INDICATORS PART III

Context for Learning

TIME SPENT ON MATHEMATICS LEARNING

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

On average, formal classroom instructional time per week on mathematics learning ranged from 3.0 hours in Germany to 3.7 hours in Canada and the United States. The number of instructional weeks per year ranged from 33.5 in Italy to 39.7 in Germany.

Using data from the student background questionnaire from the 2003 Program for International Student Assessment (PISA 2003), this indicator examines how much time students spend in mathematics learning in at-school and out-of-school settings. On average, formal classroom instructional time per week ranged from 3.0 hours in Germany to 3.7 hours in Canada and the United States (figure 11). U.S. students reported more formal classroom instructional hours per week than their French, Russian, and German peers did. Apart from hours spent in formal classroom settings, 15-year-olds in the United States spent about 30 minutes per week each in remedial and in enrichment classes (data not shown). Students from the Russian Federation reported spending close to 2 hours per week in remedial and enrichment classes combined.

Instruction in classroom settings at school, however, is only one aspect of student learning. Learning time in out-of-school activities ranged from 35 to 42 percent of students' total mathematics learning time in Japan, the United States, Canada, and France; it was 54 percent in the Russian Federation (computed from data in figure 11). U.S. 15-year-olds reported spending 2.8 hours per week on mathematics homework or other study set by teachers, less than that reported by their peers in Italy (3.5 hours per week) and the Russian Federation (5.0 hours per week).

Adding up the various time allocations, U.S. 15-year-olds reported spending 4.6 hours learning mathematics in at-school settings and 3.3 hours per week learning mathematics in out-of-school settings (computed from data in figure 11).

Since the data on instructional hours presented in this indicator refer to school weeks only, and countries differ in the number of weeks per year in which schools are open, data are also presented on the number of instructional weeks per year for six of the G-8 countries reporting data.[12] The number of instructional weeks per year ranged from 33.5 in Italy to 39.7 in Germany. In the United States, the number of instructional weeks per year was 36.0, which is more than in the Russian Federation and Italy, but less than in Canada, Japan, and Germany.

Definitions and Methodology

The 2003 Program for International Student Assessment (PISA 2003) asked 15-year-olds to report how much time they spent learning mathematics at school and outside of school.

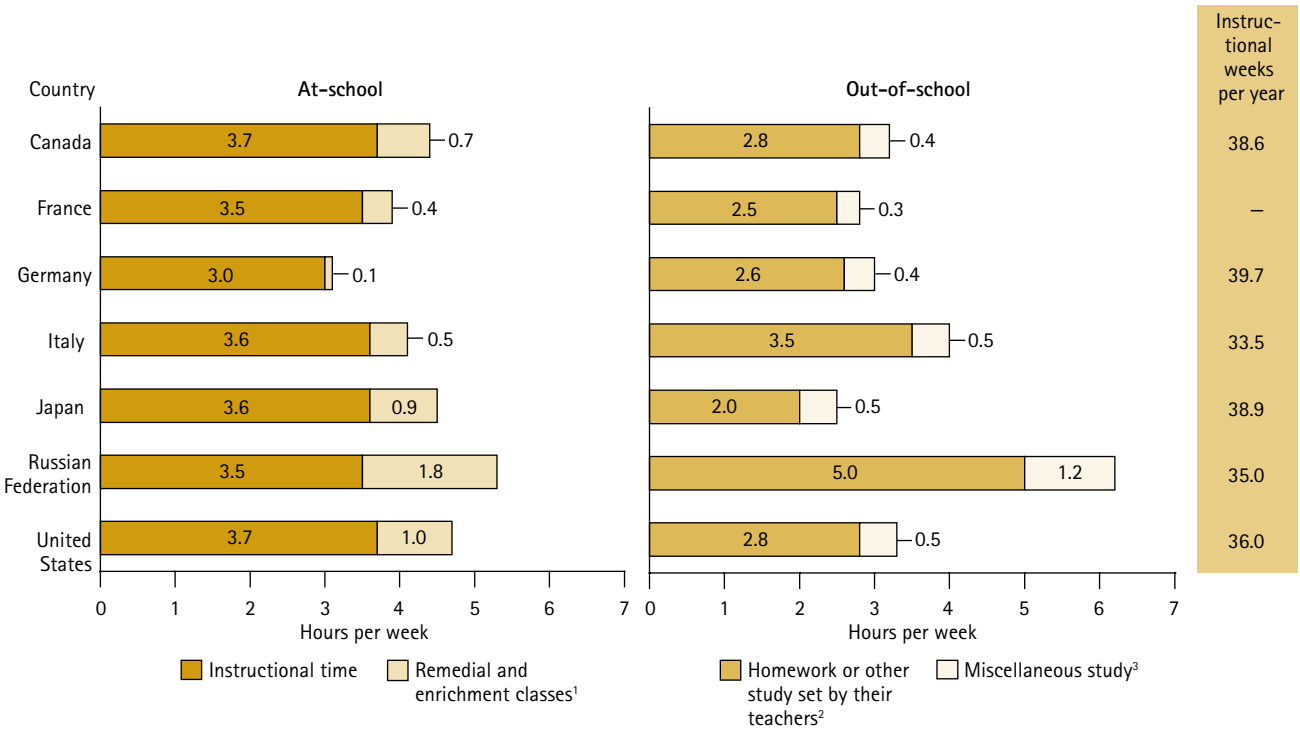
At-school time included (a) formal instructional time in the classroom (calculated by multiplying the average length of a class period reported in minutes by the number of class periods receiving mathematics instruction per week), (b) number of hours spent each week on remedial classes, and (c) number of hours spent each week on enrichment classes.

Out-of-school activities included number of hours spent each week on (a) homework or other study set by the mathematics teacher, (b) working with a mathematics tutor, (c) attending out-of-school mathematics classes, and (d) other mathematics activities (e.g., mathematics competitions and mathematics clubs) (out-of-school activities b, c, and d are grouped as miscellaneous study in figure 11).

The computations presented in the text are carried out using unrounded numbers; therefore, they may differ from computations made using the rounded numbers that appear in figure 11.

[12]Data on instructional weeks per year are not available for France. Due to low response rates, data for the United Kingdom are not shown at all in this indicator.

Figure 11. Average hours spent per week on mathematics learning in at-school and out-of-school settings as reported by 15-year-old students, and instructional weeks per year, by country: 2003



–Not available.

[1]Some item response rates by country are below 85 percent, with a range from 72 to 88 percent. For the composite variable (i.e., remedial and enrichment classes together as a single variable), response rates range from 70 to 83 percent across countries. Missing data have not been explicitly accounted for in the data.

[2]Item response rate for Canada is below 85 percent (i.e., 82 percent), and missing data have not been explicitly accounted for in the data.

[3]Some item response rates by country are below 85 percent, with a range from 69 to 90 percent. For the composite variable (i.e., miscellaneous study as a single variable; see general note below for the out-of-school activities that this consists of), response rates range from 66 to 88 percent across countries. Missing data have not been explicitly accounted for in the data.

NOTE: Miscellaneous study reported under out-of-school activities combines (1) working with a mathematics tutor, (2) attending out-of-school mathematics classes, and (3) other mathematics activities (e.g., mathematics competitions and mathematics clubs).

SOURCE: Organization for Economic Cooperation and Development (OECD). (2004). *Learning for Tomorrow's World, First Results From PISA 2003*, table 5.14. Paris: Author.

CLASS SIZE AND RATIO OF STUDENTS TO TEACHING STAFF

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

The U.S. student/teacher ratio at the primary level (15) was lower than the ratio in all but one of the G-8 countries. At the secondary level, student/teacher ratios ranged from 10 in the Russian Federation to 16 in the United States.

The issue of class size has received a great deal of attention in U.S. education policy, since it is commonly looked upon as a factor influencing the interaction between teachers and students. While smaller classes are generally valued because they may allow students to receive more individual attention from their teachers, evidence on the effects of variation in class size upon student performance is mixed (OECD 2006a). One factor that confounds the association between class size and student performance is the ratio of students to teaching staff. Unlike measures of class size, the ratio of students to teaching staff accounts for teaching staff in addition to classroom teachers, such as teachers who may be developing curriculum or have other indirect instructional roles. Hence, it is useful to jointly examine both class size and the student/teacher ratio as indicators of the resources devoted to education.

Figure 12a shows average class size in primary education for seven G-8 countries reporting data. In 2004, two countries had an average class size of less than 20 students—the Russian Federation (16 students) and Italy (18 students). Four countries had an average class size between 20 and 25 students—Germany, with 22 students; France and the United States, both with 23 students; and the United Kingdom, with 24 students. Japan had the largest average class size in primary education, with 29 students.

Figure 12b shows the ratio of students to teaching staff for the G-8 countries, broken down by four levels of education: preprimary, primary, secondary (lower and upper secondary combined), and higher education. In the United States, student/teacher ratios were fairly consistent across education levels. In other countries, such as Japan, ratios tended to be higher at the lower education levels, but lower at the higher levels. On the other hand, in Italy, lower ratios were observed at the lower education levels, with a sharp increase at the higher education level. Specifically, in 2004, the U.S. student/teacher ratio at the preprimary level was 14, which was higher than the corresponding ratios in Italy (12) and the Russian Federation (7), but lower than those in the United Kingdom (18), Japan (18), and France (19). At the primary level, the student/teacher ratio in the United States was 15, which was higher than the corresponding ratio in Italy (11), but lower than those in the other G-8 countries (with ratios ranging from 17 to 21). At the secondary level, student/teacher ratios ranged from 10 in the Russian Federation to 16 in the United States. Finally, at the higher education level, the student/teacher ratio in the United States was 16, which was higher than the corresponding ratios in the Russian Federation (13), Germany (13), and Japan (11), but lower than those in the United Kingdom (18), France (18), and Italy (22).

Definition and Methodology

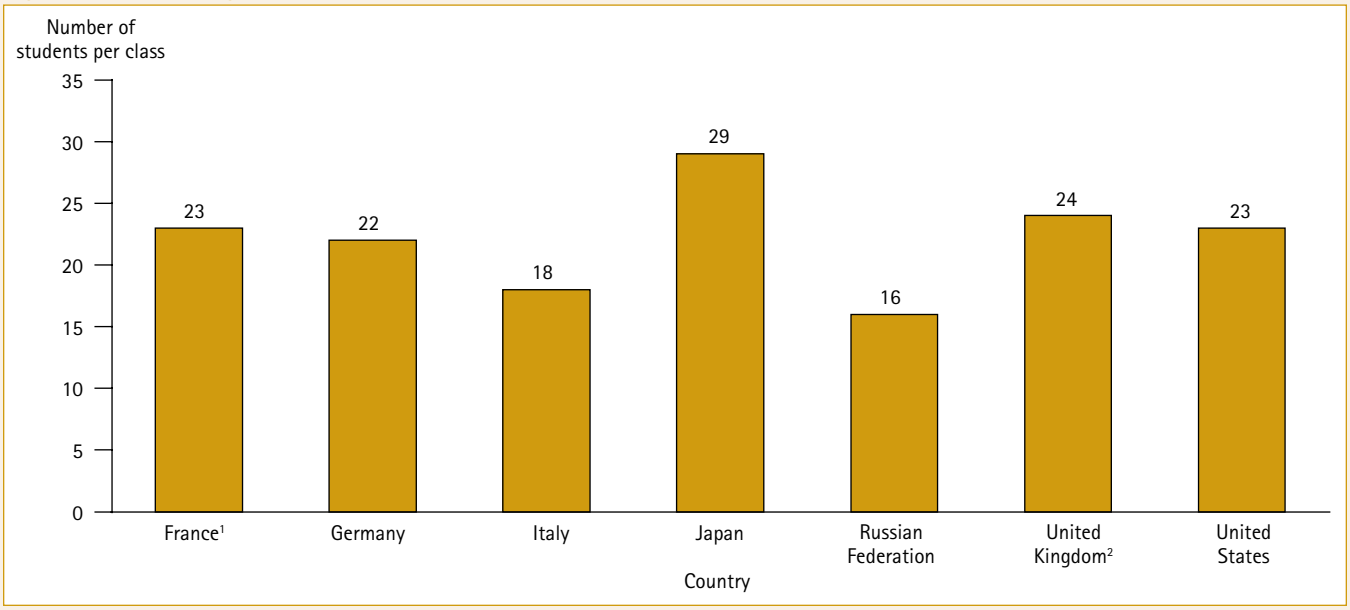
Average class size is calculated by dividing the number of students enrolled by the number of classes. Average class size refers to the division of students who are following a common course of study, based on the highest number of common courses (usually compulsory studies), and excludes teaching in subgroups outside the regular classroom setting. In order to ensure comparability among countries, the data include only regular programs at the primary level of education; special-needs programs have been excluded from the calculation.

Data on average class size are not available for the education levels of preprimary, lower and upper secondary combined, and higher education, and thus are not shown in this indicator as is done for the ratio of students to teaching staff.

The ratio of students to teaching staff is calculated by dividing the number of full-time-equivalent students at a given level of education by the number of full-time-equivalent teachers at that level. Teaching staff refers to professional personnel directly involved in teaching students. This includes classroom teachers; special education teachers; and other teachers who work with a whole class of students in a classroom, in small groups in a resource room, or in one-to-one teaching situations inside or outside a regular classroom. Teaching staff also includes department chairpersons whose duties include some teaching, but excludes paraprofessional personnel who support teachers in providing instruction to students, such as teacher aides.

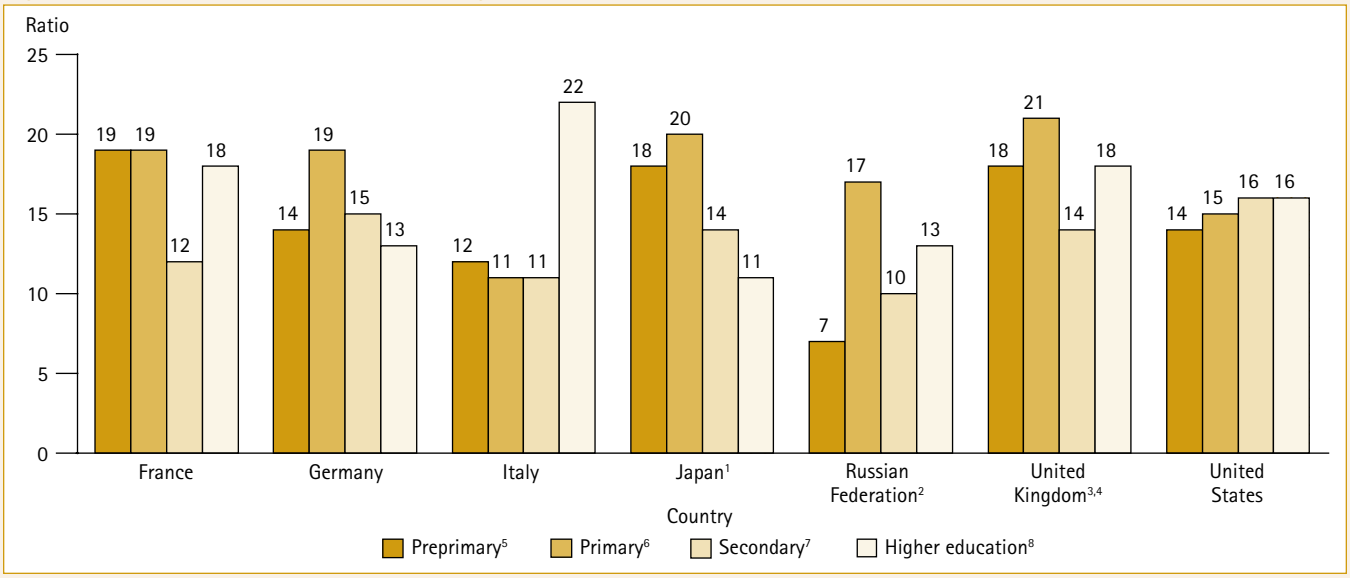
As shown in the figures, education levels are defined according to the International Standard Classification of Education (ISCED). For more information on the ISCED levels, see appendix A.

Figure 12a. Average class size in primary education, by country: 2004



[1]Reference year is 2003 rather than 2004.
[2]The United Kingdom includes England, Northern Ireland, Scotland, and Wales.
NOTE: Data shown include public and private institutions, with calculations based on number of students and number of classes. In order to ensure comparability among countries, the data include only regular programs at the primary level of education; special needs programs have been excluded from the calculation. Education levels are defined according to the International Standard Classification of Education (ISCED). Primary education refers to ISCED level 1. For more information on the ISCED levels, see appendix A in this report.
SOURCE: Organization for Economic Cooperation and Development (OECD). (2005). *Education at a Glance: OECD Indicators 2005*, table D2.1. Paris: Author; and OECD. (2006). *Education at a Glance: OECD Indicators 2006*, table D2.1. Paris: Author.

Figure 12b. Ratio of students to teaching staff in education institutions, by level of education and country: 2004



[1]In Japan, the ratio of students to teaching staff at the secondary level and the higher education level include postsecondary nontertiary education data (ISCED level 4), as some ISCED level 4 teachers are included in ISCED level 3, while some others are included in ISCED level 5.
[2]Reference year for preprimary education is 2003 rather than 2004.
[3]Includes only general programs in upper secondary education.
[4]The United Kingdom includes England, Northern Ireland, Scotland, and Wales.
[5]Includes ISCED level 0 (preprimary education).
[6]Includes ISCED level 1 (primary education).
[7]Includes ISCED levels 2 (lower secondary education) and 3 (upper secondary education). In Japan, the Russian Federation, and the United Kingdom, ISCED level 4 (postsecondary nontertiary education) data are also included.
[8]Includes ISCED levels 5A (academic higher education below the doctoral level), 5B (vocational higher education), and 6 (doctoral level of academic higher education). In Japan, ISCED level 4 (postsecondary nontertiary education) data are also included.
NOTE: Data shown include public and private institutions, with calculations based on full-time equivalents. Education levels are defined according to the International Standard Classification of Education (ISCED). For more information on the ISCED levels, see appendix A in this report.
SOURCE: Organization for Economic Cooperation and Development (OECD). (2005). *Education at a Glance: OECD Indicators 2005*, table D2.2. Paris: Author; and OECD. (2006). *Education at a Glance: OECD Indicators 2006*, table D2.2. Paris: Author.

Key Findings: Italy, Japan, Russian Federation, United Kingdom (England and Scotland only),[13] United States

About two-thirds of U.S. fourth-graders had teachers who reported participating in professional development pertaining to mathematics content. Teacher participation in this area was lower in Italy, Japan, and Scotland.

The 2003 Trends in International Mathematics and Science Study (TIMSS 2003) asked teachers of fourth- and eighth-graders to report on their professional development participation in several areas in the 2 years before the assessment. This indicator discusses the results for teachers of fourth-graders in four areas: content, pedagogy/instruction, improving students' critical thinking or problem-solving skills, and assessment. (Teachers reported participation separately for mathematics and science.) The results show considerable variation by area of professional development, subject area, and country.

In 2003, about two-thirds of U.S. fourth-graders had teachers who reported participating in professional development pertaining to mathematics content in the previous 2 years (figure 13). Teacher participation in this area was lower in Italy, Japan, and Scotland (ranging from 29 to 42 percent), but higher in England (76 percent). At least half of the fourth-graders in England, the Russian Federation, and the United States had teachers who reported participating in the other three areas of professional development in mathematics.

The percentage of fourth-graders whose teachers reported participating in professional development pertaining to mathematics pedagogy/instruction ranged from 30 percent in Italy to 88 percent in England, with the United States at 54 percent. In mathematics, more fourth-graders in the United States than in Scotland, Japan, and Italy had teachers who reported participating in professional development in the area of improving students' critical thinking or problem-solving skills and in the area of assessment. However, a greater percentage of students in England than in the United States had teachers who reported participating in professional development in the area of improving students' critical thinking or problem-solving skills in mathematics (72 vs. 58 percent).

In England, Italy, and the United States, there was generally more reported participation in professional development in mathematics than in science in each of the four areas, with one exception (in Italy, no statistically significant difference was detected in the area of content). Across all four areas, no G-8 country reporting data had more fourth-graders with teachers reporting professional development participation in science than in mathematics.

The percentage of fourth-graders in England, the Russian Federation, and the United States whose teachers reported participating in professional development in science ranged from 30 percent in England in assessment to 51 percent in the Russian Federation in pedagogy/instruction. In Italy, the percentage of fourth-graders whose teachers reported participating in professional development in science was 22 percent or less in all four areas.

The percentage of fourth-graders whose teachers reported participating in professional development pertaining to science pedagogy/instruction ranged from 15 percent in Italy to 51 percent in the Russian Federation, with the United States at 38 percent. In science as in mathematics, more fourth-graders in the United States than in Scotland, Japan, and Italy had teachers who reported participating in professional development in the area of improving students' critical thinking or problem-solving skills and in the area of assessment. However, a greater percentage of students in the Russian Federation than in the United States had teachers who reported participating in professional development in the area of science assessment (45 vs. 34 percent).

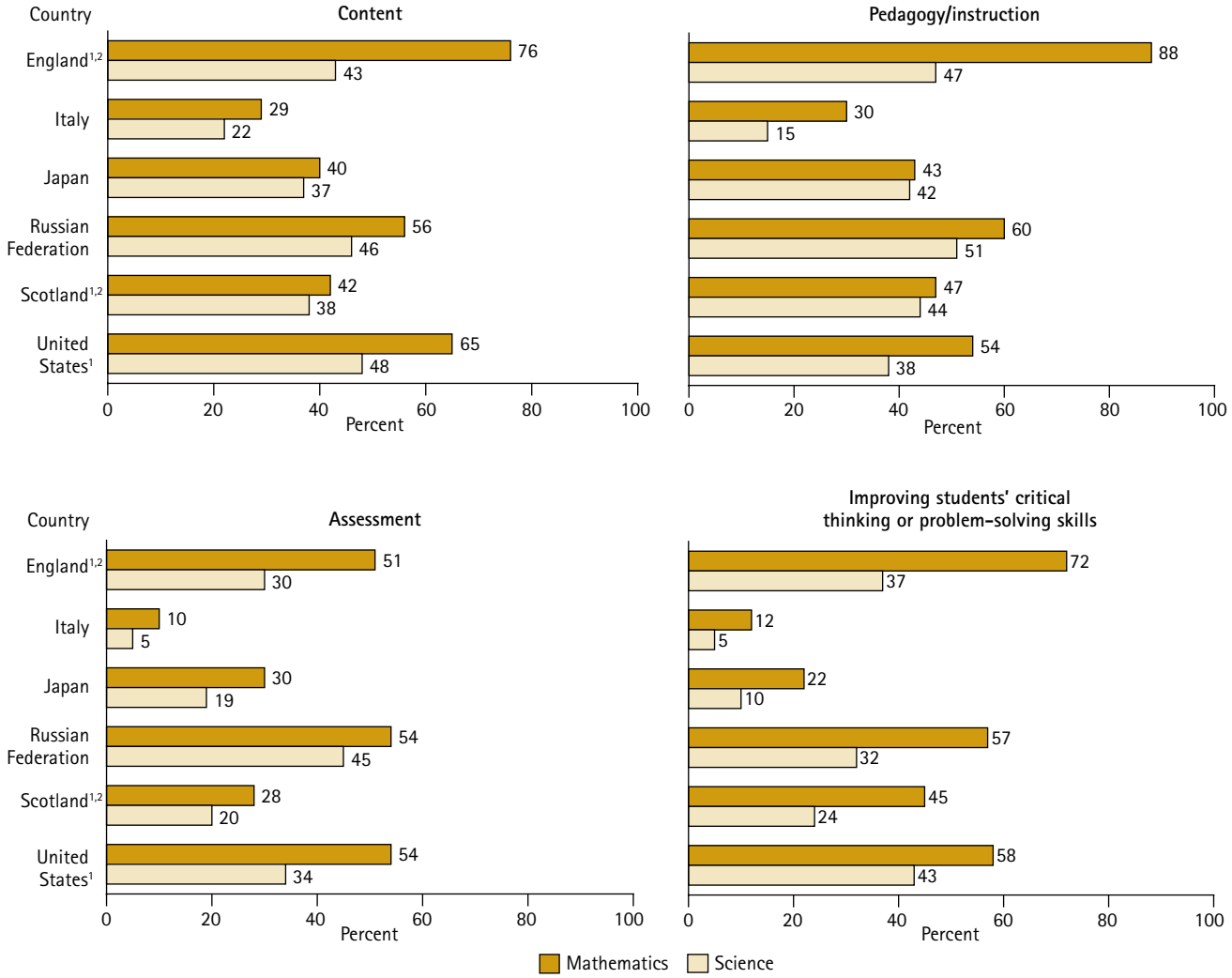
Definitions and Methodology

Data for this indicator are from the TIMSS 2003 fourth-grade teacher questionnaire, which was designed to obtain information about the classroom contexts for the teaching and learning of mathematics and science, and about the implemented curriculum in these subjects. For each participating school at the fourth grade, one teacher questionnaire was administered to the classroom teacher of the sampled fourth-grade class. The TIMSS 2003 fourth-grade teachers do not constitute representative samples of teachers. Rather, they are the teachers for nationally representative samples of fourth-grade students. Thus, the teacher data presented in this indicator were analyzed at the student level.

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.

[13]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 13. Percentage of fourth-grade students whose teachers reported that they participated in various professional development activities in mathematics and science in the 2 years prior to assessment, by country: 2003



[1]Met international guidelines for participation rates in 2003 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.
[2]Data are available for at least 70 percent, but less than 85 percent, of the students. Missing data have not been explicitly accounted for in the data.
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 6.8. 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 6.7. Chestnut Hill, MA: Boston College.

SCHOOL PRINCIPALS' USES FOR ASSESSMENTS

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

A greater percentage of U.S. students than their peers in all other G-8 countries had principals who reported that they used assessment results to compare their school's performance to district- or national-level performance.

Results from assessments can be used for many purposes, and there is considerable debate as to what the best uses may be (Phye 1997; OECD 2004). The 2003 Program for International Student Assessment (PISA 2003) asked school principals to report whether or not they have used assessment results for various purposes.

In 2003, principals across the G-8 countries very frequently reported using assessment results to inform parents about their child's progress. In all of the G-8 countries reporting data,[14] at least 96 percent of 15-year-olds had principals who reported that they used assessment results for this purpose (figure 14). Similarly, principals frequently cited using assessment results to make decisions about students' retention or promotion. In all G-8 countries, at least three-quarters of the students had principals who reported that they used assessment results for this purpose. In the United States, however, this percentage was lower than the corresponding percentages for Japan, Canada, Germany, and the Russian Federation—76 percent in the United States compared to a range from 90 to 97 percent. In all but one of the G-8 countries, at least three-quarters of the students had principals who reported that they used assessment results to identify aspects of instruction or the curriculum that could be improved. (The exception was Germany, at 45 percent.) In the United States, the percentage was 92 percent.

On the other hand, the percentage of 15-year-olds with principals who reported using assessment results to group students for instructional purposes ranged from 36 percent in Germany to 72 percent in Canada; in the United States, the percentage was 66 percent.

There was also considerable variation across G-8 countries in principals' reports pertaining to several other assessment purposes. For example, a greater percentage of U.S. 15-year-old students than their peers in all other G-8 countries in 2003 had principals who reported using assessment results to compare their school's performance to district- or national-level performance. This frequency ranged from about 2 out of 10 students in Germany and Japan, 3 out of 10 students in Italy, and 7 out of 10 students in Canada and the Russian Federation to 9 out of 10 students in the United States. Similarly, a greater percentage of U.S. students than their peers in four other G-8 countries had principals who reported using assessment results to compare their school with other schools (80 percent in the United States vs. 53 percent in Canada, 29 percent in Italy, 17 percent in Germany, and 12 percent in Japan). Assessment results were also more likely to be used in the United States than in the same four G-8 countries to monitor schools' progress from year to year (93 percent of students in the United States had principals reporting this compared to a range from 44 to 79 percent).

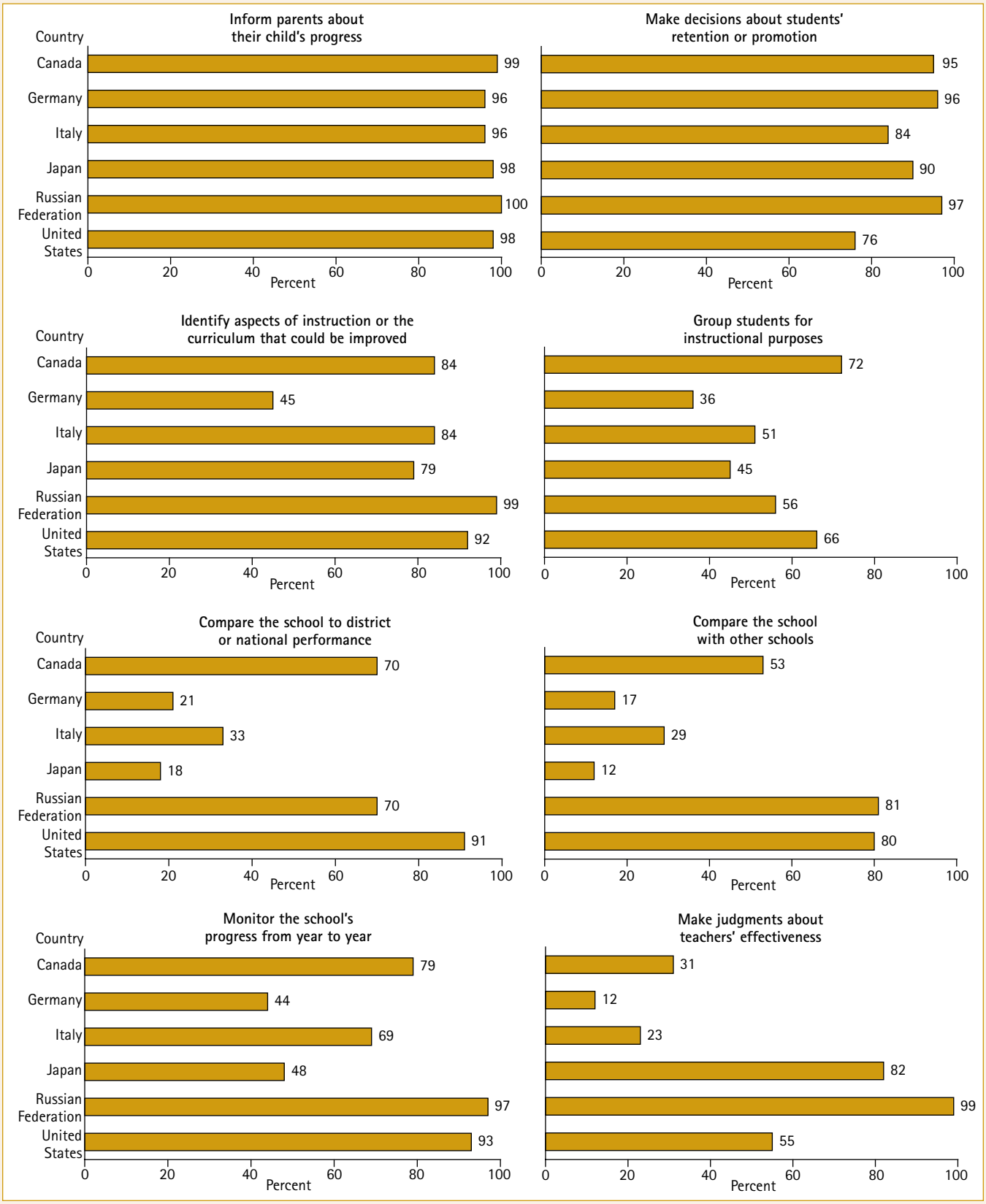
In the United States, the assessment purpose least frequently cited was making judgments about teachers' effectiveness (55 percent of students had principals reporting this). Compared to the United States, a greater percentage of students in Japan and the Russian Federation (82 and 99 percent, respectively) and a smaller percentage in Canada, Italy, and Germany (31, 23, and 12 percent, respectively) had principals who reported that they used assessment results for this purpose.

Definitions and Methodology

Data for this indicator are from the PISA 2003 school questionnaire, which was designed to obtain information about a variety of school-related aspects, including school characteristics, the school's resources, the student body, teachers in the school, pedagogical practices of the school, and administrative structures within the school. At all schools with participating 15-year-old students, a school questionnaire was administered to the principal. The PISA 2003 principals do not constitute representative samples of principals. Rather, they are the principals for nationally representative samples of 15-year-old students. Thus, the school data presented in this indicator were analyzed at the student level.

[14]Data for France have been withdrawn at the request of the country and thus are not shown in this indicator. Due to low response rates, data for the United Kingdom are also not shown here.

Figure 14. Percentage of 15-year-old students whose principals reported that they used assessment results for various purposes, by country: 2003



NOTE: For the United States, item response rates across the purposes of assessment are at least 84 percent; for all other countries shown, item response rates are at least 85 percent. Missing data have not been explicitly accounted for in the data. Data for France have been withdrawn at the request of the country and thus are not shown here. Due to low response rates, data for the United Kingdom are not shown.

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