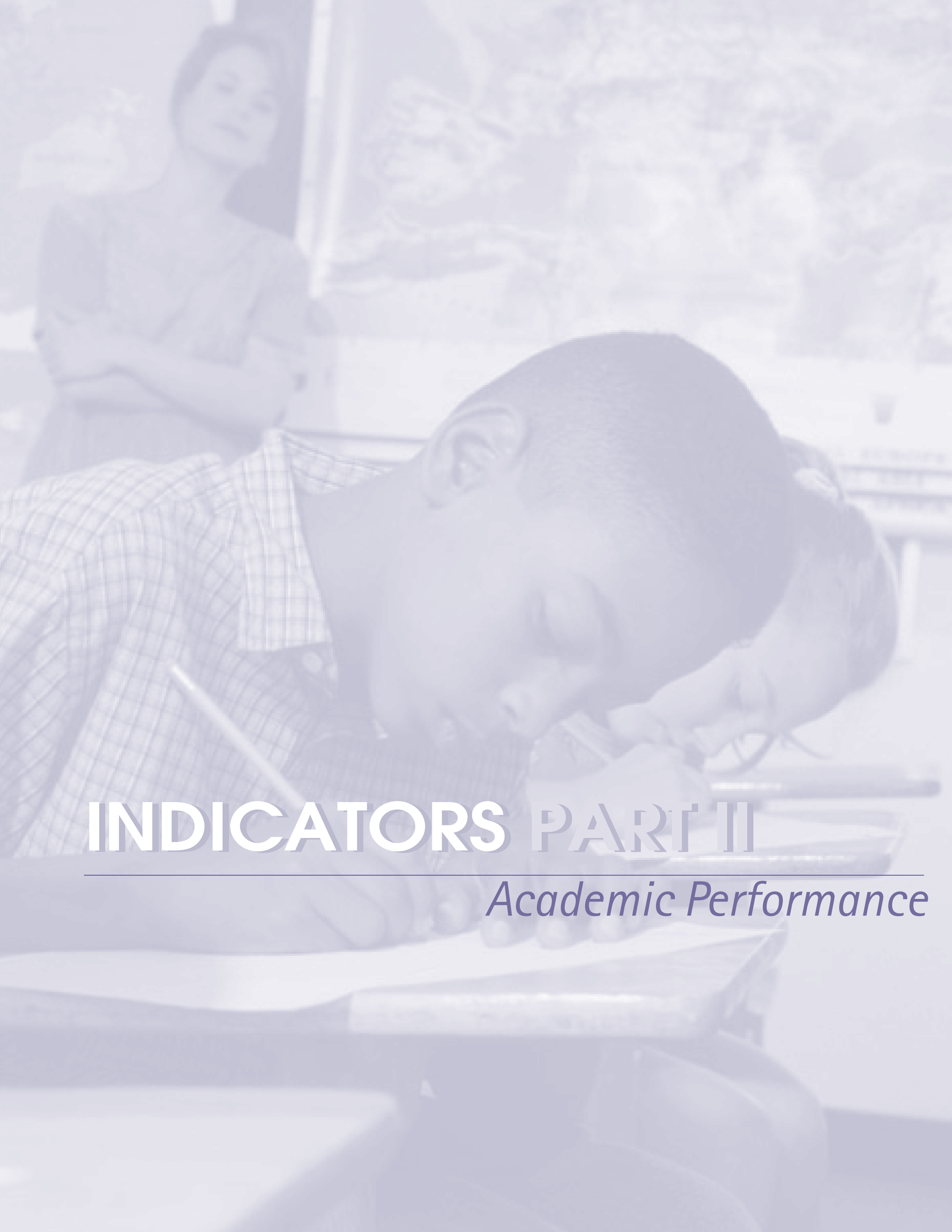


INDICATORS PART II

Academic Performance

ACADEMIC PERFORMANCE OF FOURTH-GRADERS IN MATHEMATICS AND SCIENCE

Key Findings: Italy, Japan, Russian Federation, United Kingdom (England and Scotland only),[4] United States

On the TIMSS 2003 fourth-grade mathematics assessment, students in Japan outperformed students in the other participating G-8 countries, with higher percentages of students in Japan reaching each international benchmark.

The Trends in International Mathematics and Science Study (TIMSS) assessed students in fourth and eighth grade in mathematics and science in 2003. This indicator presents the percentage of fourth-grade students reaching the four international benchmarks (low, intermediate, high, and advanced) that were established in each of the two subject areas.

On the TIMSS 2003 fourth-grade mathematics assessment, students in Japan outperformed students in the other participating G-8 countries, with higher percentages of students in Japan reaching each benchmark. In Japan, 89 percent of fourth-grade students were at or above the intermediate benchmark in mathematics; the percentages in the other G-8 countries ranged from 60 percent in Scotland to 76 percent in the Russian Federation (figure 4). In the United States, 72 percent of students met the intermediate benchmark in mathematics.

Similarly, a higher percentage of fourth-grade students in Japan than in the other G-8 countries were at or above the high benchmark in mathematics. In Japan, 60 percent of fourth-grade students reached the high benchmark, while in the other countries, the percentages ranged from 22 percent in Scotland to 43 percent in England. In the United States, 35 percent of fourth-graders reached the high benchmark in mathematics.

The highest international benchmark, advanced, was reached by 21 percent of Japan's fourth-grade students in mathematics, compared with percentages ranging from 3 percent in Scotland to 14 percent in England. In the United States, 7 percent of fourth-graders reached the advanced benchmark in mathematics.

As in mathematics, a greater percentage of Japanese students than their peers in the other G-8 countries were at or above the intermediate benchmark in science. In Japan, 84 percent of fourth-graders met the intermediate benchmark, compared with percentages ranging from 66 percent in Scotland to 79 percent in England. In the United States, 78 percent of fourth-graders met the intermediate benchmark in science.

The percentages of fourth-grade students at or above the high achievement benchmark in science ranged from 27 percent in Scotland to 49 percent in Japan. In the United States, 45 percent of students reached the high benchmark in science.

The percentages of students meeting the advanced benchmark in science ranged from 5 percent in Scotland to 15 percent in England (with Japan at 12 percent). In the United States, 13 percent of fourth-graders reached the advanced benchmark. Thus, whereas higher percentages of students in Japan than in the other G-8 countries reached each benchmark in mathematics, this was not a consistent finding in science.

Definitions and Methodology

On the 2003 Trends in International Mathematics and Science Study (TIMSS 2003), countries were required to sample students in the upper of the two grades that contained the largest number of 9-year-olds. In the United States and most countries, this corresponds to grade 4.

Since the TIMSS mathematics and science achievement scales were designed to provide reliable measures of student achievement over time, the metric of the scale was established originally with the 1995 assessment. To facilitate the cross country comparison of achievement scores, an international average was calculated whereby all the participating countries contributed equally. The data were then standardized to set the international average at 500, with a range from 0 to 1000 and a standard deviation of 100. Since the individual country means were weighted averages of the student scores, this standardization implied that about two-thirds of the students across all the participating countries scored between 400 and 600.

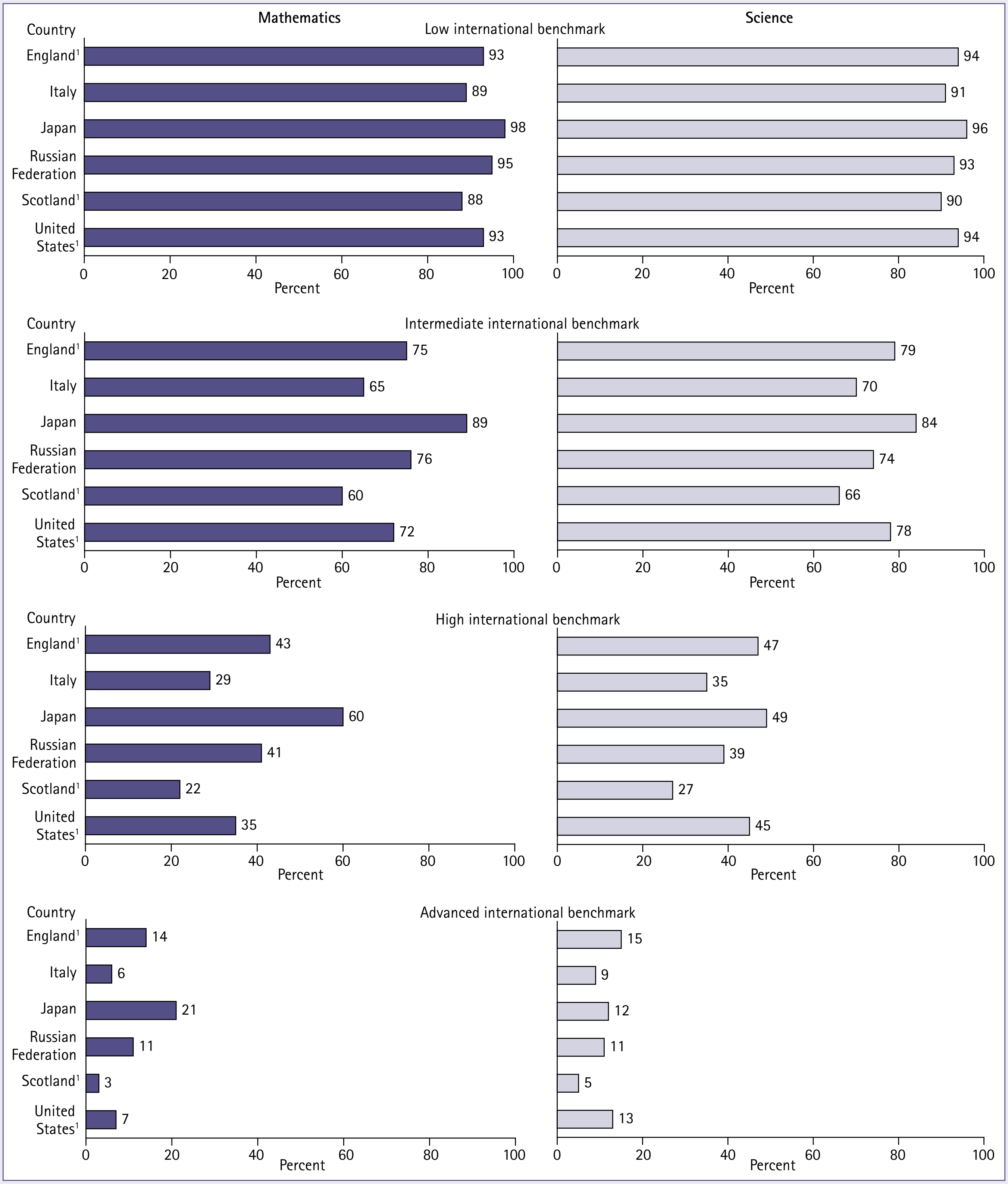
In order to provide meaningful descriptions of what performance on the scales could mean in terms of the mathematics or science that students know and can do, TIMSS established four international achievement benchmarks in mathematics and science (low, intermediate, high, and advanced). Four points on the scales were identified for use as international benchmarks: 625 for the advanced benchmark, 550 for the high benchmark, 475 for the intermediate benchmark, and 400 for the low benchmark. These were selected to represent the range of performance shown by students internationally.

At the fourth-grade level in mathematics, students at the low benchmark demonstrate some basic mathematical knowledge, such as an understanding of whole numbers and the properties of basic geometric shapes. At the intermediate benchmark, students can apply basic mathematical knowledge in straightforward situations, such as performing operations with 3- and 4-digit numbers and decimals and extending simple patterns. At the high benchmark, students can apply their knowledge and understanding to solve problems, such as multistep word problems involving addition, multiplication, and division and problems requiring the use of data in tables and graphs. Students at the advanced benchmark demonstrate an understanding of fractions, decimals, and measurement concepts, and use data interpretation in a wide variety of relatively complex situations.

At the fourth-grade level in science, students at the low benchmark demonstrate some elementary knowledge of the earth, life, and physical sciences, such as simple facts about magnets, electricity, and boiling. At the intermediate benchmark, students can apply basic knowledge and understanding to practical situations in the sciences, such as knowing some basic information about Earth's features and processes, human biology, and health. At the high benchmark, students can apply knowledge and understanding to explain everyday phenomena, such as demonstrating some knowledge of life processes, physical states, and chemical changes. Students at the advanced benchmark can apply knowledge and understanding in beginning scientific inquiry, such as classifying organisms according to major physical and behavioral features.

[4]In the data source for this indicator (TIMSS 2003), the United Kingdom is represented separately by two of its component jurisdictions, England and Scotland. Northern Ireland and Wales did not participate in this study.

Figure 4. Percentage of fourth-grade students reaching TIMSS international benchmarks in mathematics and science, by country: 2003



[1]Met guidelines for sample participation rates only after replacement schools were included. That is, to avoid sample size losses resulting from sampled schools not participating in the 2003 Trends in International Mathematics and Science Study (TIMSS 2003), a mechanism was instituted to identify, a priori, replacement schools that have similar characteristics to the sampled schools that they may replace.

SOURCE: Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., and Chrostowski, S.J. (2004). *TIMSS 2003 International Science Report: Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades,* exhibit 2.2. Chestnut Hill, MA: Boston College; and Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., and Chrostowski, S.J. (2004). *TIMSS 2003 International Mathematics Report: Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades,* exhibit 2.2. Chestnut Hill, MA: Boston College.

DIFFERENCES IN FOURTH-GRADE MATHEMATICS AND SCIENCE ACHIEVEMENT BY SEX

Key Findings: Italy, Japan, Russian Federation, United Kingdom (England and Scotland only),[5] United States

In the United States and Scotland, fourth-grade males scored higher, on average, than fourth-grade females in both mathematics and science achievement.

The Trends in International Mathematics and Science Study (TIMSS) assessed fourth- and eighth-grade students in mathematics and science in 2003. This indicator addresses differences by sex in mathematics and science achievement among fourth-grade students in participating G-8 countries.

On the TIMSS 2003 mathematics assessment, fourth-grade males in Italy, Scotland, and the United States outperformed females. In the United States, the difference in performance was 8 points, with males scoring an average of 522 compared with 514 among females (figures 5a and 5b). In Italy, the difference by sex was 9 points (507 for males vs. 498 for females), and in Scotland, the difference by sex was 11 points (496 for males vs. 485 for females). In England, Japan, and the Russian Federation, no measurable differences were detected between the average scale scores of fourth-grade males and females.

On the TIMSS 2003 science assessment, the United States and Scotland were the only G-8 countries where there was a difference by sex in the average scale scores of fourth-graders. In the United States, fourth-grade males scored 5 points higher than fourth-grade females (538 versus 533); in Scotland, males outperformed females by an average of 11 points (508 versus 496). In England, Italy, Japan, and the Russian Federation, no measurable differences by sex were detected in the performance of fourth-grade students.

Definitions and Methodology

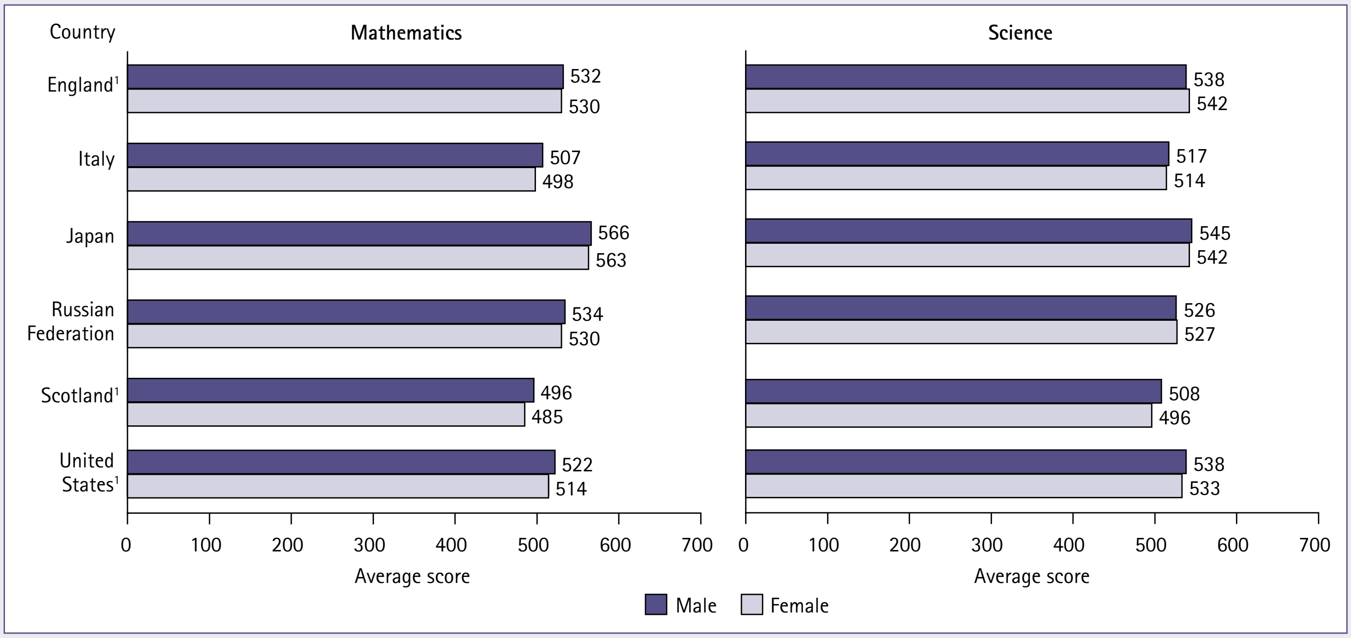
On the 2003 Trends in International Mathematics and Science Study (TIMSS 2003), countries were required to sample students in the upper of the two grades that contained the largest number of 9-year-olds. In the United States and most countries, this corresponds to grade 4.

Since the TIMSS mathematics and science achievement scales were designed to provide reliable measures of student achievement over time, the metric of the scale was established originally with the 1995 assessment. To facilitate the cross country comparison of achievement scores, an international average was calculated whereby all the participating countries contributed equally. The data were then standardized to set the international average at 500, with a range from 0 to 1000 and a standard deviation of 100. Since the individual country means were weighted averages of the student scores, this standardization implied that about two-thirds of the students across all the participating countries scored between 400 and 600.

Male-female score-point differences in mathematics and science achievement presented in the text and in figure 5b are computed from unrounded numbers; therefore, they may differ from computations made using the rounded whole numbers that appear in figure 5a.

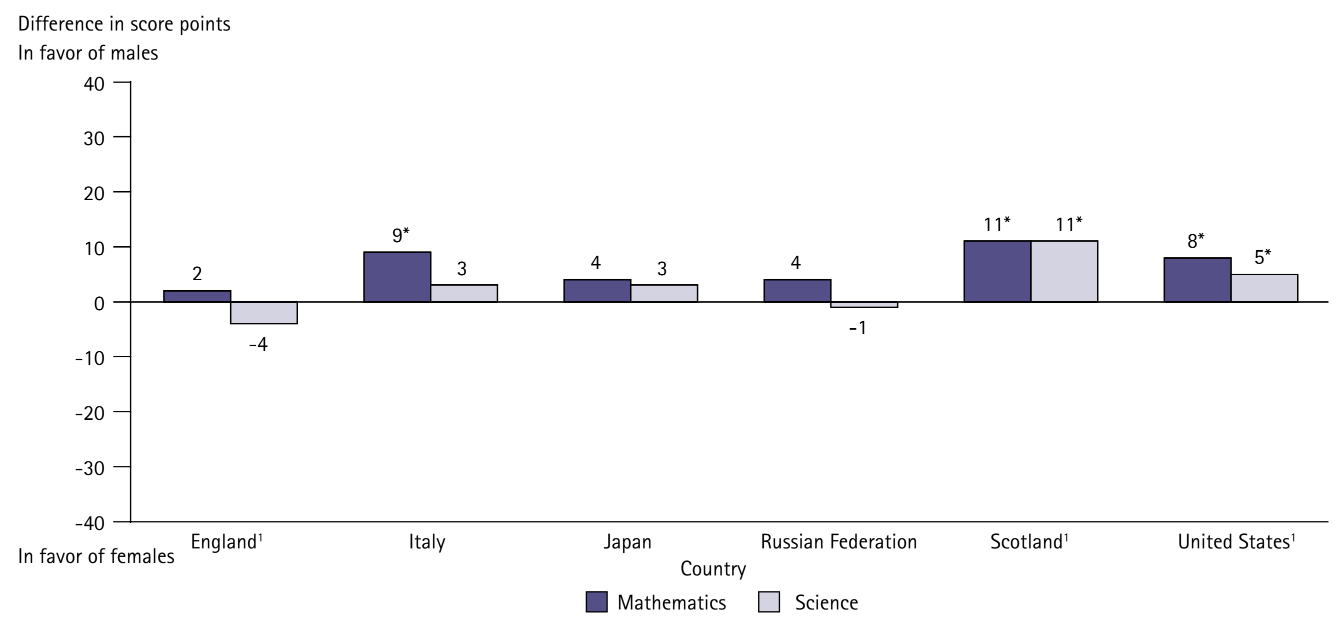
[5]In the data source for this indicator (TIMSS 2003), the United Kingdom is represented separately by two of its component jurisdictions, England and Scotland. Northern Ireland and Wales did not participate in this study.

Figure 5a. Average scale scores of fourth-grade students in mathematics and science, by sex and country: 2003



[1]Met guidelines for sample participation rates only after replacement schools were included. That is, to avoid sample size losses resulting from sampled schools not participating, a mechanism was instituted to identify, a priori, replacement schools that have similar characteristics to the sampled schools that they may replace.
SOURCE: Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., and Chrostowski, S.J. (2004). *TIMSS 2003 International Science Report: Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades*, exhibit 1.4. Chestnut Hill, MA: Boston College; and Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., and Chrostowski, S.J. (2004). *TIMSS 2003 International Mathematics Report: Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades*, exhibit 1.4. Chestnut Hill, MA: Boston College.

Figure 5b. Difference in average scale scores between fourth-grade males and females in mathematics and science, by country: 2003



*p < .05 (difference in score points is statistically significant).
[1]Met guidelines for sample participation rates only after replacement schools were included. That is, to avoid sample size losses resulting from sampled schools not participating, a mechanism was instituted to identify, a priori, replacement schools that have similar characteristics to the sampled schools that they may replace.
NOTE: Differences shown are computed by subtracting the average unrounded score for females from the average unrounded score for males. Thus, positive values indicate higher average scores for males.
SOURCE: Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., and Chrostowski, S.J. (2004). *TIMSS 2003 International Science Report: Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades*, exhibit 1.4. Chestnut Hill, MA: Boston College; and Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., and Chrostowski, S.J. (2004). *TIMSS 2003 International Mathematics Report: Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades*, exhibit 1.4. Chestnut Hill, MA: Boston College.

MATHEMATICS PROFICIENCY OF 15-YEAR-OLDS

Key Findings: Canada, France, Germany, Italy, Japan, Russian Federation, United States

About one-quarter of 15-year-old students in the United States scored at or below the lowest proficiency level on the PISA 2003 combined mathematics literacy scale, a higher proportion of students than in Germany, France, Japan, and Canada.

The Program for International Student Assessment (PISA) is a system of international assessments that measures 15-year-old students' capabilities in reading literacy, mathematics literacy, and science literacy every 3 years. In 2003, PISA was conducted in 41 countries, including 30 Organization for Economic Cooperation and Development (OECD) countries and 11 non-OECD countries. PISA 2003 included an in-depth assessment of mathematics literacy, with less detailed assessments in reading and science literacy. In PISA 2003, each student was awarded a score on the combined mathematics literacy scale based on the difficulty of the tasks that he or she could reliably perform. These student performance scores were also used to create six proficiency levels, with level 6 the highest. Students who failed to complete the tasks associated with level 1 were categorized as having proficiency below level 1.

In Japan, Canada, France, and Germany, students performed, on average, at proficiency level 3 on the PISA 2003 combined mathematics literacy scale; in the United States, the average score of 483 (see Indicator 7: Mathematics Performance of 15-Year-Olds Across Content Areas) was above the bottom cut point for level 3 by about 1 score point. Students in the Russian Federation and Italy scored, on average, at level 2 on the combined mathematics literacy scale.

Looking at the distribution of students across the mathematics proficiency levels, 26 percent of U.S. students scored at level 1 or below; these students failed to demonstrate consistently that they have baseline mathematical skills (figure 6). The U.S. percentage was higher than the percentages in four of the other G-8 countries reporting data[6] (Germany, France, Japan, and Canada), but lower than the percentages in the Russian Federation and Italy.

The United States had a lower percentage of students at each of the higher proficiency levels of 4, 5, and 6 than did Germany, France, Japan, and Canada. None of the other G-8 countries had a lower percentage of students scoring at level 6 (the highest proficiency level) than the United States. The PISA 2003 results are somewhat different from those for PISA 2000, when reading literacy was the major domain and the United States had a higher percentage of students at the lowest proficiency level, but also a higher percentage of students at the highest proficiency level (Lemke et al. 2001).

Definitions and Methodology

PISA defines mathematics literacy as "an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments 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).

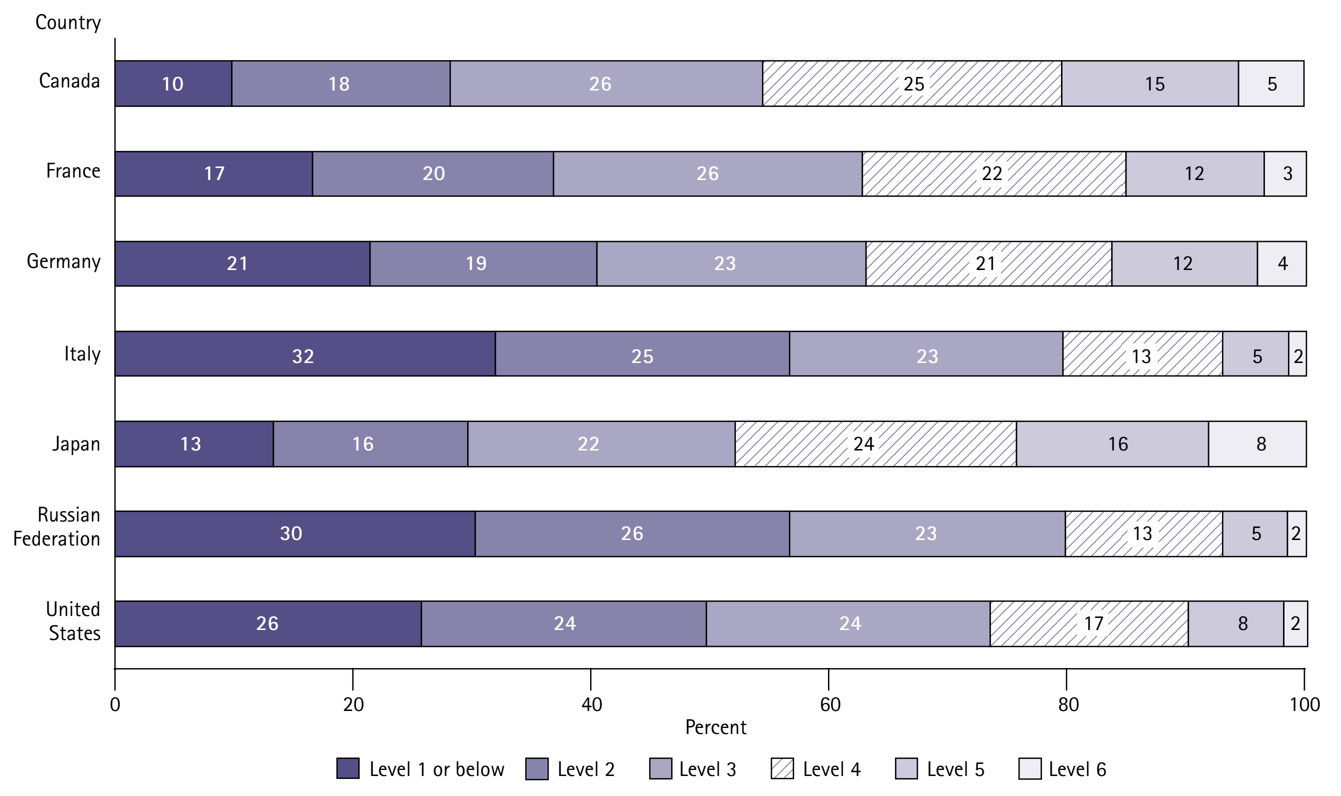
To facilitate the cross country comparison of achievement scores on the PISA 2003 combined mathematics literacy scale, an OECD average was calculated whereby all the participating OECD countries contributed equally. The data were then standardized to set the OECD average at 500, with a range from 0 to 1000 and a standard deviation of 100. Since the individual country means were weighted averages of the student scores, this standardization implied that about two-thirds of the students across all the participating OECD countries scored between 400 and 600.

Mathematics proficiency was defined in terms of six levels (levels 1 through 6) based on student performance scores on the combined mathematics literacy scale. 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); and level 6 (a score greater than 669.30). 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 at each succeeding level are capable of solving mathematical problems of increasing complexity.

Students proficient at level 1 are able to identify information and carry out routine procedures according to direct instructions in explicit situations, such as locating and reading a specified value in a simple table or performing simple calculations involving relationships between two familiar variables. Level 2 can be considered the baseline at which students begin to demonstrate mathematical skills allowing them to use mathematics actively; they can extract relevant information from a single source and make literal interpretations of the results, such as recognizing simple geometric patterns and identifying relevant information in a simple and familiar graph. At level 3, students can use simple problem-solving strategies and skills, such as reasoning in familiar contexts, interpreting tables to locate information, and basic reasoning with simple probability concepts; they can link and connect multiple related representations (e.g., a formula and a graph) and carry out clearly described procedures requiring sequential processes. At level 4, students can reason flexibly and with some insight; they can solve problems that involve reasoning and argumentation in unfamiliar contexts, interpret complex text and graphs, and use multiple representations and multi-step calculations to solve practical problems. Students at level 5 can use well-developed reasoning skills, insight, and interpretation with different representations; interpret complex information about real-world situations; work strategically; use complex and multistep problem-solving skills; and make assumptions or work with assumptions to solve problems. Students proficient at level 6 can identify and combine multiple pieces of information to solve complex problems in the context of unfamiliar real-world situations; they can carry out a complex sequence of calculations and communicate complex arguments and explanations through reflection, insight, and generalization of the results. For more information about how proficiency levels were set for PISA 2003, see the technical appendix in Lemke et al. (2004).

[6]Due to low response rates, data for the United Kingdom are not shown in this indicator.

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



NOTE: In the Program for International Student Assessment (PISA), mathematics proficiency was defined in terms of six levels (levels 1 through 6) based on student performance scores on the combined mathematics literacy scale. In this way, mathematics literacy was assessed along a continuum, with level 1 or below indicative of the lowest performing students. Due to low response rates, data for the United Kingdom are not shown. Detail may not sum to totals because of rounding.
SOURCE: Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2003.

MATHEMATICS PERFORMANCE OF 15-YEAR-OLDS ACROSS CONTENT AREAS

Key Findings: Canada, France, Germany, Italy, Japan, Russian Federation, United States

In the United States, 15-year-old students in PISA 2003 generally scored lower than their peers in Canada, France, Germany, and Japan on each of the four mathematics literacy subscales: space and shape, change and relationships, quantity, and uncertainty.

The Program for International Student Assessment (PISA) assessed 15-year-old students in mathematics literacy in 2003. In the United States, 15-year-old students had an average score of 483 on the PISA 2003 combined mathematics literacy scale (figure 7). The U.S. score was lower than the average score of 500 for the participating Organization for Economic Cooperation and Development (OECD) countries (data not shown) (Lemke et al. 2004). Among the G-8 countries reporting data,[7] the U.S. score was lower than the average scores for Germany, France, Canada, and Japan and higher than the average scores for the Russian Federation and Italy.

For the most part, U.S. 15-year-olds scored lower than their peers in Canada, France, Germany, and Japan on the four mathematics literacy subscales, with each subscale representing a different content area: space and shape, change and relationships, quantity, and uncertainty. (There was one exception: no measurable difference between the United States and Germany on the uncertainty subscale.) For example, the U.S. mean score of 472 on the space and shape subscale was lower than the mean scores for Germany (500), France (508), Canada (518), and Japan (553). Among the G-8 countries, students in Japan earned the highest score on the space and shape subscale, followed by students in Canada.

On the change and relationships subscale, 15-year-olds in Japan and Canada earned the highest mean scores: 536 and 537, respectively. Students in the United States had a mean score of 486, outscoring only students in Italy (452). Similarly, on the quantity subscale, students in Japan and Canada earned mean scores of 527 and 528, respectively, outscoring students in all other G-8 countries. Students in Germany and France scored 514 and 507, respectively, and students in the United States had a mean score of 476.

On the uncertainty subscale, students in the United States received a mean scale score of 491, outscoring students in Italy and the Russian Federation, who had mean scores of 463 and 436, respectively. Among the G-8 countries, students in Canada earned the highest score on this subscale, followed by students in Japan, with scores of 542 and 528, respectively.

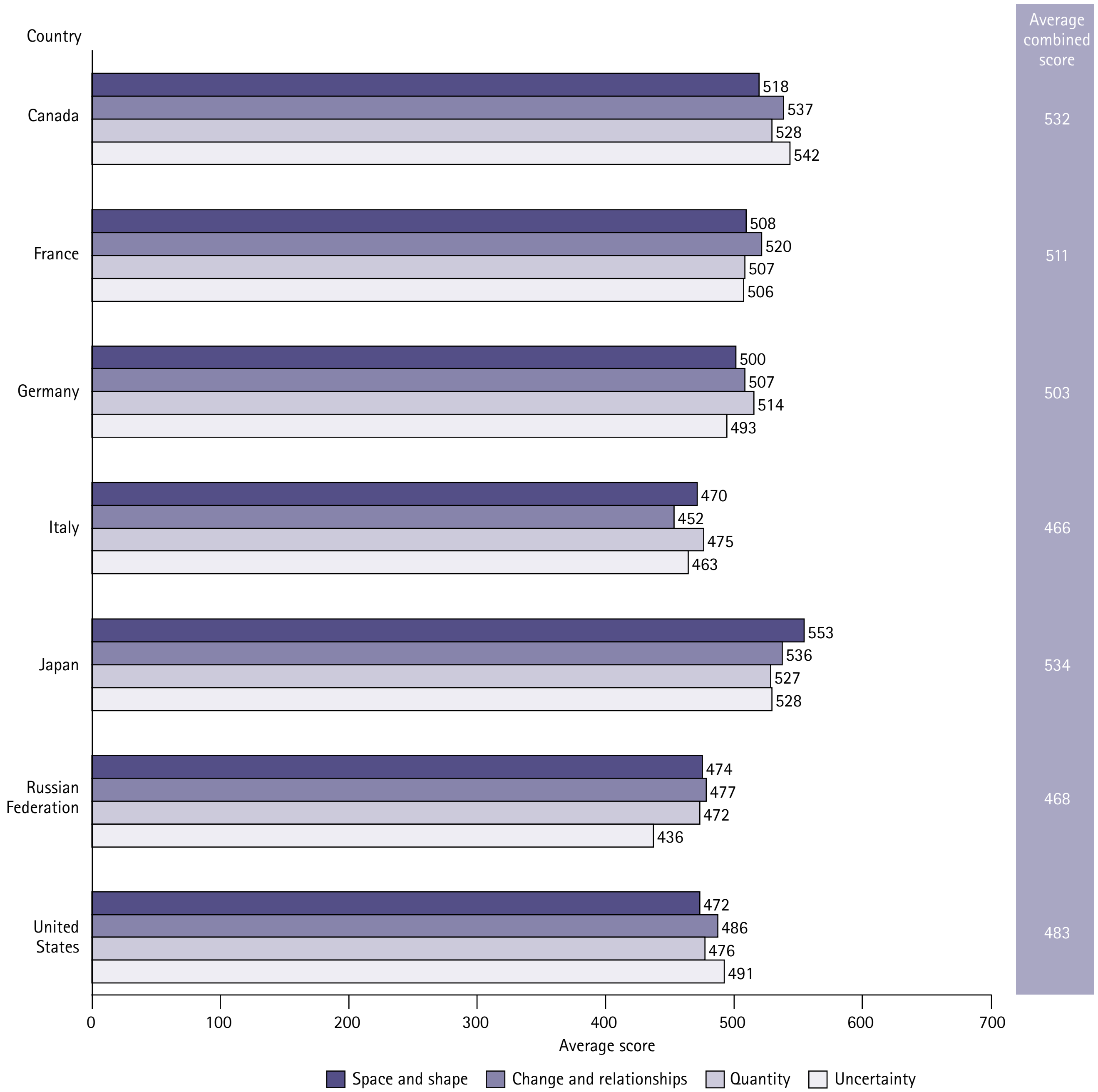
Definitions and Methodology

PISA defines mathematics literacy as "an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments 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). In PISA 2003, students were assessed on their mathematical knowledge in four content areas (space and shape, change and relationships, quantity, and uncertainty), as well as the processes that need to be performed to solve mathematical problems in these four content areas and the real-world situations in which students encounter such mathematical problems. The space and shape subscale is related to spatial and geometric phenomena and relationships. The change and relationships subscale pertains to mathematical manifestations of change, functional relationships, and dependency among variables. The quantity subscale is related to numeric phenomena and quantitative relationships and patterns. The uncertainty subscale focuses on probabilistic and statistical phenomena and relationships.

To facilitate the cross country comparison of achievement scores on the PISA 2003 combined mathematics literacy scale, an OECD average was calculated whereby all the participating OECD countries contributed equally. The data were then standardized to set the OECD average at 500, with a range from 0 to 1000 and a standard deviation of 100. Since the individual country means were weighted averages of the student scores, this standardization implied that about two-thirds of the students across all the participating OECD countries scored between 400 and 600.

[7]Due to low response rates, data for the United Kingdom are not shown in this indicator.

Figure 7. Average mathematics literacy subscale scores of 15-year-old students, by country: 2003



NOTE: The space and shape subscale is related to spatial and geometric phenomena and relationships. The change and relationships subscale pertains to mathematical manifestations of change, functional relationships, and dependency among variables. The quantity subscale is related to numeric phenomena and quantitative relationships and patterns. The uncertainty subscale focuses on probabilistic and statistical phenomena and relationships. Due to low response rates, data for the United Kingdom are not shown.
SOURCE: Organization for Economic Cooperation and Development (OECD). (2004). *Learning for Tomorrow's World: First Results From PISA 2003*, tables 2.1c, 2.2c, 2.3c, 2.4c, and 2.5c. Paris: Author.

MATHEMATICS ACHIEVEMENT AND SOCIOECONOMIC STATUS

Key Findings: Canada, France, Germany, Italy, Japan, Russian Federation, United States

Although U.S. students were generally at an advantage in terms of socioeconomic status (SES) compared to their G-8 peers, low-SES 15-year-old students in the United States were outperformed by their peers in Germany, France, Japan, and Canada in mathematics literacy.

The 2003 Program for International Student Assessment (PISA 2003) measured socioeconomic status (SES) based on the occupational status of the 15-year-old student's mother or father (whichever parent had the higher occupational status), with parental occupation reported by the student. Parental occupations were translated into socioeconomic index scores. For example, whereas a low index score (i.e., between 16 and 34 points) corresponds with a parental occupation requiring a minimal level of education and skill (e.g., taxi driver, waiter/waitress), a high index score (i.e., between 71 and 90 points) corresponds with a parental occupation requiring a high level of education and skill (e.g., medical doctor, university professor).

In 2003, the United States had the highest mean socioeconomic index score of all the G-8 countries reporting data[8] (54.6 in the United States compared to a range from 46.8 in Italy to 52.6 in Canada) (data not shown). Furthermore, when students were classified into national quarters on the index, U.S. 15-year-olds in the bottom national quarter had a higher mean index score than their peers in all but one G-8 country (32.6 in the United States compared to a range from 26.9 in Italy to 31.7 in Canada). Only in Japan did students in the bottom national quarter have a higher mean index score (33.4) than their U.S. counterparts. These results show that U.S. students were generally at an advantage in terms of SES compared to their G-8 peers (both overall as well as specifically at the low SES level).

On the other hand, when looking at the mathematics achievement of low-SES students, U.S. students did not demonstrate an advantage over their counterparts in most G-8 countries. Specifically, U.S. students in the bottom national quarter of the socioeconomic index were outperformed by their peers in Germany, France, Japan, and Canada on the PISA 2003 combined mathematics literacy scale (448 in the United States compared to a range from 463 in Germany to 506 in Canada) (figure 8a). U.S. students in the bottom national quarter of the index scored higher than their counterparts in only one G-8 country—Italy (with an average score of 430).

Nevertheless, in all G-8 countries, there was a relationship between SES and achievement scores. Specifically, students in the top national quarter of the socioeconomic index scored higher on the combined mathematics literacy scale than students in the bottom national quarter of the index. This difference ranged from 58 points in the Russian Federation to 102 points in Germany; in the United States, this difference was 82 points.

Another way to evaluate the relationship between socioeconomic status and mathematics achievement is to examine the specific change in score on the combined mathematics literacy scale in response to a one-standard-deviation increase (i.e., 16.4 units) in the socioeconomic index score. A greater increase in a country's average achievement score implies a stronger relationship between socioeconomic status and performance in that country. In the United States, an increase of one standard deviation on the index was associated with an average performance increase of 30 score points (figure 8b). Compared to the United States, three G-8 countries had a weaker relationship between the socioeconomic index and mathematics literacy performance—the Russian Federation, Japan, and Canada (with a range from 21 to 24 score points)—and one G-8 country had a stronger relationship—Germany (with 38 score points).

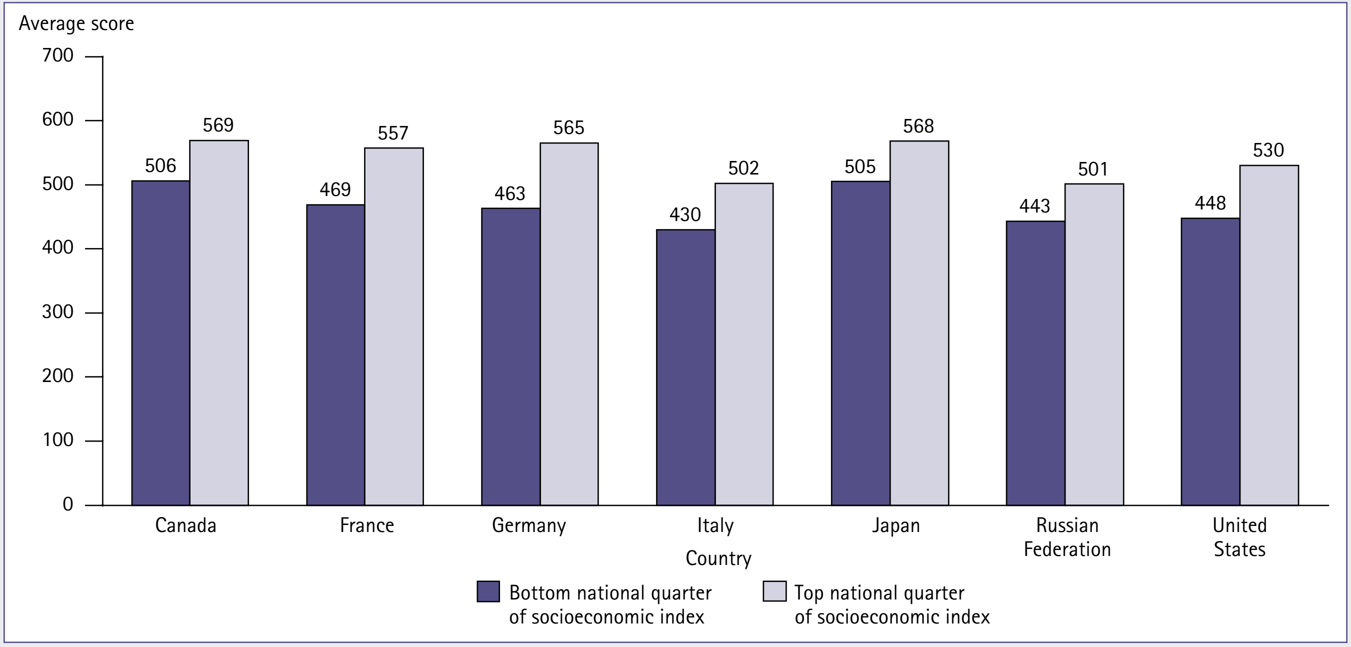
Definitions and Methodology

To facilitate the cross country comparison of achievement scores on the PISA 2003 combined mathematics literacy scale, an Organization for Economic Cooperation and Development (OECD) average was calculated whereby all the participating OECD countries contributed equally. The data were then standardized to set the OECD average at 500, with a range from 0 to 1000 and a standard deviation of 100. Since the individual country means were weighted averages of the student scores, this standardization implied that about two-thirds of the students across all the participating OECD countries scored between 400 and 600. For more information about mathematics literacy in PISA 2003, see the Definitions and Methodology section of indicators 6 and 7.

Socioeconomic status is measured by the Highest International Socioeconomic Index of Occupational Status (HISEI), which corresponds to the highest occupational index score of the student's father or mother. Parental occupation, as reported by the student, was coded based on the current version of the International Standard Classification of Occupations (ISCO-88) (International Labor Organization 1988). Occupational codes were, in turn, mapped onto an internationally comparable index of occupational status, the International Socioeconomic Index of Occupational Status (ISEI), developed by Ganzeboom, De Graaf, and Treiman (1992). The ISEI captures the attributes of occupations that convert parents' education into income. It is derived by optimally scaling occupation groups to maximize the indirect effect of education on income through occupation and to minimize the direct effect of education on income, net of occupation (both effects being net of age).

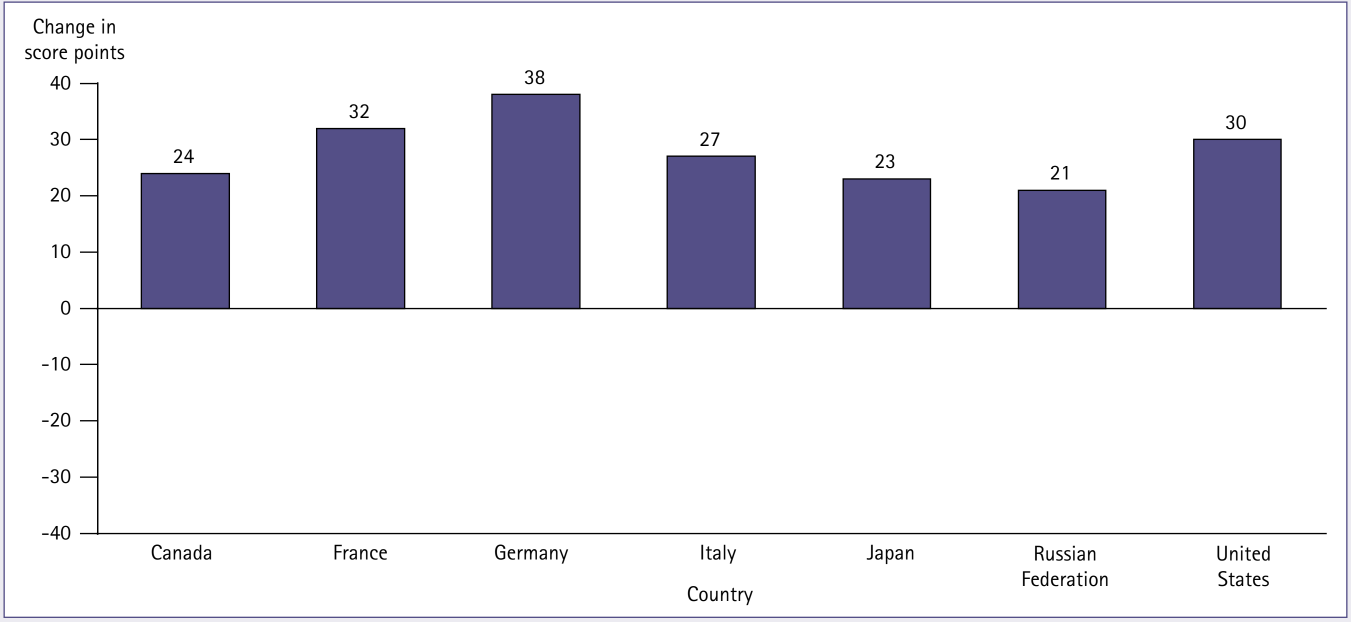
[8]Due to low response rates, data for the United Kingdom are not shown in this indicator.

Figure 8a. Combined mathematics literacy scores of 15-year-old students in PISA 2003, by socioeconomic status and country: 2003



NOTE: In the 2003 Program for International Student Assessment (PISA 2003), socioeconomic status is measured by the Highest International Socioeconomic Index of Occupational Status (HISEI), which corresponds to the highest occupational index score of the student's father or mother. This information, derived from students' responses to questionnaire items pertaining to parental occupation, is transformed into an index developed by Ganzeboom, De Graaf, and Treiman (1992). The index is keyed to the International Standard Classification of Occupations (ISCO) and allows direct comparisons between nations. Due to low response rates, data for the United Kingdom are not shown.
SOURCE: Organization for Economic Cooperation and Development (OECD). (2004). *Learning for Tomorrow's World: First Results From PISA 2003*, table 4.2a. Paris: Author.

Figure 8b. Change in the combined mathematics literacy scores of 15-year-old students in PISA 2003 per one-standard-deviation increase in the socioeconomic index, by country: 2003



NOTE: In the 2003 Program for International Student Assessment (PISA 2003), socioeconomic status is measured by the Highest International Socioeconomic Index of Occupational Status (HISEI), which corresponds to the highest occupational index score of the student's father or mother. This information, derived from students' responses to questionnaire items pertaining to parental occupation, is transformed into an index developed by Ganzeboom, De Graaf, and Treiman (1992). The index is keyed to the International Standard Classification of Occupations (ISCO) and allows direct comparisons between nations. Shown in this figure is the average score-point difference that is associated with an increase of one standard deviation (i.e., 16.4 units) on the socioeconomic index. Due to low response rates, data for the United Kingdom are not shown.
SOURCE: Organization for Economic Cooperation and Development (OECD). (2004). *Learning for Tomorrow's World: First Results From PISA 2003*, table 4.2a. Paris: Author.

MATHEMATICS ACHIEVEMENT AND LANGUAGE SPOKEN AT HOME

Key Findings: Canada, France, Germany, Italy, Japan, Russian Federation, United States

In all G-8 countries, 15-year-old students who spoke the language of assessment, other official languages, or other national dialects at home most of the time scored higher in mathematics literacy than did their peers who spoke another language at home most of the time.

Children in the United States who speak languages other than English at home and who also have difficulty speaking English may face greater challenges progressing in school and in the labor market (Federal Interagency Forum on Child and Family Statistics 2005). Among the G-8 countries, the United States is not unique with respect to educating language minority students.

The 2003 Program for International Student Assessment (PISA 2003) distinguished between 15-year-old students who reported speaking the language of assessment, other official languages, or other national dialects at home most of the time and those who reported speaking another language at home most of the time. In 2003, 9 percent of U.S. students reported speaking another language at home most of the time (figure 9a). The U.S. percentage is higher than the corresponding percentages for France, the Russian Federation, Italy, and Japan (all 6 percent or less) and lower than the corresponding percentage for Canada (11 percent).

In all G-8 countries reporting data,[9] 15-year-olds who spoke the language of assessment, other official languages, or other national dialects at home most of the time scored higher on the PISA 2003 combined mathematics literacy scale than did their peers who spoke another language at home most of the time (figure 9b). This difference ranged from 13 points in Canada to 90 points in Germany; in the United States, this difference was 46 points.

In the United States, 15-year-olds who spoke another language at home most of the time scored 444 on the combined mathematics literacy scale. This is measurably different from the corresponding score in one G-8 country—Canada. In Canada, students who spoke another language at home most of the time had a higher score (525) than their U.S. peers did.

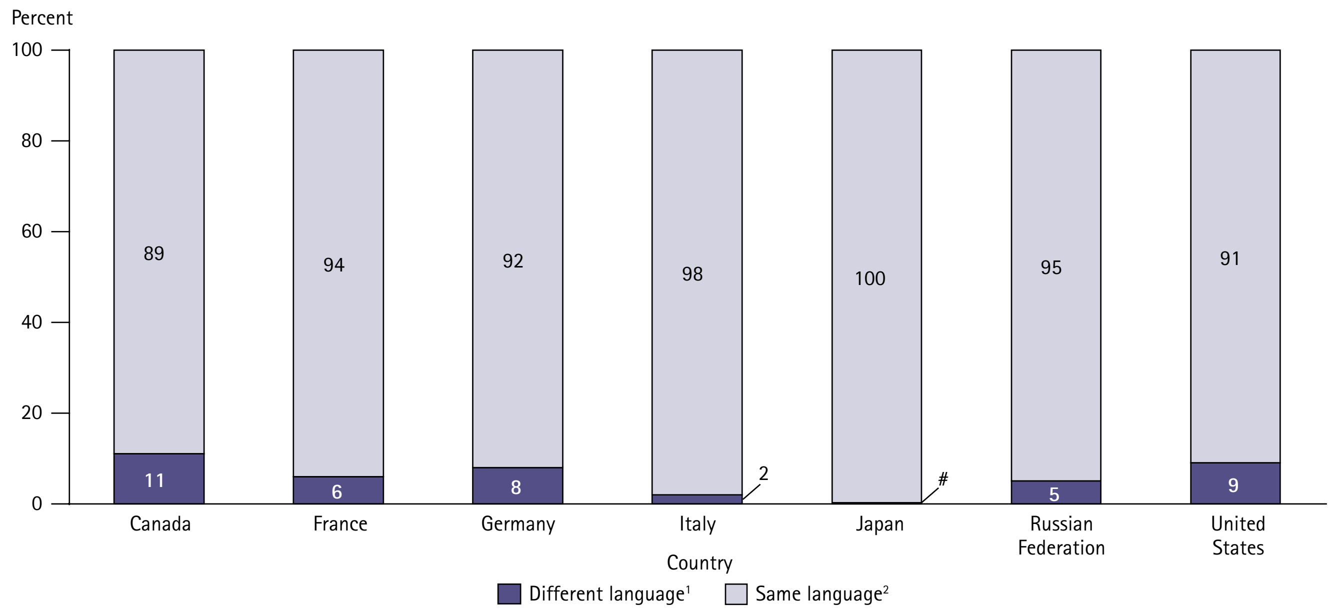
Definitions and Methodology

To facilitate the cross country comparison of achievement scores on the PISA 2003 combined mathematics literacy scale, an Organization for Economic Cooperation and Development (OECD) average was calculated whereby all the participating OECD countries contributed equally. The data were then standardized to set the OECD average at 500, with a range from 0 to 1000 and a standard deviation of 100. Since the individual country means were weighted averages of the student scores, this standardization implied that about two-thirds of the students across all the participating OECD countries scored between 400 and 600. For more information about mathematics literacy in PISA 2003, see the Definitions and Methodology section of indicators 6 and 7.

Score-point differences presented in the text are computed from unrounded numbers; therefore, they may differ from computations made using the rounded whole numbers that appear in figure 9b.

[9]Due to low response rates, data for the United Kingdom are not shown in this indicator. In Italy and Japan, combined mathematics literacy scores are not shown for students whose language spoken at home most of the time is different from the language of assessment, other official languages, or other national dialects because there are too few cases to provide reliable estimates.

Figure 9a. Percentage distribution of 15-year-old students, by language spoken at home and country: 2003



#Rounds to zero.

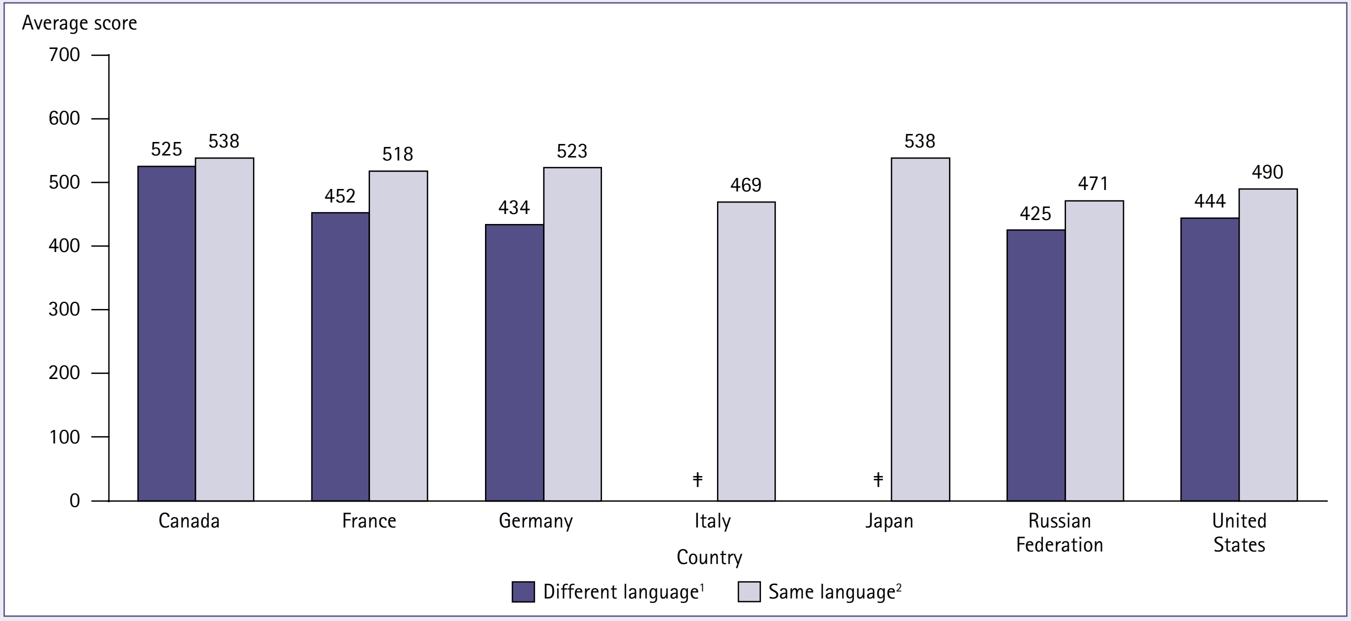
[1]Language spoken at home most of the time is different from the language of assessment, other official languages, or other national dialects.

[2]Language spoken at home most of the time is the same as the language of assessment, other official languages, or other national dialects.

NOTE: Due to low response rates, data for the United Kingdom are not shown. Detail may not sum to totals because of rounding.

SOURCE: Organization for Economic Cooperation and Development (OECD). (2004). *Learning for Tomorrow's World: First Results From PISA 2003*, table 4.2g. Paris: Author.

Figure 9b. Combined mathematics literacy scores of 15-year-old students, by language spoken at home and country: 2003



‡Reporting standards not met. Too few observations to provide reliable estimates.

[1]Language spoken at home most of the time is different from the language of assessment, other official languages, or other national dialects.

[2]Language spoken at home most of the time is the same as the language of assessment, other official languages, or other national dialects.

NOTE: Due to low response rates, data for the United Kingdom are not shown.

SOURCE: Organization for Economic Cooperation and Development (OECD). (2004). *Learning for Tomorrow's World: First Results From PISA 2003*, table 4.2g. Paris: Author.

RELATIONSHIP BETWEEN READING AND MATHEMATICS ACHIEVEMENT

Key Findings: Canada, France, Germany, Italy, Japan, Russian Federation, United States

In all G-8 countries, 15-year-old students who scored low in either mathematics or reading tended to score lower than average in the other subject as well.

This indicator examines the extent to which students who perform poorly in reading are also likely to perform poorly in mathematics, and vice versa. Student performance can be evaluated not only by examining mean scores, but also by looking at the percentages of students who can accomplish tasks at particular proficiency levels. In the 2003 Program for International Student Assessment (PISA 2003), 15-year-old students' proficiency in reading literacy was defined in terms of five levels and their proficiency in mathematics literacy in terms of six levels. In this way, literacy skills were assessed along a continuum, with level 1 and below indicative of the lowest performing students. This indicator focuses on the reading performance of the lowest mathematics performers and the mathematics performance of the lowest reading performers. The results show that in all of the G-8 countries reporting data,[10] 15-year-old students who scored low in either mathematics or reading tended to score lower than average in the other subject as well. The sections that follow describe the results separately for reading and mathematics, respectively.

In all of the G-8 countries, the average reading scores for students at level 1 or below in mathematics were lower than the respective country averages in reading (figure 10a). In fact, in the majority of the G-8 countries in 2003, the average reading scores of the lowest mathematics performers were at least 100 points lower (i.e., at least one standard deviation lower) than the respective country averages in reading. In the United States, the average reading score of the lowest mathematics performers was 116 points lower than the average U.S. reading score (380 vs. 495).[11]

Another way of evaluating the relationship between reading and mathematics achievement is to consider the percentage of students at level 1 or below in mathematics who are also at level 1 or below in reading, and vice versa. In all of the G-8 countries, at least one-half of the lowest mathematics performers were also among the lowest reading performers (with the United States at 62 percent) (figure 10b).

As noted, the mathematics performance of the lowest reading performers can also be examined. Similar to the results for reading, in all of the G-8 countries, the average mathematics scores for students at level 1 or below in reading were lower than the respective country averages in mathematics (figure 10a). Once again, in the majority of the G-8 countries, the lowest reading performers scored at least 100 points lower in mathematics compared to the respective country averages in mathematics. However, in Italy and the Russian Federation, which were the two lowest performing G-8 countries overall in mathematics, average mathematics scores were 93 points and 70 points lower, respectively, among the lowest reading performers. In Japan and Canada, the two highest performing G-8 countries overall in mathematics, average mathematics scores were about 130 points lower among the lowest reading performers.

The percentage of students at level 1 or below in reading who were also at level 1 or below in mathematics ranged from 61 percent in Japan to 82 percent in the United States, with the U.S. percentage higher than that of its G-8 peers (figure 10b).

Definitions and Methodology

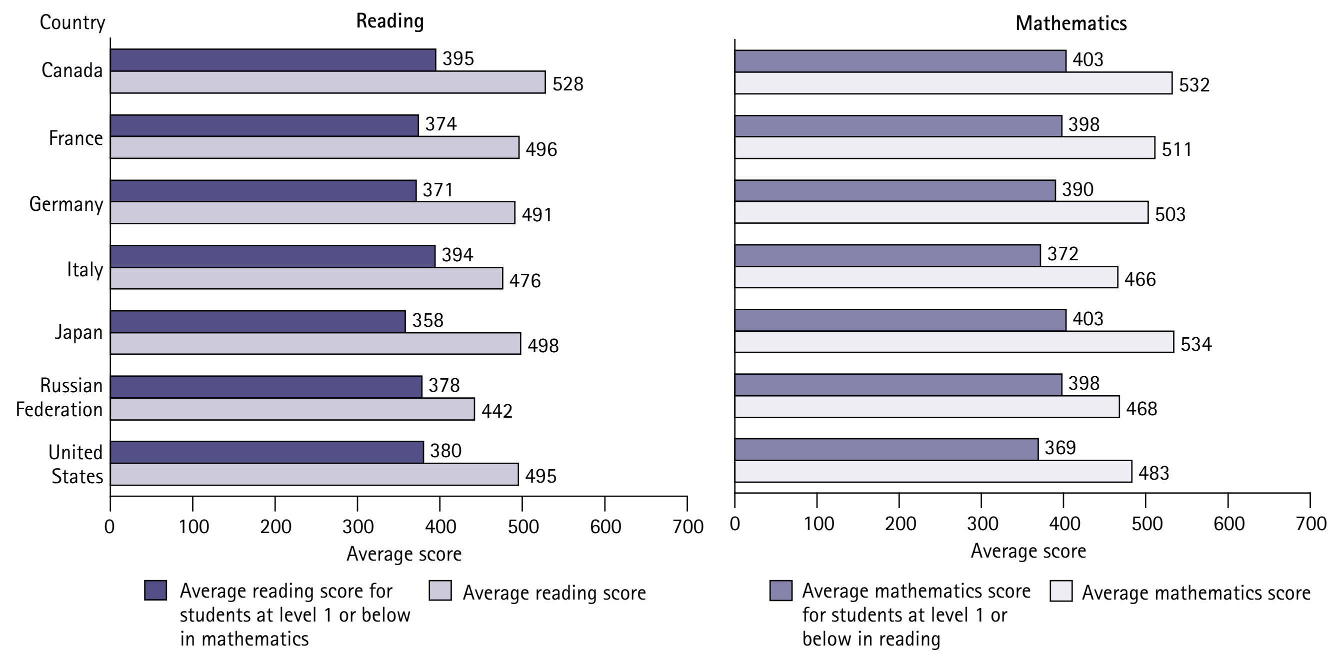
To facilitate the cross country comparison of achievement scores on the PISA combined reading literacy scale and the combined mathematics literacy scale, an Organization for Economic Cooperation and Development (OECD) average was calculated whereby all the participating OECD countries contributed equally. The data were then standardized to set the OECD average on the reading scale and the mathematics scale at 500, with a range from 0 to 1000 and a standard deviation of 100. Since the individual country means were weighted averages of the student scores, this standardization implied that about two-thirds of the students across all the participating OECD countries scored between 400 and 600.

Proficiency in reading literacy and mathematics literacy was defined in terms of levels based on student performance scores on the combined scales for each subject area. Exact cut point scores in reading literacy are as follows: below level 1 (a score less than or equal to 334.75); level 1 (a score greater than 334.75 and less than or equal to 407.47); level 2 (a score greater than 407.47 and less than or equal to 480.18); level 3 (a score greater than 480.18 and less than or equal to 552.89); level 4 (a score greater than 552.89 and less than or equal to 625.61); and level 5 (a score greater than 625.61). See the Definitions and Methodology section of indicator 6 for cut point scores in mathematics literacy. In order to reach a particular proficiency level, a student must have been able to answer correctly a majority of items at that level. In reading literacy, tasks at level 1 require students to locate single pieces of information with little or no competing information or draw simple inferences. On the other hand, tasks at level 5 require students to examine very complex texts, locate and organize multiple pieces of information, interpret language or apply unfamiliar categorization schemes, or evaluate and hypothesize about the information in the text. See the Definitions and Methodology section of indicator 6 for a description of the proficiency levels in mathematics literacy.

Score-point differences presented in the text are computed from unrounded numbers; therefore, they may differ from computations made using the rounded whole numbers that appear in figure 10a.

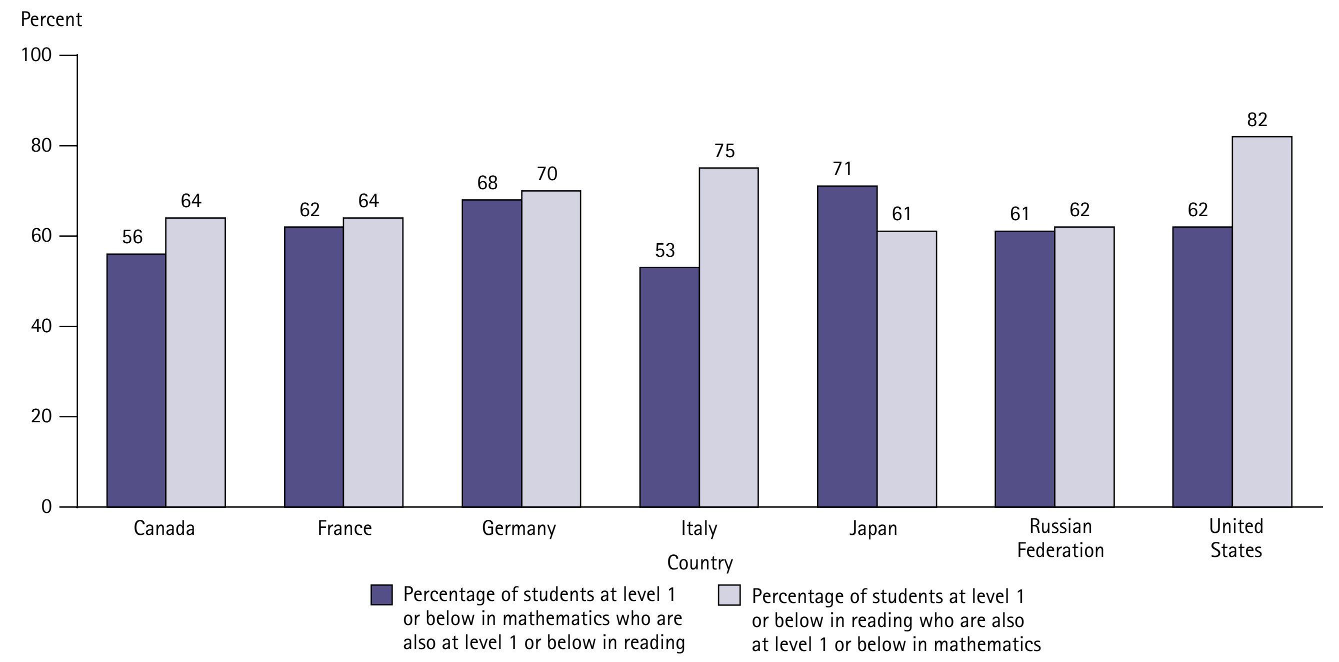
[10]Due to low response rates, data for the United Kingdom are not shown in this indicator.
[11]Score-point difference was computed from unrounded numbers.

Figure 10a. Average scores of 15-year-old students in reading and mathematics, and average scores in reading and mathematics for students at PISA proficiency level 1 or below in the other subject area, by country: 2003



NOTE: In the Program for International Student Assessment (PISA), proficiency in reading literacy and mathematics literacy was defined in terms of levels based on student performance scores on the combined scales for each subject area. There were five levels for reading and six levels for mathematics. Students were classified into levels according to their scores. In this way, literacy skills were assessed along a continuum, with level 1 or below indicative of the lowest performing students. Due to low response rates, data for the United Kingdom are not shown.
SOURCE: Organization for Economic Cooperation and Development (OECD). (2004). *Learning for Tomorrow's World: First Results From PISA 2003,* tables 2.5c and 6.2. Paris: Author; OECD. (2006). *Education at a Glance: OECD Indicators 2006,* tables A6.2 and A6.3. Paris: Author; and OECD, PISA 2003, previously unpublished tabulations (June 2006).

Figure 10b. Percentage of 15-year-old students at PISA proficiency level 1 or below in mathematics who are also at level 1 or below in reading, and percentage of students at PISA proficiency level 1 or below in reading who are also at level 1 or below in mathematics, by country: 2003



NOTE: In the Program for International Student Assessment (PISA), proficiency in reading literacy and mathematics literacy was defined in terms of levels based on student performance scores on the combined scales for each subject area. There were five levels for reading and six levels for mathematics. Students were classified into levels according to their scores. In this way, literacy skills were assessed along a continuum, with level 1 or below indicative of the lowest performing students. Due to low response rates, data for the United Kingdom are not shown.
SOURCE: Organization for Economic Cooperation and Development (OECD). (2006). *Education at a Glance: OECD Indicators 2006,* tables A6.2 and A6.3. Paris: Author; and OECD, PISA 2003, previously unpublished tabulations (June 2006).