5.6	0.71	11.1	0.85	12.3	0.81
Switzerland	4.4	0.46	5.5	0.65	9.1	0.76	10.2	0.83
Turkey	26.4	2.35	29.2	2.37	22.9	1.51	26.6	1.82
United States	10.5	0.96	9.9	1.03	14.7	0.82	16.4	1.16
Non-OECD countries								
Hong Kong-China	5.1	1.12	2.7	0.71	6.7	0.87	6.3	0.87
Indonesia	49.2	2.22	51.8	2.22	28.8	1.29	26.5	1.30
Latvia	8.1	1.56	7.2	1.05	16.3	1.50	15.9	1.28
Liechtenstein	4.7	1.79	4.9	2.37	5.5	2.16	9.6	3.03
Macao-China	2.3	1.07	2.4	0.77	8.5	1.83	9.1	1.72
Russian Federation	11.4	1.46	11.4	1.02	18.4	1.47	19.2	1.40
Serbia and Montenegro	19.2	1.69	16.1	1.65	24.1	1.44	24.8	1.57
Thailand	25.3	1.70	22.6	1.49	29.7	1.52	30.6	1.82
Tunisia	48.2	1.71	53.8	1.68	28.1	1.38	25.8	1.39
Uruguay	24.7	1.56	27.7	1.58	20.9	0.95	22.7	1.28
United Kingdom[1]	5.3	0.65	5.2	0.72	12.1	0.96	12.9	0.89

See notes at end of table.

Table B-19. Percentage distribution of 15-year-old students scoring at each proficiency level on the combined mathematics literacy scale, by sex and country: 2003—Continued

Country	Level 2				Level 3			
	Male		Female		Male		Female	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**20.0**	**0.20**	**22.1**	**0.23**	**22.9**	**0.23**	**24.5**	**0.22**
OECD countries								
Australia	17.8	0.95	19.4	0.78	22.7	1.19	25.3	0.79
Austria	20.4	1.11	22.7	1.35	23.3	1.47	26.5	1.39
Belgium	15.1	0.94	16.9	0.88	18.6	0.82	21.8	1.00
Canada	16.1	0.91	18.7	0.80	23.4	0.85	28.6	1.20
Czech Republic	19.8	1.25	20.4	1.42	23.2	1.06	25.4	1.38
Denmark	18.7	1.30	22.3	1.09	26.4	1.28	26.0	1.20
Finland	15.4	0.75	16.7	0.80	25.9	0.93	29.5	1.09
France	18.7	1.01	21.6	1.12	25.1	1.47	26.6	1.37
Germany	18.1	1.21	19.9	1.42	21.4	0.98	23.9	1.37
Greece	24.7	1.36	27.8	1.15	21.0	1.05	19.4	1.53
Hungary	23.6	1.44	24.0	1.61	23.9	1.30	24.7	1.26
Iceland	20.4	1.17	20.1	1.40	25.3	1.31	26.9	1.19
Ireland	22.5	1.44	24.7	1.37	27.8	1.46	28.2	1.36
Italy	22.8	1.27	26.4	1.35	22.7	1.12	23.1	1.17
Japan	15.8	1.15	16.9	1.10	20.2	1.41	24.5	1.19
Korea, Republic of	14.6	1.01	19.6	1.66	22.3	1.04	26.7	1.51
Luxembourg	21.4	1.06	24.4	1.22	24.8	1.09	26.9	1.12
Mexico	21.6	1.46	20.2	1.32	11.4	1.00	8.9	1.15
Netherlands	18.2	1.49	17.9	1.42	22.9	1.57	23.0	1.34
New Zealand	17.7	0.91	20.6	1.15	21.9	1.17	24.5	1.17
Norway	23.2	1.25	24.1	1.54	23.9	1.35	26.5	1.20
Poland	22.9	1.06	26.8	0.99	24.5	1.22	26.2	1.13
Portugal	24.6	1.20	29.4	1.33	23.9	1.20	24.1	1.37
Slovak Republic	22.0	1.10	25.0	1.42	24.5	1.28	25.4	1.46
Spain	23.3	1.17	26.1	0.98	25.6	1.49	27.7	1.06
Sweden	21.3	1.13	22.1	1.02	25.4	1.51	25.6	1.02
Switzerland	16.5	1.15	18.6	1.11	23.2	1.48	25.4	1.17
Turkey	22.2	1.28	21.9	1.75	14.3	1.45	12.4	1.47
United States	23.2	1.05	24.6	1.37	23.1	1.39	24.5	1.11
Non-OECD countries								
Hong Kong-China	13.0	0.95	14.9	1.57	18.1	1.02	21.8	2.29
Indonesia	15.2	1.25	14.3	1.23	5.1	0.64	5.8	0.94
Latvia	24.6	1.44	26.3	1.52	25.6	1.48	26.9	1.70
Liechtenstein	15.6	3.07	19.2	3.92	19.6	3.48	23.6	3.71
Macao-China	16.8	1.74	22.3	2.12	23.7	2.59	29.8	2.60
Russian Federation	24.5	1.56	28.3	1.52	22.6	1.48	23.6	1.29
Serbia and Montenegro	26.3	1.47	30.9	1.45	17.5	1.19	20.2	1.47
Thailand	24.5	1.41	26.1	1.37	13.2	1.34	14.0	0.99
Tunisia	15.1	1.00	14.3	1.00	6.3	0.66	5.1	0.87
Uruguay	24.3	1.27	24.1	1.50	17.4	1.05	16.1	1.10
United Kingdom[1]	19.5	1.54	22.7	1.38	25.8	1.52	25.4	1.04

See notes at end of table.

Table B-19. Percentage distribution of 15-year-old students scoring at each proficiency level on the combined mathematics literacy scale, by sex and country: 2003—Continued

Country	Level 4				Level 5			
	Male		Female		Male		Female	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
OECD average	**19.5**	**0.22**	**18.8**	**0.24**	**11.8**	**0.19**	**9.5**	**0.15**
OECD countries								
Australia	22.9	1.07	23.6	1.03	14.6	0.96	13.4	0.81
Austria	20.4	1.28	20.5	1.43	11.9	1.04	9.2	1.04
Belgium	20.1	0.86	22.1	0.84	18.1	1.04	16.7	0.75
Canada	25.0	0.70	25.4	1.04	17.6	0.88	13.6	0.82
Czech Republic	20.3	0.99	21.3	1.33	15.0	1.12	10.8	0.98
Denmark	23.5	1.11	20.4	1.26	13.1	1.02	10.6	1.05
Finland	25.4	1.14	26.9	1.22	17.7	1.08	15.7	0.83
France	21.6	1.51	22.6	1.06	13.3	1.16	10.1	1.02
Germany	20.7	1.32	20.6	1.18	13.0	1.14	11.3	0.97
Greece	12.8	1.24	8.6	0.83	4.8	0.80	2.1	0.46
Hungary	18.3	1.20	18.1	1.11	8.6	0.75	7.7	1.01
Iceland	21.0	1.17	25.5	1.10	11.4	0.92	12.2	0.95
Ireland	21.0	1.63	19.4	1.21	10.8	1.09	7.4	0.83
Italy	15.1	1.06	11.9	0.77	7.1	0.64	3.9	0.39
Japan	22.3	1.42	24.9	1.62	16.5	1.37	15.6	1.19
Korea, Republic of	25.9	1.42	23.6	1.53	18.9	1.20	13.4	1.21
Luxembourg	20.0	1.11	17.4	1.08	10.5	0.93	6.6	0.67
Mexico	3.4	0.53	2.1	0.52	0.5	0.15	0.2	0.07
Netherlands	22.6	1.65	22.5	1.51	18.1	1.51	18.3	1.21
New Zealand	21.9	1.18	21.8	1.08	15.7	1.00	12.4	0.99
Norway	19.1	1.23	18.7	1.17	9.7	0.79	7.7	0.69
Poland	17.9	1.23	17.5	1.06	9.0	0.89	6.5	0.78
Portugal	15.6	1.56	11.5	1.01	5.9	0.82	3.3	0.59
Slovak Republic	20.0	1.20	17.8	1.00	11.4	0.93	8.1	0.76
Spain	18.7	1.08	16.7	0.91	8.0	1.09	5.1	0.48
Sweden	19.4	1.43	20.2	1.19	12.4	1.01	10.9	1.03
Switzerland	22.6	1.25	22.3	1.16	15.2	1.80	13.1	1.15
Turkey	7.5	1.14	5.8	1.25	3.5	0.91	2.6	0.83
United States	16.9	1.08	16.2	1.01	8.9	0.70	7.2	0.79
Non-OECD countries								
Hong Kong-China	23.9	1.58	26.1	1.29	20.4	1.52	19.9	1.56
Indonesia	1.4	0.36	1.3	0.49	0.2	0.10	0.2	0.13
Latvia	16.1	1.54	17.0	1.28	7.1	1.01	5.6	0.79
Liechtenstein	22.2	4.93	24.2	4.45	21.5	5.54	15.0	3.60
Macao-China	24.7	3.18	22.7	2.17	17.2	3.28	10.7	1.45
Russian Federation	14.1	1.11	12.3	1.15	6.6	0.86	4.2	0.59
Serbia and Montenegro	9.6	0.97	6.7	1.16	2.9	0.62	1.3	0.35
Thailand	5.6	0.77	5.1	0.72	1.5	0.41	1.4	0.45
Tunisia	2.0	0.42	0.9	0.36	0.3	0.19	0.2	0.10
Uruguay	8.9	0.76	7.4	0.88	3.0	0.45	1.7	0.35
United Kingdom[1]	21.4	0.87	19.9	1.14	11.6	1.15	10.5	1.14

See notes at end of table.

Table B-19. Percentage distribution of 15-year-old students scoring at each proficiency level on the combined mathematics literacy scale, by sex and country: 2003—Continued

Country	Level 6			
	Male		Female	
	Percent	s.e.	Percent	s.e.
OECD average	**5.1**	**0.14**	**2.9**	**0.10**
OECD countries				
Australia	7.0	0.74	4.5	0.49
Austria	4.8	0.75	2.7	0.51
Belgium	10.9	0.72	6.8	0.54
Canada	7.5	0.79	4.2	0.36
Czech Republic	6.6	0.72	4.1	0.54
Denmark	4.9	0.62	3.3	0.56
Finland	8.2	0.85	5.1	0.53
France	4.6	0.58	2.5	0.56
Germany	5.3	0.65	2.9	0.57
Greece	1.0	0.33	0.2	0.14
Hungary	3.3	0.56	1.6	0.37
Iceland	3.7	0.53	3.8	0.49
Ireland	2.9	0.50	1.6	0.36
Italy	2.5	0.30	0.7	0.13
Japan	10.9	1.94	5.7	0.78
Korea, Republic of	9.7	1.01	5.7	1.15
Luxembourg	3.4	0.56	1.4	0.32
Mexico	#	†	#	†
Netherlands	8.0	0.82	6.6	0.70
New Zealand	8.3	0.73	5.0	0.58
Norway	3.5	0.52	1.9	0.43
Poland	3.1	0.50	1.5	0.30
Portugal	1.3	0.26	0.4	0.18
Slovak Republic	4.1	0.58	1.7	0.30
Spain	1.9	0.39	1.0	0.29
Sweden	4.9	0.70	3.4	0.58
Switzerland	9.0	1.30	4.9	0.89
Turkey	3.0	1.24	1.6	0.86
United States	2.8	0.52	1.2	0.39
Non-OECD countries				
Hong Kong-China	12.7	1.46	8.3	0.96
Indonesia	#	†	#	†
Latvia	2.3	0.53	1.1	0.33
Liechtenstein	10.8	2.66	3.6	1.78
Macao-China	6.8	1.86	3.0	0.91
Russian Federation	2.3	0.63	1.0	0.31
Serbia and Montenegro	0.4	0.21	0.1	0.09
Thailand	0.2	0.12	0.2	0.11
Tunisia	#	†	#	†
Uruguay	0.8	0.26	0.2	0.13
United Kingdom[1]	4.4	0.59	3.4	0.68

† Not applicable.
\# Rounds to zero.
[1]Due to low response rates, 2003 data for the United Kingdom are not discussed in this report.
NOTE: In order to reach a particular level, a student must have been able to correctly answer a majority of items at that level. Students were classified into mathematics literacy levels according to their scores. Exact cut point scores are as follows: below level 1 (*a score less than or equal to 357.7*); level 1 (*a score greater than 357.7 and less than or equal to 420.07*); level 2 (*a score greated than 420.07 and less than or equal to 482.38*); level 3 (*a score greater than 482.38 and less than or equal to 544.68*); level 4 (*a score greater than 544.68 and less than or equal to 606.99*); level 5 (*a score greater than 606.99 and less than or equal to 669.3*); level 6 (*a score greater than 669.3*). The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error. Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-20. Average mathematics literacy subscale scores of 15-year-old students, by sex and country: 2003

Country	Space and shape					
	Male		Female		Male-female score point difference	
	Average	s.e.	Average	s.e.		s.e.
OECD average	**504.6**	**0.81**	**487.9**	**0.79**	**16.7**	**0.90**
OECD countries						
Australia	526.4	3.15	514.5	2.91	11.9	3.88
Austria	524.5	4.41	505.8	4.34	18.7	5.18
Belgium	538.1	3.23	520.3	3.25	17.9	4.62
Canada	530.1	2.07	510.6	2.18	19.5	2.52
Czech Republic	542.3	4.76	512.1	5.05	30.2	5.68
Denmark	520.7	3.41	504.4	3.26	16.3	3.73
Finland	540.3	2.63	537.8	2.40	2.4	2.96
France	517.0	4.26	499.2	3.25	17.8	4.72
Germany	505.8	4.03	494.3	3.99	11.5	4.69
Greece	447.1	4.75	427.8	3.82	19.3	4.02
Hungary	486.1	3.78	471.1	3.92	15.0	4.04
Iceland	496.2	2.43	511.3	2.30	-15.1	3.74
Ireland	488.9	2.96	463.4	3.44	25.5	4.28
Italy	479.7	4.74	461.5	4.06	18.1	6.33
Japan	557.8	6.30	548.9	4.20	8.9	6.35
Korea, Republic of	562.7	5.14	535.7	6.24	27.0	7.96
Luxembourg	502.5	2.21	474.3	2.02	28.3	3.28
Mexico	389.8	4.06	374.2	3.48	15.6	3.84
Netherlands	530.1	3.70	522.0	3.45	8.2	4.28
New Zealand	533.9	2.70	516.0	3.35	17.9	3.89
Norway	486.3	3.10	479.0	3.53	7.3	4.27
Poland	496.9	3.20	483.7	3.29	13.1	3.70
Portugal	458.1	4.25	443.0	3.53	15.1	3.52
Slovak Republic	522.4	4.75	487.4	4.11	35.0	4.48
Spain	485.9	3.52	467.4	2.35	18.5	2.96
Sweden	503.5	3.01	493.1	3.21	10.4	3.52
Switzerland	551.7	5.30	526.5	3.70	25.3	5.57
Turkey	422.7	7.59	410.9	6.15	11.7	5.99
United States	479.5	3.34	464.3	3.09	15.2	3.24
Non-OECD countries						
Hong Kong-China	560.5	6.79	556.4	4.95	4.1	6.85
Indonesia	368.7	3.69	353.0	4.21	15.7	2.86
Latvia	493.7	5.22	479.7	3.91	14.0	4.19
Liechtenstein	557.0	7.94	518.4	7.08	38.5	12.13
Macao-China	539.8	5.13	516.6	4.30	23.3	6.76
Russian Federation	484.7	5.78	464.1	4.97	20.6	5.03
Serbia and Montenegro	434.1	4.28	430.8	4.93	3.3	4.88
Thailand	426.4	4.35	421.8	3.83	4.5	4.67
Tunisia	367.2	2.81	350.9	3.15	16.3	3.02
Uruguay	422.8	3.59	401.7	3.37	21.1	3.61
United Kingdom[1]	501.5	3.03	491.2	3.97	10.3	5.04

See notes at end of table.

Table B-20. Average mathematics literacy subscale scores of 15-year-old students, by sex and country: 2003—Continued

Country	Change and relationships					
	Male		Female		Male-female score point difference	
	Average	s.e.	Average	s.e.		s.e.
OECD average	**504.3**	**0.85**	**493.3**	**0.83**	**11.0**	**0.89**
OECD countries						
Australia	527.5	3.18	523.1	2.78	4.4	3.81
Austria	502.1	4.36	497.4	4.42	4.6	4.99
Belgium	538.9	3.55	531.3	3.50	7.6	5.08
Canada	545.8	2.20	532.4	2.01	13.5	2.29
Czech Republic	521.2	4.48	508.4	3.98	12.8	4.93
Denmark	519.9	3.67	499.1	3.25	20.8	3.50
Finland	548.8	2.80	537.4	2.39	11.4	2.82
France	522.0	4.02	517.6	3.18	4.4	4.97
Germany	513.5	4.28	501.8	4.37	11.8	4.43
Greece	444.8	5.18	427.0	4.42	17.8	4.18
Hungary	499.2	3.63	489.5	3.62	9.7	3.88
Iceland	504.8	2.43	514.4	2.30	-9.6	3.79
Ireland	512.2	3.05	499.6	3.52	12.6	4.44
Italy	462.9	4.85	442.1	3.99	20.8	6.27
Japan	539.4	6.41	533.1	4.26	6.3	6.56
Korea, Republic of	557.8	4.68	532.5	5.80	25.3	7.29
Luxembourg	494.0	2.51	480.2	1.76	13.8	3.67
Mexico	368.2	4.87	360.3	4.56	7.9	4.43
Netherlands	554.3	3.84	548.4	3.71	5.9	4.27
New Zealand	534.4	2.79	517.0	3.43	17.4	4.06
Norway	489.8	3.18	485.5	3.05	4.3	3.33
Poland	488.2	3.15	480.5	3.36	7.7	3.63
Portugal	474.7	4.82	461.6	4.00	13.1	3.80
Slovak Republic	502.4	4.09	486.0	3.90	16.4	4.16
Spain	485.0	3.81	476.6	2.58	8.4	3.25
Sweden	505.8	3.42	504.4	3.88	1.4	4.33
Switzerland	529.9	5.11	515.0	3.95	14.9	5.30
Turkey	425.5	9.07	419.5	7.43	6.0	7.25
United States	488.3	3.42	482.7	3.29	5.6	2.90
Non-OECD countries						
Hong Kong-China	540.2	6.83	539.2	4.77	1.0	7.16
Indonesia	336.0	4.35	331.7	5.38	4.3	3.45
Latvia	486.7	5.27	487.7	4.31	-1.0	3.98
Liechtenstein	552.0	7.45	526.4	6.49	25.6	12.10
Macao-China	529.1	5.03	509.0	4.59	20.1	6.56
Russian Federation	478.5	6.02	475.0	4.47	3.4	5.05
Serbia and Montenegro	419.8	4.47	418.3	4.87	1.4	4.93
Thailand	399.7	4.52	409.3	3.95	-9.6	5.06
Tunisia	342.3	2.99	331.0	3.35	11.3	3.01
Uruguay	419.7	4.24	414.4	4.21	5.2	4.38
United Kingdom[1]	517.3	2.97	509.0	4.04	8.3	5.04

See notes at end of table.

Table B-20. Average mathematics literacy subscale scores of 15-year-old students, by sex and country: 2003—Continued

Country	Quantity					
	Male		Female			
	Average	s.e.	Average	s.e.	Male-female score point difference	s.e.
OECD average	**503.8**	**0.77**	**497.6**	**0.77**	**6.2**	**0.84**
OECD countries						
Australia	517.5	2.85	516.3	2.65	1.2	3.67
Austria	514.7	3.68	511.6	3.66	3.1	4.19
Belgium	530.1	3.30	529.1	3.26	0.9	4.66
Canada	532.7	2.16	528.0	1.93	4.7	2.23
Czech Republic	530.8	4.16	525.1	4.55	5.8	5.11
Denmark	520.3	3.21	511.0	2.89	9.3	3.07
Finland	550.1	2.26	546.9	2.07	3.2	2.33
France	508.1	3.78	505.8	2.88	2.3	4.45
Germany	514.5	4.19	513.9	3.85	0.6	4.40
Greece	457.6	4.91	435.0	3.97	22.6	3.99
Hungary	497.2	3.27	495.3	3.24	1.9	3.61
Iceland	499.6	2.53	528.0	2.32	-28.5	3.89
Ireland	506.1	3.06	497.2	3.47	8.9	4.28
Italy	481.4	4.96	468.7	4.38	12.7	6.54
Japan	528.3	5.59	525.2	3.73	3.1	5.67
Korea, Republic of	546.1	3.96	524.2	4.91	21.9	6.15
Luxembourg	505.8	2.17	497.3	1.62	8.5	3.17
Mexico	400.0	4.81	388.0	4.31	12.0	4.46
Netherlands	526.3	4.18	530.3	3.57	-4.0	4.73
New Zealand	516.9	2.66	505.3	3.24	11.6	3.89
Norway	494.2	2.85	494.2	2.70	#	†
Poland	492.6	2.94	491.0	2.98	1.6	3.27
Portugal	472.7	4.12	458.9	3.69	13.8	3.27
Slovak Republic	518.6	4.03	506.1	3.63	12.6	3.64
Spain	494.8	3.60	490.0	2.18	4.8	3.07
Sweden	515.2	2.92	511.9	3.24	3.2	3.63
Switzerland	536.0	4.41	529.0	3.23	7.0	4.60
Turkey	421.1	8.04	403.5	6.62	17.5	6.33
United States	478.5	3.63	474.3	3.57	4.2	3.38
Non-OECD countries						
Hong Kong-China	543.9	6.05	546.5	4.12	-2.6	6.09
Indonesia	358.5	4.05	356.5	5.01	2.1	3.12
Latvia	483.2	4.42	480.3	3.55	2.9	3.43
Liechtenstein	543.9	7.00	522.6	5.65	21.4	9.89
Macao-China	541.6	4.28	524.9	4.18	16.7	6.00
Russian Federation	475.7	5.04	469.3	4.18	6.4	4.43
Serbia and Montenegro	454.8	4.22	457.9	4.67	-3.1	4.71
Thailand	412.3	4.15	416.9	3.84	-4.5	4.91
Tunisia	372.3	2.90	356.6	3.30	15.6	2.69
Uruguay	435.9	3.91	423.8	3.76	12.0	4.09
United Kingdom[1]	499.6	2.87	497.6	4.03	2.1	4.95

See notes at end of table.

Table B-20. Average mathematics literacy subscale scores of 15-year-old students, by sex and country: 2003—Continued

Country	Uncertainty					
	Male		Female		Male-female score point difference	
	Average	s.e.	Average	s.e.		s.e.
OECD average	**508.3**	**0.71**	**495.6**	**0.75**	**12.6**	**0.78**
OECD countries						
Australia	534.5	3.03	527.2	2.74	7.3	3.72
Austria	497.7	3.81	489.9	3.99	7.8	4.58
Belgium	529.2	3.23	521.8	3.21	7.3	4.68
Canada	551.4	2.20	538.4	1.89	13.0	2.26
Czech Republic	508.5	3.88	491.8	3.77	16.7	4.63
Denmark	526.6	3.40	505.0	3.03	21.6	3.21
Finland	550.8	2.64	538.7	2.27	12.1	2.63
France	511.7	3.53	501.0	2.83	10.7	4.25
Germany	502.0	3.86	483.9	3.79	18.1	3.97
Greece	468.9	4.29	448.7	3.68	20.2	3.68
Hungary	492.8	3.16	484.8	3.00	7.9	3.34
Iceland	524.2	2.45	531.7	2.35	-7.5	3.76
Ireland	524.9	3.24	509.4	3.73	15.5	4.60
Italy	475.1	4.51	451.1	3.80	24.1	5.94
Japan	535.2	5.57	521.1	3.82	14.0	5.69
Korea, Republic of	547.1	4.12	525.4	5.18	21.7	6.62
Luxembourg	503.1	2.23	481.5	1.82	21.7	3.49
Mexico	392.1	3.79	387.7	3.63	4.5	3.51
Netherlands	554.0	3.56	544.5	3.69	9.5	4.10
New Zealand	538.0	2.73	526.5	3.31	11.5	3.93
Norway	517.9	2.97	507.6	3.16	10.3	3.32
Poland	494.8	2.82	492.3	2.84	2.6	3.15
Portugal	475.6	4.10	466.0	3.45	9.6	3.15
Slovak Republic	484.1	3.80	467.1	3.41	17.0	3.49
Spain	493.0	3.34	485.0	2.17	8.0	2.83
Sweden	515.2	3.18	506.4	3.38	8.8	3.66
Switzerland	526.4	4.73	505.9	3.68	20.5	5.16
Turkey	451.1	7.31	432.2	6.07	19.0	5.74
United States	493.0	3.41	489.8	3.15	3.2	2.79
Non-OECD countries						
Hong Kong-China	564.1	6.57	552.4	4.58	11.8	6.66
Indonesia	382.1	2.81	386.9	3.38	-4.8	2.42
Latvia	473.7	4.23	473.9	3.08	-0.2	3.32
Liechtenstein	538.4	6.94	507.6	5.62	30.8	10.46
Macao-China	540.7	4.51	523.0	4.20	17.8	5.88
Russian Federation	440.7	5.13	432.3	3.94	8.4	4.19
Serbia and Montenegro	430.6	4.01	425.2	4.19	5.4	4.25
Thailand	419.9	3.44	424.9	3.01	-5.0	4.00
Tunisia	366.7	2.50	360.1	2.77	6.7	2.58
Uruguay	422.9	3.85	414.5	3.60	8.3	4.09
United Kingdom[1]	523.1	2.90	517.5	3.84	5.6	4.87

† Not applicable.
# Rounds to zero.
[1]Due to low response rates, 2003 data for the United Kingdom are not discussed in this report.
NOTE: The male-female score point difference is calculated by subtracting the average scores of females from the average scores of males. The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error. Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-21. Average problem-solving scores of 15-year-old students, by sex and country: 2003

Country	Male		Female		Male-female score point difference	s.e.
	Average	s.e.	Average	s.e.		
OECD average	**499.2**	**0.76**	**500.9**	**0.77**	**-1.7**	**0.82**
OECD countries						
Australia	526.7	2.68	533.1	2.48	-6.4	3.33
Austria	504.7	3.92	507.6	3.75	-2.9	4.34
Belgium	523.6	3.14	527.1	3.15	-3.5	4.52
Canada	532.7	2.01	532.2	1.82	0.5	2.06
Czech Republic	519.6	4.10	513.1	4.34	6.5	4.99
Denmark	519.3	3.08	514.4	2.93	4.9	3.20
Finland	542.6	2.54	552.6	2.25	-10.0	3.03
France	518.7	3.81	519.5	2.93	-0.8	4.14
Germany	511.0	3.87	516.7	3.67	-5.7	3.90
Greece	449.5	4.94	447.5	4.11	1.9	4.37
Hungary	499.3	3.43	503.0	3.39	-3.7	3.71
Iceland	490.0	2.25	520.4	2.49	-30.5	3.90
Ireland	498.7	2.78	498.2	3.46	0.5	4.20
Italy	467.4	5.04	471.4	3.54	-4.1	6.01
Japan	546.1	5.74	548.5	4.07	-2.4	5.66
Korea, Republic of	553.7	3.99	545.6	4.82	8.1	6.10
Luxembourg	494.9	2.41	492.5	1.85	2.4	3.32
Mexico	387.0	5.04	381.9	4.67	5.1	4.45
Netherlands	522.4	3.60	517.9	3.58	4.5	4.09
New Zealand	531.1	2.65	534.4	3.11	-3.3	3.82
Norway	485.6	3.08	494.1	3.24	-8.5	3.57
Poland	486.1	3.37	487.1	3.00	-1.1	3.13
Portugal	469.8	4.58	469.8	3.90	#	†
Slovak Republic	495.1	4.07	488.2	3.56	6.9	3.66
Spain	479.2	3.64	485.2	2.59	-6.0	3.13
Sweden	503.6	2.96	513.5	2.83	-9.9	3.12
Switzerland	520.1	3.98	522.6	3.29	-2.5	4.11
Turkey	408.4	7.31	406.4	5.84	2.0	5.83
United States	476.9	3.44	477.8	3.50	-0.9	3.03
Non-OECD countries						
Hong Kong-China	545.4	6.16	550.4	4.05	-5.1	6.27
Indonesia	357.7	3.15	365.0	4.03	-7.3	3.01
Latvia	481.2	5.07	483.7	3.98	-2.6	4.65
Liechtenstein	535.1	6.65	523.5	5.92	11.5	9.84
Macao-China	538.2	4.25	526.9	3.20	11.2	5.55
Russian Federation	479.7	5.92	477.4	4.37	2.3	4.87
Serbia and Montenegro	416.5	3.81	423.9	3.92	-7.4	4.07
Thailand	418.2	3.87	430.5	3.07	-12.4	4.33
Tunisia	346.1	2.50	343.4	2.45	2.7	2.57
Uruguay	412.1	4.59	409.3	4.21	2.7	4.77
United Kingdom[1]	505.7	2.97	514.1	3.50	-8.4	4.51

† Not applicable.
# Rounds to zero.
[1]Due to low response rates, 2003 data for the United Kingdom are not discussed in this report.
NOTE: The male-female score point difference is calculated by subtracting the average scores of females from the average scores of males. The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error. Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-22. Average combined reading literacy and science literacy scores of 15-year-old students, by sex and country: 2000 and 2003

Country	Reading literacy in 2000					
	Male		Female		Male-female score point difference	
	Average	s.e.	Average	s.e.		s.e.
OECD average	**484.8**	**0.82**	**516.5**	**0.75**	**-31.7**	**0.94**
OECD countries						
Australia	512.7	4.04	546.3	4.74	-33.6	5.44
Austria	494.7	3.23	520.3	3.59	-25.6	5.24
Belgium	492.4	4.24	525.2	4.92	-32.8	5.99
Canada	518.9	1.76	551.1	1.70	-32.2	1.63
Czech Republic	472.6	4.11	510.1	2.53	-37.4	4.71
Denmark	485.4	2.95	510.3	2.87	-24.8	3.28
Finland	520.1	3.00	571.4	2.78	-51.3	2.63
France	490.3	3.50	519.1	2.72	-28.8	3.38
Germany	467.6	3.17	502.2	3.88	-34.7	5.21
Greece	455.7	6.07	492.7	4.63	-37.0	5.01
Hungary	464.5	5.34	496.2	4.35	-31.6	5.73
Iceland	488.5	2.12	528.1	2.14	-39.7	3.11
Ireland	512.8	4.18	541.5	3.55	-28.7	4.56
Italy	469.2	5.14	507.4	3.57	-38.2	7.05
Japan	507.3	6.74	536.9	5.39	-29.7	6.44
Korea, Republic of	518.5	3.77	532.7	3.70	-14.2	6.02
Luxembourg	428.8	2.58	455.7	2.30	-26.9	3.77
Mexico	411.5	4.18	431.8	3.84	-20.3	4.34
Netherlands	—	—	—	—	—	—
New Zealand	506.8	4.18	552.6	3.80	-45.8	6.28
Norway	485.6	3.79	528.8	2.86	-43.2	4.04
Poland	461.4	5.99	497.5	5.52	-36.1	6.97
Portugal	457.7	4.98	482.4	4.64	-24.7	3.77
Slovak Republic	—	—	—	—	—	—
Spain	481.2	3.35	505.4	2.76	-24.1	3.17
Sweden	498.6	2.56	535.6	2.48	-37.0	2.70
Switzerland	480.1	4.85	510.0	4.50	-30.0	4.17
Turkey	—	—	—	—	—	—
United States	489.7	8.41	518.2	6.20	-28.6	4.12
Non-OECD countries						
Hong Kong-China	—	—	—	—	—	—
Indonesia	—	—	—	—	—	—
Latvia	431.9	5.53	484.7	5.40	-52.8	4.20
Liechtenstein	468.5	7.33	499.6	6.83	-31.2	11.54
Macao-China	—	—	—	—	—	—
Russian Federation	442.8	4.53	481.0	4.09	-38.2	2.92
Serbia and Montenegro	—	—	—	—	—	—
Thailand	—	—	—	—	—	—
Tunisia	—	—	—	—	—	—
Uruguay	—	—	—	—	—	—
United Kingdom[1]	511.6	3.03	537.2	3.40	-25.6	4.28

See notes at end of table.

Table B-22. Average combined reading literacy and science literacy scores of 15-year-old students, by sex and country: 2000 and 2003—Continued

Country	Reading literacy in 2003					
	Male		Female		Male-female score point difference	
	Average	s.e.	Average	s.e.		s.e.
OECD average	**477.3**	**0.74**	**511.4**	**0.72**	**-34.1**	**0.78**
OECD countries						
Australia	506.1	2.84	545.4	2.55	-39.3	3.60
Austria	467.1	4.54	514.4	4.21	-47.2	5.23
Belgium	489.3	3.76	526.2	3.30	-36.9	5.10
Canada	514.0	2.05	545.5	1.82	-31.5	2.02
Czech Republic	473.1	4.11	504.4	4.42	-31.3	4.94
Denmark	479.4	3.31	504.8	2.98	-25.4	2.88
Finland	521.4	2.21	565.4	1.97	-44.0	2.66
France	476.1	3.79	514.3	3.18	-38.2	4.47
Germany	470.8	4.23	512.9	3.91	-42.1	4.62
Greece	452.9	5.10	490.4	3.96	-37.5	4.12
Hungary	467.2	3.16	498.2	3.05	-31.0	3.76
Iceland	463.8	2.33	521.6	2.22	-57.8	3.47
Ireland	501.1	3.26	530.1	3.71	-29.0	4.56
Italy	455.2	5.06	494.6	3.40	-39.3	6.03
Japan	486.6	5.48	509.0	4.07	-22.4	5.40
Korea, Republic of	525.5	3.69	546.7	4.27	-21.3	5.59
Luxembourg	462.7	2.60	495.7	1.84	-33.0	3.36
Mexico	388.6	4.56	410.1	4.57	-21.5	4.36
Netherlands	502.9	3.66	523.8	3.20	-20.9	3.93
New Zealand	507.7	3.13	535.4	3.29	-27.6	4.37
Norway	475.3	3.36	524.5	3.38	-49.2	3.73
Poland	476.8	3.55	516.3	3.19	-39.6	3.66
Portugal	458.5	4.28	494.9	3.72	-36.3	3.34
Slovak Republic	453.3	3.82	485.8	3.32	-32.5	3.50
Spain	460.7	3.78	499.8	2.48	-39.1	3.88
Sweden	495.9	2.81	532.7	2.89	-36.7	3.15
Switzerland	482.0	4.37	517.5	3.10	-35.5	4.69
Turkey	426.0	6.80	459.3	6.12	-33.3	5.83
United States	479.3	3.66	511.3	3.55	-32.0	3.35
Non-OECD countries						
Hong Kong-China	493.8	5.31	525.4	3.49	-31.5	5.51
Indonesia	369.5	3.35	393.5	3.92	-24.0	2.78
Latvia	470.4	4.51	509.1	3.66	-38.7	4.25
Liechtenstein	516.6	7.24	534.0	6.54	-17.4	11.87
Macao-China	490.8	3.62	504.1	2.75	-13.3	4.77
Russian Federation	427.8	4.73	456.4	3.69	-28.5	3.88
Serbia and Montenegro	389.9	3.66	433.0	3.91	-43.1	3.93
Thailand	396.4	3.72	439.2	3.01	-42.7	4.05
Tunisia	361.8	3.31	387.1	3.27	-25.3	3.56
Uruguay	414.0	4.50	453.3	3.72	-39.3	4.71
United Kingdom[1]	491.8	3.07	520.4	3.62	-28.6	4.81

See notes at end of table.

Table B-22. Average combined reading literacy and science literacy scores of 15-year-old students, by sex and country: 2000 and 2003—Continued

Country	Science literacy in 2000					
	Male		Female		Male-female score point difference	
	Average	s.e.	Average	s.e.		s.e.
OECD average	**500.5**	**0.88**	**500.7**	**0.76**	**0.2**	**1.01**
OECD countries						
Australia	526.4	3.91	528.9	4.78	-2.5	5.29
Austria	525.7	3.79	513.9	4.27	11.8	6.25
Belgium	495.9	5.24	498.0	5.61	-2.1	6.68
Canada	529.1	1.91	531.0	1.74	-1.8	1.88
Czech Republic	511.9	3.83	511.4	3.20	0.5	5.07
Denmark	487.6	3.91	475.9	3.54	11.7	4.76
Finland	534.5	3.51	541.0	2.70	-6.5	3.83
France	504.1	4.24	498.1	3.77	6.0	4.80
Germany	489.2	3.38	486.7	3.43	2.5	4.73
Greece	457.0	6.08	464.4	5.16	-7.4	5.75
Hungary	495.7	5.79	497.3	5.02	-1.6	6.90
Iceland	494.8	3.44	499.5	3.01	-4.7	4.73
Ireland	510.7	4.23	516.9	4.17	-6.5	5.52
Italy	473.6	5.62	482.6	3.90	-9.0	7.73
Japan	546.7	7.18	554.1	5.89	-7.4	7.20
Korea, Republic of	560.7	4.34	541.3	5.13	19.4	7.64
Luxembourg	441.0	3.58	447.5	3.25	-6.5	4.99
Mexico	423.3	4.20	419.0	3.85	4.3	4.82
Netherlands	—	—	—	—	—	—
New Zealand	522.9	4.62	534.8	3.80	-11.9	7.00
Norway	498.8	4.07	505.4	3.25	-6.6	4.95
Poland	486.1	6.10	480.0	6.50	6.1	7.37
Portugal	456.2	4.81	462.5	4.24	-6.3	4.35
Slovak Republic	—	—	—	—	—	—
Spain	492.1	3.49	491.4	3.58	0.7	4.01
Sweden	512.2	3.49	512.6	2.87	-0.4	3.92
Switzerland	499.7	5.69	492.7	4.65	7.0	5.38
Turkey	—	—	—	—	—	—
United States	497.0	8.93	501.8	6.49	-4.9	5.31
Non-OECD countries						
Hong Kong-China	—	—	—	—	—	—
Indonesia	—	—	—	—	—	—
Latvia	449.3	6.40	472.0	5.83	-22.7	5.36
Liechtenstein	484.1	10.93	468.4	9.29	15.7	14.65
Macao-China	—	—	—	—	—	—
Russian Federation	453.2	5.36	467.4	5.16	-14.2	4.50
Serbia and Montenegro	—	—	—	—	—	—
Thailand	—	—	—	—	—	—
Tunisia	—	—	—	—	—	—
Uruguay	—	—	—	—	—	—
United Kingdom[1]	535.0	3.44	531.4	3.98	3.6	5.20

See notes at end of table.

Table B-22. Average combined reading literacy and science literacy scores of 15-year-old students, by sex and country: 2000 and 2003—Continued

Country	Science literacy in 2003					
	Male		Female		Male-female score point difference	
	Average	s.e.	Average	s.e.		s.e.
OECD average	**502.5**	**0.74**	**496.8**	**0.75**	**5.8**	**0.90**
OECD countries						
Australia	524.9	2.91	525.2	2.78	-0.2	3.84
Austria	489.7	4.28	492.3	4.18	-2.6	4.95
Belgium	508.8	3.57	508.9	3.48	-0.1	5.03
Canada	527.4	2.30	516.3	2.22	11.0	2.58
Czech Republic	526.1	4.25	520.4	4.07	5.7	4.90
Denmark	484.0	3.59	466.8	3.16	17.2	3.18
Finland	545.2	2.55	551.2	2.17	-6.1	2.77
France	511.2	4.14	511.3	3.54	-0.1	4.82
Germany	505.7	4.47	500.0	4.19	5.7	4.77
Greece	487.4	4.78	475.1	3.93	12.3	4.20
Hungary	502.7	3.31	504.0	3.35	-1.3	3.68
Iceland	489.8	2.37	500.0	2.42	-10.2	3.79
Ireland	506.4	3.08	504.4	3.88	2.0	4.48
Italy	489.5	5.16	483.6	3.63	5.9	6.31
Japan	550.0	6.00	545.6	4.10	4.4	6.01
Korea, Republic of	545.9	4.73	527.5	5.51	18.4	7.05
Luxembourg	489.2	2.53	476.5	1.88	12.7	3.31
Mexico	409.7	3.87	400.4	4.23	9.3	4.06
Netherlands	526.9	4.16	521.8	3.65	5.1	4.66
New Zealand	528.8	2.96	513.0	3.36	15.8	4.21
Norway	485.0	3.45	483.3	3.33	1.7	3.61
Poland	501.2	3.24	494.4	3.37	6.8	3.30
Portugal	471.0	4.01	464.8	3.64	6.3	3.18
Slovak Republic	502.1	4.28	487.3	3.92	14.8	3.67
Spain	489.1	3.85	485.1	2.59	4.0	3.92
Sweden	508.6	3.07	503.7	3.46	4.9	3.61
Switzerland	518.0	4.99	507.6	3.94	10.3	5.01
Turkey	434.4	6.66	434.0	6.42	0.5	5.79
United States	493.7	3.45	488.7	3.52	5.0	3.27
Non-OECD countries						
Hong Kong-China	537.8	6.05	541.2	4.19	-3.4	6.00
Indonesia	395.6	3.07	394.5	3.84	1.1	2.68
Latvia	487.2	5.11	490.9	3.90	-3.8	4.68
Liechtenstein	537.8	7.72	511.9	7.32	26.0	12.48
Macao-China	529.0	5.02	520.6	4.04	8.3	6.78
Russian Federation	493.9	5.35	484.7	3.97	9.2	4.27
Serbia and Montenegro	433.7	3.69	438.9	4.22	-5.2	3.82
Thailand	424.7	3.73	432.7	3.13	-8.0	4.24
Tunisia	379.7	2.75	389.5	2.99	-9.9	2.64
Uruguay	440.5	3.71	436.3	3.59	4.2	4.42
United Kingdom[1]	520.2	3.14	516.8	3.98	3.4	5.16

—Not available.

[1]Due to low response rates, 2003 data for the United Kingdom are not discussed in this report.

NOTE: The male-female score point difference is calculated by subtracting the average scores of females from the average scores of males. The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. s.e. means standard error.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2000 and 2003.

Table B-23. Mean International Socioeconomic Index (ISEI) score of 15-year-old students, by quarters of the ISEI index and country: 2003

Country	Mean		Bottom quarter		Second quarter		Third quarter		Top quarter	
	Index score	s.e.	Index score	s.e.	Index score	s.e.	Index score	s.e.	Index score	s.e.
OECD average	**48.8**	**0.08**	**28.2**	**0.04**	**42.3**	**0.08**	**53.2**	**0.09**	**71.2**	**0.13**
OECD countries										
Australia	52.6	0.30	31.6	0.14	48.0	0.07	58.3	0.11	72.5	0.14
Austria	47.1	0.52	27.3	0.19	40.9	0.11	51.4	0.12	68.7	0.28
Belgium	50.6	0.38	29.0	0.13	44.5	0.13	56.4	0.13	72.4	0.16
Canada	52.6	0.27	31.7	0.11	47.7	0.08	58.1	0.09	72.9	0.15
Czech Republic	50.1	0.34	32.3	0.18	45.7	0.12	52.5	0.05	69.7	0.23
Denmark	49.3	0.45	29.4	0.19	44.2	0.11	53.2	0.07	70.3	0.29
Finland	50.2	0.36	28.7	0.12	43.4	0.16	56.4	0.14	72.4	0.18
France	48.7	0.47	27.6	0.20	42.3	0.15	53.6	0.05	71.2	0.26
Germany	49.3	0.42	29.5	0.17	42.6	0.14	53.7	0.06	71.5	0.25
Greece	46.9	0.72	26.9	0.13	38.8	0.13	51.8	0.07	70.3	0.39
Hungary	48.6	0.33	30.2	0.18	42.3	0.08	51.6	0.11	70.2	0.20
Iceland	53.7	0.26	31.5	0.20	48.0	0.13	61.7	0.19	73.7	0.25
Ireland	48.3	0.49	28.5	0.17	42.2	0.11	52.7	0.08	70.0	0.29
Italy	46.8	0.38	26.9	0.16	40.3	0.11	50.6	0.05	69.5	0.38
Japan	50.0	0.31	33.4	0.17	43.9	0.04	50.6	0.08	72.0	0.25
Korea, Republic of	46.3	0.36	28.9	0.20	43.5	0.09	49.4	0.06	63.5	0.43
Luxembourg	48.2	0.22	27.3	0.15	42.1	0.13	52.8	0.06	70.5	0.24
Mexico	40.1	0.68	22.2	0.12	28.9	0.04	42.1	0.28	67.3	0.25
Netherlands	51.3	0.38	30.9	0.26	45.4	0.15	56.9	0.20	71.8	0.25
New Zealand[1]	51.5	0.36	30.1	0.19	46.2	0.12	56.8	0.17	72.7	0.26
Norway	54.6	0.39	35.0	0.20	49.0	0.12	60.6	0.16	73.9	0.21
Poland	45.0	0.34	26.9	0.21	39.5	0.11	49.1	0.10	64.4	0.34
Portugal	43.1	0.54	26.4	0.14	33.9	0.08	46.6	0.19	65.5	0.53
Slovak Republic	48.8	0.40	29.3	0.17	41.4	0.09	53.1	0.10	71.5	0.21
Spain	44.3	0.58	26.2	0.13	35.5	0.14	49.3	0.11	66.1	0.39
Sweden	50.6	0.38	30.4	0.18	44.1	0.14	56.1	0.17	71.9	0.21
Switzerland	49.3	0.43	29.4	0.14	43.1	0.14	53.5	0.08	71.1	0.27
Turkey	41.6	0.75	23.7	0.29	33.6	0.15	47.2	0.10	61.8	0.77
United States	54.6	0.37	32.6	0.21	49.9	0.15	61.4	0.12	74.3	0.21
Non-OECD countries										
Hong Kong-China	41.1	0.45	25.9	0.14	34.9	0.07	45.1	0.13	58.7	0.37
Indonesia	33.6	0.61	16.0	0.00	24.1	0.15	34.6	0.33	59.9	0.42
Latvia	50.3	0.52	29.1	0.23	44.2	0.16	54.8	0.14	73.0	0.30
Liechtenstein	50.7	0.75	30.8	0.63	47.4	0.52	55.0	0.09	70.0	0.67
Macao-China	39.4	0.40	25.8	0.32	34.4	0.12	41.7	0.25	55.9	0.52
Russian Federation	49.9	0.38	30.8	0.16	40.8	0.10	54.2	0.21	73.6	0.20
Serbia and Montenegro	48.1	0.53	28.3	0.20	41.2	0.12	51.4	0.11	71.4	0.38
Thailand	36.0	0.43	22.1	0.14	26.7	0.13	35.6	0.13	59.6	0.41
Tunisia	37.5	0.60	18.0	0.17	29.2	0.18	39.6	0.19	63.1	0.44
Uruguay	46.1	0.48	25.2	0.16	37.8	0.15	50.8	0.12	70.8	0.36
United Kingdom[2]	49.6	0.39	28.5	0.14	43.0	0.14	53.2	0.09	71.6	0.19

[1]The item response rate for ISEI for New Zealand is below 85 percent. Missing data have not been explicitly accounted for. See also table A-2.

[2]Due to low response rates, 2003 data for the United Kingdom are not discussed in this report.

NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. The International Socioeconomic Index (ISEI) is an internationally comparable index of occupational status, with a range of approximately 16 to 90, developed by Ganzeboom, De Graaf, and Treiman (1992). s.e. means standard error.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-24. Average combined mathematics literacy scores of 15-year-old students, by quarters of the International Socioeconomic Index (ISEI) and country: 2003

Country	Mathematics literacy							
	Bottom quarter		Second quarter		Third quarter		Top quarter	
	Average	s.e.	Average	s.e.	Average	s.e.	Average	s.e.
OECD average	**455.5**	**0.92**	**493.2**	**0.75**	**516.1**	**0.73**	**547.7**	**0.84**
OECD countries								
Australia	488.5	2.81	520.2	2.74	539.3	2.68	565.6	2.87
Austria	466.7	4.40	492.3	3.65	523.9	3.26	547.7	4.44
Belgium	482.1	3.69	527.3	3.16	555.5	2.82	589.8	3.26
Canada	506.1	1.96	530.9	2.31	544.1	2.11	568.7	2.79
Czech Republic	485.6	4.01	507.7	3.85	530.0	3.89	569.7	4.25
Denmark	480.9	3.42	504.0	3.64	525.5	3.94	554.2	3.53
Finland	515.1	2.66	536.3	2.73	551.8	2.92	576.5	2.89
France	469.4	3.72	507.2	4.22	524.8	2.97	556.6	3.76
Germany	462.7	4.93	505.1	3.32	528.1	3.83	564.6	3.98
Greece	409.3	4.28	435.5	3.75	450.4	4.46	492.9	5.00
Hungary	449.5	3.93	472.8	3.87	503.0	3.36	547.5	3.92
Iceland	497.1	3.11	512.4	3.19	518.6	3.06	537.7	3.11
Ireland	470.8	3.93	495.9	3.22	512.9	3.05	540.9	3.50
Italy	430.5	4.19	456.8	3.93	478.2	3.62	502.2	4.11
Japan	505.1	5.09	534.4	4.75	543.0	4.40	567.6	6.36
Korea, Republic of	511.3	4.44	547.4	3.67	549.0	3.58	567.7	6.09
Luxembourg	448.4	2.96	481.1	2.96	508.8	2.55	542.4	3.14
Mexico	357.4	4.81	373.6	3.87	394.3	3.66	424.1	4.87
Netherlands	501.5	4.33	534.8	3.79	558.6	3.48	584.2	3.90
New Zealand[1]	484.8	3.80	514.5	3.38	532.4	3.30	564.3	3.42
Norway	460.8	3.49	488.5	3.64	506.7	3.45	532.6	3.52
Poland	455.0	3.94	479.1	3.22	497.7	3.33	534.4	3.14
Portugal	431.3	5.28	447.1	3.38	481.0	3.82	511.5	3.83
Slovak Republic	456.5	4.17	484.2	3.35	523.0	3.54	544.3	3.84
Spain	454.0	3.62	475.1	2.79	495.9	3.18	519.4	3.32
Sweden	477.1	3.69	501.3	3.13	517.8	3.88	550.7	4.15
Switzerland	487.1	4.05	523.9	4.12	537.8	4.86	568.3	3.89
Turkey	395.3	5.65	410.9	6.74	419.6	7.48	478.8	12.51
United States	447.7	3.16	476.9	3.76	496.7	4.03	529.7	3.68
Non-OECD countries								
Hong Kong-China	532.1	5.50	547.4	5.11	562.0	4.15	574.7	5.57
Indonesia	335.5	4.30	355.6	4.14	360.9	4.48	397.1	6.28
Latvia	456.6	3.80	474.7	4.31	493.5	4.55	514.0	5.03
Liechtenstein	482.5	10.29	530.3	11.22	552.9	9.56	587.5	10.97
Macao-China	521.8	5.22	523.3	6.33	527.6	7.45	540.5	7.32
Russian Federation	443.1	4.48	459.3	5.27	472.9	4.89	501.3	4.75
Serbia and Montenegro	406.0	3.72	426.1	3.81	448.6	4.29	474.8	4.99
Thailand	396.0	3.60	398.9	3.45	426.5	4.04	456.6	5.17
Tunisia	330.8	3.03	341.9	3.97	360.8	3.84	405.6	6.13
Uruguay	388.2	4.77	415.1	3.98	429.8	4.17	477.6	3.83
United Kingdom[2]	469.1	2.92	500.0	3.06	519.1	3.53	555.1	3.43

[1]The item response rate for ISEI for New Zealand is below 85 percent. Missing data have not been explicitly accounted for. See also table A-2.
[2]Due to low response rates, 2003 data for the United Kingdom are not discussed in this report.
NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. The International Socioeconomic Index (ISEI) is an internationally comparable index of occupational status developed by Ganzeboom, De Graaf, and Treiman (1992). s.e. means standard error.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-25. Change in the combined mathematics literacy and problem-solving scores per one standard deviation change in the International Socioeconomic Index (ISEI) score, by country: 2003

Country	Mathematics literacy		Problem solving	
	Change	s.e.	Change	s.e.
OECD average	**33.7**	**0.40**	—	—
OECD countries				
Australia	30.1	1.35	27.6	1.36
Austria	30.7	1.92	30.2	1.98
Belgium	39.8	1.71	37.0	1.73
Canada	24.4	1.17	21.8	1.19
Czech Republic	37.5	1.97	33.8	2.12
Denmark	28.9	1.71	25.4	1.73
Finland	21.7	1.29	20.0	1.48
France	31.6	1.93	32.9	2.22
Germany	38.0	1.95	36.5	1.85
Greece	29.4	2.11	31.1	2.10
Hungary	40.8	2.17	41.7	2.34
Iceland	14.4	1.51	14.3	1.53
Ireland	27.4	1.89	28.1	1.85
Italy	27.1	1.88	28.4	2.08
Japan	23.0	3.12	21.0	3.01
Korea, Republic of	26.4	3.28	23.0	3.06
Luxembourg	33.7	1.56	33.3	1.75
Mexico	23.5	1.88	28.9	2.40
Netherlands	32.3	2.03	32.9	2.00
New Zealand[1]	29.4	1.65	30.6	1.88
Norway	29.2	1.62	31.2	1.95
Poland	35.2	1.82	33.8	1.93
Portugal	34.3	1.70	35.4	2.20
Slovak Republic	33.2	1.83	34.4	2.08
Spain	25.4	1.43	28.7	1.58
Sweden	28.7	1.79	26.9	1.73
Switzerland	30.3	1.71	29.4	1.75
Turkey	38.1	5.87	34.9	5.33
United States	30.2	1.37	31.1	1.58
Non-OECD countries				
Hong Kong-China	22.6	2.64	24.9	2.60
Indonesia	22.0	2.35	22.2	2.02
Latvia	21.0	1.69	19.8	2.17
Liechtenstein	41.2	5.92	40.3	5.44
Macao-China	11.7	3.97	10.6	4.33
Russian Federation	21.4	1.77	24.0	2.07
Serbia and Montenegro	26.0	1.86	24.9	1.75
Thailand	26.6	2.35	26.0	2.32
Tunisia	28.3	2.56	27.2	2.08
Uruguay	31.4	1.83	35.6	2.37
United Kingdom[2]	31.8	1.46	29.7	1.63

—Not available.

[1]The item response rate for ISEI for New Zealand is below 85 percent. Missing data have not been explicitly accounted for. See also table A-2.

[2]Due to low response rates, 2003 data for the United Kingdom are not discussed in this report.

NOTE: The OECD average is the average of the national averages of the OECD member countries with data available. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and are not included in the OECD average. The International Socioeconomic Index (ISEI) is an internationally comparable index of occupational status, with a range of approximately 16 to 90, developed by Ganzeboom, De Graaf, and Treiman (1992). The overall linkage of ISEI to mathematics literacy and problem solving is examined using the specific change in score on the combined mathematics literacy scale or problem solving in response to a one standard deviation change in the ISEI index score for each country. A greater increase in achievement score in a country implies a stronger relationship between socioeconomic status and performance in that country. s.e. means standard error.

SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Table B-26. Average combined mathematics literacy, problem-solving, reading literacy, and science literacy scores of U.S. 15-year-old students, by race/ethnicity: 2003

Race/ethnicity	Mathematics literacy		Problem solving		Reading literacy		Science literacy	
	Average	s.e.	Average	s.e.	Average	s.e.	Average	s.e.
Total	**482.9**	**2.95**	**477.4**	**3.13**	**495.2**	**3.22**	**491.3**	**3.08**
White	511.6	2.51	505.7	2.54	524.8	2.57	521.6	2.60
Black	417.3	5.08	413.2	5.69	429.9	5.62	422.7	4.69
Hispanic	442.7	5.13	435.6	5.54	452.6	5.86	448.1	5.63
Asian	506.3	9.79	505.3	9.94	513.1	9.22	508.9	10.59
More than one race	502.2	6.36	497.5	7.05	515.2	7.35	517.0	7.21
OECD average	500.0	0.63	500.0	0.65	494.2	0.65	499.6	0.60

NOTE: Reporting standards not met for American Indian/Alaska Native and Native Hawaiian/Other Pacific Islander; thus, they are included in the total, but not reported separately. Black includes African American and Hispanic includes Latino. Racial categories exclude Hispanic origin. s.e. means standard error.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

Appendix C: TIMSS-PISA 2003 Expert Panelists

Rolf Blank
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Council of Chief State School Officers
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Betsy Brand
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Nancy R. Bunt, Ed.D.
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Ramesh Gangolli
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Patricia Harvey
Superintendent
Saint Paul Public Schools
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Kati Haycock
Director
The Education Trust
Washington, DC

S. Anders Hedberg
Director
Bristol-Myers Squibb Foundation
Princeton, NJ

Jack Jennings
Director
Center on Education Policy
Washington, DC

Appendix D:
PISA Online Resources and Publications

Online Resources

The PISA NCES website (http://nces.ed.gov/surveys/pisa) provides background information on the PISA surveys, copies of NCES publications that relate to PISA, and sample PISA items from previous assessments.

NCES Publications

The following publications are intended to serve as examples of some of the numerous reports that have been produced in relation to PISA by NCES. All of the publications listed here are available at http://nces.ed.gov/surveys/pisa.

Summary Reports

Lemke, M., Calsyn, C., Lippman, L., Jocelyn, L., Kastberg, D., Liu, Y., Roey, S., Williams, T., Kruger, T., and Bairu, G. (2001). *Highlights from the 2000 Program for International Student Assessment* (NCES 2002–116). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Lemke, M., Calsyn, C., Lippman, L., Jocelyn, L., Kastberg, D., Liu, Y.Y., Roey, S., Williams, T., Kruger, T., Bairu, G. (2001). *Outcomes of Learning: Results from the 2000 Program for International Student Assessment of 15-Year-Olds in Reading, Mathematics, and Science Literacy* (NCES 2002–115). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Thematic Reports

Lemke, M., Sen, A., Pahlke, E., Williams, T., Kastberg, D., and Jocelyn, L. (forthcoming). *Characteristics of U.S. 15-Year-Old Low Achievers in an International Context: Findings from PISA 2000* (NCES 2002–005). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Data Products

U.S. Department of Education, National Center for Education Statistics. (2004). *Program for International Student Assessment (PISA) 2000 Data File* (NCES 2004–006). Washington, DC: Author.

International Publications

The following publications are intended to serve as examples of some of the numerous reports that have been produced in relation to PISA by the OECD and other international organizations. All of the publications listed here are available at http://www.pisa.oecd.org.

Summary and Achievement Reports

Organization for Economic Cooperation and Development (OECD). (2001). *Knowledge and Skills for Life: First Results from the OECD Programme for International Student Assessment*. Paris: Author.

Thematic Reports

Artelt, C., Baumert, J., Julius-McElvany, N. and Peschar, J. (2003) *Learners for Life: Student Approaches to Learning. Results from PISA 2000*. Paris: OECD.

Kirsch, I., de Jong, J., Lafontaine, D., McQueen, J., Mendelovits, J., and Monseur, C. (2002). *Reading for Change: Performance and Engagement Across Countries. Results from PISA 2000*. Paris: OECD.

Willms, J.D. (2003). *Student Engagement in School: A Sense of Belonging and Participation. Results from PISA 2000*. Paris: OECD.

Technical Reports and Frameworks

Adams, R (Ed.) (2003). *PISA 2000 Technical Report*. Paris: Organization for Economic Cooperation and Development (OECD).

Organization for Economic Cooperation and Development (OECD). (2000). *Measuring Student Knowledge and Skills: The PISA 2000 Assessment of Reading, Mathematical and Scientific Literacy*. Paris: Author.

Organization for Economic Cooperation and Development (OECD). (1999). *Measuring Student Knowledge and Skills: A New Framework for Assessment*. Paris: Author.

Organization for Economic Cooperation and Development (OECD). (2002). *Programme for International Student Assessment (PISA): Manual for the PISA 2000 Database*. Paris: Author.