

Chapter 5

TEACHERS AND INSTRUCTION

Teachers and the instructional approaches they use are fundamental in building students' understanding of science. Primary among their many duties and responsibilities, teachers structure and guide the pace of individual, small-group, and whole-class work to present new material, engage students in scientific tasks, and help deepen students' grasp of the science being studied. Teachers may help students use technology and laboratory equipment to investigate scientific ideas, develop their understanding of scientific approaches to problem solving, and promote positive attitudes towards science. They also may assign homework and conduct informal as well as formal assessments to monitor progress in student learning, make ongoing instructional decisions, and evaluate achievement outcomes.

Effective science teaching is a complex endeavor requiring knowledge of the subject matter of science, understanding of student learning, and appreciation of the pedagogy of science. It can be fostered through institutional support and adequate resources. Teachers also can support each other in planning instructional strategies, devising real-world applications of scientific concepts, and developing sequences that move students from concrete tasks to the ability to think for themselves and explore scientific theories.

TIMSS administered a background questionnaire to teachers to gather information about their backgrounds, training, and how they think about science. The questionnaire also asked about how they spend their time related to their teaching tasks and the instructional approaches they use in their classrooms. Information was collected about the materials used in instruction, the activities students do in class, the use of calculators and computers in science lessons, the role of homework, and the reliance on different types of assessment approaches.

This chapter presents the results of teacher's responses to some of these questions. Because the sampling for the teacher questionnaires was based on participating students, the responses to the science teacher questionnaire do not necessarily represent all of the eighth-grade science teachers in each of the TIMSS countries. Rather, they represent teachers of the representative samples of students assessed. It is important to note that in this report, the student is always the unit of analysis, even when information from the teachers' questionnaires is being reported. Using the student as the unit of analysis makes it possible to describe the instruction received by representative samples of students. Although this approach may provide a different perspective from that obtained by simply collecting information from teachers, it is consistent with the TIMSS goals of providing information about the educational contexts and performance of students.

The tables in this chapter contain special notation regarding response rates. For a country where teacher responses were available for 70% to 84% of the students, an "r" is included next to the data for that country. When teacher responses were available for 50% to 69% of the students, an "s" is included next to the data for that

country. When teacher responses were available for less than 50% of the students, an “x” replaces the data.¹

WHO DELIVERS SCIENCE INSTRUCTION?

This section provides information about the science teaching force in each of the participating countries, in terms of certification, degrees, age, gender, and years of teaching experience.

Table 5.1 summarizes information gathered from each country about the requirements for certification held by the majority of the seventh- and eighth-grade teachers. In many countries, the type of education required for qualification includes a university degree. In other countries, study at a teacher training institution is required, or even both a university degree and study at a teacher training institution. The number of years of post-secondary education required for a teaching qualification ranged from two years in Iran to as much as six years in Canada, although many countries reported four years. All of the countries except Colombia, Cyprus, Greece, and Lithuania reported that teaching practice was required. A large number of countries reported that an evaluation or examination was required for certification. Those countries not having such a requirement included Canada, Colombia, Cyprus, Greece, Iran, Israel, Korea, Portugal, Sweden, and the United States.

Table 5.2 contains teachers’ reports on their age and gender. If a constant supply of teachers were entering the teaching force, devoting their careers to the classroom, and then retiring, one might expect approximately equivalent percentages of students taught by teachers in their 20s, 30s, 40s, and 50s, and this does appear to hold for some countries. In most countries, however, the majority of the eighth-grade students were taught science by teachers in their 30s or 40s. Very few countries seemed to have a comparatively younger teaching force, with only Iran having 40% or more of the students with science teachers in their 20s or younger, and just five countries (Hong Kong, Iran, Korea, Kuwait, and Portugal) having 70% or more students with teachers in their 30s or younger. Countries with a comparatively older teaching force included Cyprus, the Czech Republic, and Germany, where 70% or more of the eighth-grade students had science teachers in their 40s or older.

In a number of countries, approximately equivalent percentages of eighth-grade students were taught science by male teachers and female teachers. However, at least 70% of the eighth-grade students had female science teachers in the Czech Republic, Hungary, Israel, Latvia (LSS), Lithuania, Portugal, Romania, the Russian Federation, and Slovenia. In contrast, at least 70% of the students had male teachers in Denmark, Japan, the Netherlands, and Switzerland.

As might be expected from the differences in teachers’ ages from country to country, the TIMSS data indicate differences in teacher experience across countries (see Table 5.3). Those countries with younger teaching forces tended to have more students

¹ Similar to Chapter 4, background data are not available for Bulgaria and South Africa.

taught by less experienced teachers. At least half the eighth-grade students had science teachers with 10 years or less of experience in Hong Kong, Iceland, Iran, Israel, Korea, Kuwait, Portugal, and Thailand. Fewer countries had relatively experienced teaching forces. Only in the Czech Republic, France, and Romania did more than half the students have science teachers with more than 20 years of experience.

The relationship between years of teaching experience and science achievement is not clear in many countries. In about one-fourth of the countries, the eighth-grade students with the most experienced teachers (more than 20 years) had higher science achievement than did those with less experienced teachers (5 years or fewer). This may reflect the practice of giving teachers with more seniority the more advanced classes. However, there were also several countries where the students with less experienced teachers had higher achievement than did those with the most experienced teachers.

Table 5.1**Requirements for Certification Held by the Majority of Lower- and Upper-Grade (Seventh and Eighth Grade*) Teachers¹**

| Country | Type of Education Required for Qualification | Number of Years of Post-Secondary Education Required | Teaching or Practice Experience Required | Evaluation or Examination Required |
|----------------|---|--|--|------------------------------------|
| Australia | University or Teacher Training Institution | 4 | yes | yes |
| Austria | Teacher Training Institution: Teachers in the general secondary schools (70%) are required to have an education from a teacher training institution. Teachers in the academic secondary schools (30%) are required to have a university education. | 3–5 | yes | yes |
| Belgium (Fl) | Teacher Training Institution | 3 | yes | yes |
| Belgium (Fr) | Teacher Training Institution | 3 | yes | yes |
| Bulgaria | University | 5 | yes | yes |
| Canada | University | 5–6 | yes | no |
| Colombia | University | 4 | no | no |
| Cyprus | University | 4 | no | no |
| Czech Republic | University | 4–5 | yes | yes |
| Denmark | Teacher Training Institution | 4 | yes | yes |
| England | University or Higher Education Institution: Teachers of lower- and upper-grade students normally study their specialist subject area for their degree for 3 or 4 years. This is followed by a one-year post graduate course. However, some teachers study education and specialty concurrently. All teachers who qualified since 1975 are graduates. Some teachers who qualified before this date hold teacher certificates but are not graduates. | 3–5 | yes | yes |
| France | University and Teacher Training: As of 1991, teachers of lower- and upper-grade students are required to have a 3-year university diploma, followed by a competitive examination and professional training. The majority of teachers (more than 50%) meet the requirements (more in the public schools than in the private sector). Yet, there are still many teachers recruited before 1991 who do not have the same level of qualification. | 4 or 5 | yes | yes |
| Germany | University and Post-University Teacher Training Institution | 3–5 +2 years | yes | yes |
| Greece | University | 4 | no | no |
| Hong Kong | University and one year Post-Graduate training | 4 | yes | yes |
| Hungary | Teacher Training Institution | 4 | yes | yes |
| Iceland | University | 3 | yes | yes |
| Iran | Teacher Training Institution | 2 | yes | no |
| Ireland | University with Post Graduate University Training | 4–5 | yes | yes |
| Israel | University | 4 | yes | no |
| Japan | University | 4 | yes | yes |

*Seventh and eighth grades in most countries; see Table 2 for more information about the grades tested in each country.

¹Certification pertains to the majority (more than 50%) of teachers of lower- and upper-grade students in each country.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Information provided by TIMSS National Research Coordinators.

Table 5.1 (Continued)**Requirements for Certification Held by the Majority of Lower- and Upper-Grade (Seventh and Eighth Grade*) Teachers¹**

| Country | Type of Education Required for Qualification | Number of Years of Post-Secondary Education Required | Teaching or Practice Experience Required | Evaluation or Examination Required |
|--------------------|--|--|--|------------------------------------|
| Korea | University | 4 | yes | no |
| Kuwait | University | 4 | yes | yes |
| Latvia | Pedagogical Institution | 4 | yes | yes |
| Lithuania | University or Teacher Training Institution | 5 | no | yes |
| Netherlands | Teacher Training Institution | 4 | yes | yes |
| New Zealand | Teacher Training Institution or University with Teacher Training Institution: Teachers of students in the lower grade are required to attend a teacher training institution. Teachers in the upper grade are required to have a university and teacher training institution education. | 3 (lower gr.) 4 (upper gr.) | yes | yes |
| Norway | Teacher Training Institution or University: Most teachers of students in the lower grade have a certificate from a teacher training institution. For teachers of students in the upper grade there is about an equal distribution between those who attended a teacher training institution and those who attended university. | 3–4 ² | yes | yes |
| Philippines | Teacher Training Institution or University | 4 | yes | yes |
| Portugal | University | 3–5 | yes | no |
| Romania | University | 4–5 | yes | yes |
| Russian Federation | University or Teacher Training Institution or Post-Graduate University Training | 4–5 | yes | yes |
| Scotland | University or Teacher Training Institution | 4 | yes | yes |
| Singapore | Post-Graduate University Training | 4–5 | yes | yes |
| Slovak Republic | Teacher Training Institution or University | 4–5 ³ | yes | yes |
| Slovenia | University | 4–5 | yes | yes |
| South Africa | Teacher Training Institution | 3 | yes | yes |
| Spain | Teacher Training Institution or University | 3 | yes | yes |
| Sweden | Teacher Training Institution (lower grade) University (upper grade) | 3-3.5 (lower gr.) ⁴ 4-4.5 (upper gr.) ⁴ | yes | yes |
| Switzerland | University or Teacher Training Institution | 2–4 | yes | yes |
| Thailand | Teacher Training Institution or University | 4 | yes | yes |
| United States | University | 4 | yes | no |

*Seventh and eighth grades in most countries; see Table 2 for more information about the grades tested in each country.

¹Certification pertains to the majority (more than 50%) of teachers of lower- and upper-grade students in each country.

²Norway: Until 1965 2 years of post-secondary education were required. Between 1965 and 1995 3 years were required.

As of 1996, new certified teachers are required to have completed 4 years of post-secondary education.

³Slovak Republic: In the past, 4 years of study at a teacher training institution were required. Currently, the requirement is 5 years at a teacher training institution or university.

⁴Sweden: Until 1988 3 years of post-secondary education were required for lower-grade teachers and 4 years for upper-grade teachers.

Since 1988 3.5 years of post-secondary education are required for lower-grade teachers and 4-4.5 years are required for upper-grade teachers.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Information provided by TIMSS National Research Coordinators.

Table 5.2**Teachers' Reports on Their Age and Gender
Science - Upper Grade (Eighth Grade*)**

| Country | Percent of Students Taught by Teachers | | | | Percent of Students Taught by Teachers | |
|---------------------------|--|---------------|---------------|-------------------|--|----------|
| | 29 Years or Under | 30 - 39 Years | 40 - 49 Years | 50 Years or Older | Female | Male |
| <i>Australia</i> | r 17 (2.2) | 31 (3.2) | 37 (3.3) | 16 (2.2) | r 39 (3.5) | 61 (3.5) |
| <i>Austria</i> | r 6 (1.8) | 41 (4.0) | 43 (3.6) | 10 (2.0) | r 52 (3.4) | 48 (3.4) |
| Belgium (FI) | 13 (2.5) | 30 (3.9) | 32 (4.3) | 25 (3.4) | 55 (4.2) | 45 (4.2) |
| <i>Belgium (Fr)</i> | s 15 (3.5) | 33 (5.8) | 31 (4.7) | 21 (3.8) | s 56 (5.8) | 44 (5.8) |
| Canada | 21 (3.5) | 27 (2.9) | 33 (4.0) | 19 (3.1) | 37 (3.6) | 63 (3.6) |
| <i>Colombia</i> | 18 (4.6) | 31 (4.2) | 36 (4.5) | 14 (3.6) | 39 (5.0) | 61 (5.0) |
| Cyprus | r 0 (0.0) | 28 (3.1) | 53 (3.7) | 19 (3.3) | r 52 (4.0) | 48 (4.0) |
| Czech Republic | 8 (2.1) | 18 (2.9) | 32 (2.8) | 42 (3.0) | 76 (2.5) | 24 (2.5) |
| <i>Denmark</i> | s 8 (3.5) | 23 (5.7) | 39 (6.1) | 30 (5.8) | s 23 (4.4) | 77 (4.4) |
| England | s 15 (2.0) | 25 (2.5) | 41 (2.9) | 19 (2.6) | s 39 (3.2) | 61 (3.2) |
| France | 13 (1.9) | 19 (2.7) | 41 (3.5) | 27 (3.3) | 51 (3.9) | 49 (3.9) |
| <i>Germany</i> | s 0 (0.0) | 15 (3.7) | 37 (4.0) | 47 (3.9) | s 39 (4.8) | 61 (4.8) |
| <i>Greece</i> | 2 (0.4) | 43 (3.4) | 43 (3.4) | 12 (2.1) | 43 (3.9) | 57 (3.9) |
| Hong Kong | 34 (5.8) | 38 (6.1) | 20 (4.3) | 8 (3.1) | 32 (5.4) | 68 (5.4) |
| Hungary | 14 (1.7) | 27 (2.3) | 39 (2.2) | 20 (2.1) | 74 (2.2) | 26 (2.2) |
| Iceland | r 22 (4.2) | 46 (4.9) | 24 (3.4) | 8 (2.9) | r 44 (7.4) | 56 (7.4) |
| Iran, Islamic Rep. | 45 (5.5) | 39 (5.7) | 15 (3.9) | 1 (0.9) | 40 (4.7) | 60 (4.7) |
| Ireland | r 18 (2.6) | 40 (3.7) | 29 (4.0) | 13 (2.7) | r 54 (4.6) | 46 (4.6) |
| <i>Israel</i> | s 26 (7.8) | 49 (8.8) | 11 (5.4) | 14 (6.8) | s 91 (5.4) | 9 (5.4) |
| Japan | 19 (3.6) | 48 (4.4) | 20 (3.8) | 13 (3.2) | 20 (3.6) | 80 (3.6) |
| Korea | 24 (3.2) | 46 (4.1) | 21 (3.4) | 10 (2.2) | 48 (4.0) | 52 (4.0) |
| <i>Kuwait</i> | r 33 (8.1) | 48 (8.1) | 19 (4.9) | 1 (0.6) | r 50 (8.0) | 50 (8.0) |
| Latvia (LSS) | r 13 (1.5) | 34 (2.8) | 25 (2.2) | 28 (2.4) | r 75 (2.1) | 25 (2.1) |
| Lithuania | 17 (2.0) | 32 (2.3) | 26 (2.2) | 24 (2.2) | 78 (1.8) | 22 (1.8) |
| <i>Netherlands</i> | 11 (2.3) | 27 (3.4) | 35 (3.7) | 27 (3.4) | 20 (3.1) | 80 (3.1) |
| New Zealand | 11 (2.6) | 28 (3.8) | 39 (4.2) | 22 (3.3) | 40 (4.3) | 60 (4.3) |
| Norway | 12 (2.9) | 19 (3.6) | 41 (3.9) | 28 (3.8) | 31 (3.9) | 69 (3.9) |
| Portugal | 37 (3.0) | 44 (3.2) | 13 (2.4) | 6 (1.5) | 78 (3.0) | 22 (3.0) |
| <i>Romania</i> | 11 (1.6) | 21 (2.0) | 38 (2.2) | 30 (2.3) | 74 (1.9) | 26 (1.9) |
| Russian Federation | 18 (3.7) | 26 (3.0) | 31 (2.5) | 25 (2.4) | 86 (2.0) | 14 (2.0) |
| <i>Scotland</i> | s 9 (1.7) | 26 (4.3) | 43 (4.8) | 22 (3.9) | s 37 (3.8) | 63 (3.8) |
| Singapore | 30 (4.3) | 23 (4.0) | 28 (4.9) | 19 (3.6) | 69 (4.6) | 31 (4.6) |
| Slovak Republic | 13 (2.7) | 25 (3.9) | 40 (4.4) | 21 (3.5) | 63 (4.2) | 37 (4.2) |
| <i>Slovenia</i> | r 13 (2.4) | 45 (3.2) | 24 (2.8) | 18 (2.9) | r 77 (2.6) | 23 (2.6) |
| Spain | 3 (1.5) | 31 (3.8) | 50 (4.1) | 16 (3.1) | 44 (4.2) | 56 (4.2) |
| Sweden | 11 (1.9) | 23 (2.6) | 28 (2.7) | 39 (3.0) | 37 (2.9) | 63 (2.9) |
| Switzerland | r 15 (4.1) | 26 (4.1) | 39 (4.6) | 19 (3.3) | r 14 (2.5) | 86 (2.5) |
| <i>Thailand</i> | r 22 (5.0) | 43 (5.7) | 33 (6.2) | 2 (2.2) | r 64 (5.7) | 36 (5.7) |
| United States | r 17 (2.9) | 27 (2.5) | 34 (3.5) | 23 (3.4) | r 54 (4.1) | 46 (4.1) |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.3**Teachers' Reports on Their Years of Teaching Experience
Science - Upper Grade (Eighth Grade*)**

| Country | 0 - 5 Years | | 6-10 Years | | 11-20 Years | | More than 20 Years | |
|---------------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|
| | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement |
| <i>Australia</i> | r 19 (2.3) | 537 (8.4) | 20 (2.9) | 539 (10.4) | 38 (3.5) | 555 (7.9) | 23 (2.7) | 548 (7.9) |
| <i>Austria</i> | r 5 (1.1) | 553 (11.5) | 17 (2.3) | 567 (5.0) | 49 (3.5) | 560 (4.9) | 30 (3.3) | 562 (4.7) |
| Belgium (Fl) | 11 (2.3) | 548 (8.0) | 11 (2.8) | 574 (6.2) | 38 (5.3) | 549 (8.8) | 40 (4.8) | 549 (7.7) |
| <i>Belgium (Fr)</i> | s 13 (3.6) | 482 (8.7) | 8 (2.7) | 492 (8.1) | 44 (5.7) | 485 (4.8) | 35 (5.0) | 478 (5.8) |
| Canada | 25 (3.3) | 535 (7.2) | 18 (2.5) | 542 (6.7) | 23 (3.0) | 521 (4.4) | 33 (3.6) | 529 (5.6) |
| <i>Colombia</i> | r 18 (3.4) | 404 (9.5) | 10 (2.8) | 410 (9.7) | 36 (3.7) | 415 (5.5) | 36 (4.6) | 421 (4.5) |
| Cyprus | s 34 (5.1) | 457 (5.0) | 10 (2.9) | 461 (11.7) | 24 (3.1) | 454 (4.8) | 32 (4.1) | 463 (3.4) |
| Czech Republic | 11 (1.8) | 566 (8.1) | 12 (1.9) | 589 (14.2) | 13 (2.0) | 573 (5.9) | 64 (2.5) | 572 (4.1) |
| <i>Denmark</i> | s 14 (4.2) | 482 (8.0) | 15 (4.6) | 461 (7.2) | 32 (5.9) | 478 (4.6) | 40 (6.3) | 484 (6.2) |
| England | s 21 (2.2) | 559 (11.5) | 14 (2.2) | 559 (10.7) | 33 (3.2) | 566 (8.3) | 32 (3.0) | 569 (8.3) |
| France | 16 (2.2) | 498 (4.3) | 9 (2.2) | 489 (7.1) | 19 (2.5) | 492 (4.3) | 55 (4.0) | 501 (3.8) |
| <i>Germany</i> | s 5 (2.0) | 557 (30.0) | 13 (3.2) | 529 (14.0) | 39 (4.3) | 546 (7.4) | 43 (4.4) | 526 (10.2) |
| <i>Greece</i> | 19 (3.0) | 485 (4.4) | 26 (4.2) | 481 (3.3) | 42 (4.0) | 508 (3.6) | 14 (2.3) | 512 (4.5) |
| Hong Kong | 38 (6.3) | 532 (7.6) | 23 (4.8) | 516 (11.3) | 25 (5.4) | 504 (10.4) | 14 (4.1) | 536 (13.5) |
| Hungary | 15 (1.9) | 545 (5.6) | 12 (1.8) | 552 (4.9) | 32 (2.7) | 556 (4.6) | 41 (2.7) | 552 (3.9) |
| Iceland | r 34 (4.6) | 489 (8.9) | 21 (5.6) | 492 (6.1) | 31 (6.5) | 485 (5.1) | 14 (3.5) | 483 (5.3) |
| Iran, Islamic Rep. | 37 (4.7) | 456 (4.2) | 20 (5.7) | 473 (5.6) | 34 (4.7) | 478 (4.8) | 9 (3.2) | 487 (6.2) |
| Ireland | r 18 (3.1) | 563 (11.3) | 17 (2.9) | 533 (12.0) | 38 (4.1) | 547 (7.0) | 27 (3.9) | 527 (10.2) |
| <i>Israel</i> | r 28 (7.8) | 501 (15.7) | 27 (7.6) | 512 (12.8) | 31 (7.4) | 553 (13.4) | 14 (6.2) | 552 (23.0) |
| Japan | 19 (3.4) | 563 (4.1) | 21 (3.4) | 573 (3.4) | 36 (4.2) | 574 (3.9) | 23 (3.5) | 573 (3.2) |
| Korea | 23 (3.5) | 562 (4.9) | 31 (3.3) | 568 (4.0) | 32 (3.7) | 562 (3.8) | 13 (2.7) | 567 (5.9) |
| <i>Kuwait</i> | s 37 (7.0) | 433 (5.0) | 25 (7.3) | 445 (8.4) | 33 (8.5) | 413 (10.8) | 5 (4.2) | 421 (41.2) |
| Latvia (LSS) | r 13 (1.8) | 485 (3.6) | 20 (2.3) | 482 (3.9) | 28 (2.7) | 486 (4.2) | 39 (2.6) | 485 (3.6) |
| Lithuania | r 19 (2.2) | 483 (4.7) | 14 (1.7) | 479 (5.4) | 28 (2.0) | 474 (5.1) | 39 (2.8) | 474 (5.0) |
| <i>Netherlands</i> | 20 (2.9) | 556 (9.2) | 11 (2.4) | 558 (7.0) | 32 (2.8) | 562 (7.5) | 37 (3.6) | 567 (11.6) |
| New Zealand | 16 (3.1) | 525 (9.1) | 21 (3.6) | 531 (10.7) | 38 (3.7) | 528 (7.0) | 25 (3.3) | 523 (9.5) |
| Norway | 16 (3.4) | 533 (5.1) | 8 (2.4) | 528 (5.6) | 36 (4.2) | 527 (3.1) | 40 (4.5) | 528 (3.9) |
| Portugal | 46 (3.4) | 473 (3.0) | 25 (2.7) | 482 (3.2) | 21 (2.6) | 484 (4.3) | 7 (1.7) | 502 (6.3) |
| <i>Romania</i> | 12 (1.6) | 465 (9.4) | 11 (1.4) | 484 (8.7) | 22 (2.0) | 488 (6.5) | 55 (2.5) | 492 (6.1) |
| Russian Federation | 17 (3.9) | 541 (8.7) | 13 (1.8) | 531 (7.2) | 28 (3.4) | 536 (6.1) | 43 (3.4) | 538 (5.6) |
| <i>Scotland</i> | s 19 (3.0) | 499 (7.3) | 15 (3.1) | 510 (11.6) | 36 (4.7) | 533 (10.1) | 31 (4.5) | 523 (7.6) |
| Singapore | 30 (4.4) | 615 (11.4) | 13 (3.0) | 591 (18.0) | 21 (4.0) | 599 (9.8) | 36 (4.4) | 610 (9.7) |
| Slovak Republic | 15 (2.8) | 546 (7.4) | 18 (3.5) | 548 (6.7) | 18 (3.2) | 540 (8.7) | 49 (4.7) | 545 (4.4) |
| <i>Slovenia</i> | r 11 (2.3) | 569 (5.6) | 17 (2.2) | 560 (4.9) | 38 (3.5) | 553 (3.5) | 33 (3.3) | 560 (3.6) |
| Spain | 9 (2.1) | 527 (9.4) | 13 (2.9) | 516 (5.1) | 40 (4.2) | 516 (3.7) | 39 (4.3) | 514 (3.2) |
| Sweden | 19 (2.3) | 538 (4.1) | 12 (2.0) | 539 (6.9) | 27 (2.3) | 534 (5.0) | 42 (3.0) | 538 (3.4) |
| Switzerland | r 17 (3.7) | 516 (9.4) | 10 (2.5) | 540 (11.6) | 37 (4.4) | 520 (6.9) | 35 (4.1) | 521 (6.7) |
| <i>Thailand</i> | r 41 (7.0) | 522 (6.1) | 20 (5.1) | 537 (10.2) | 36 (6.8) | 535 (7.7) | 3 (1.8) | 529 (47.6) |
| United States | r 30 (3.8) | 538 (8.0) | 15 (3.0) | 549 (10.5) | 26 (3.7) | 534 (7.0) | 29 (3.8) | 542 (7.4) |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

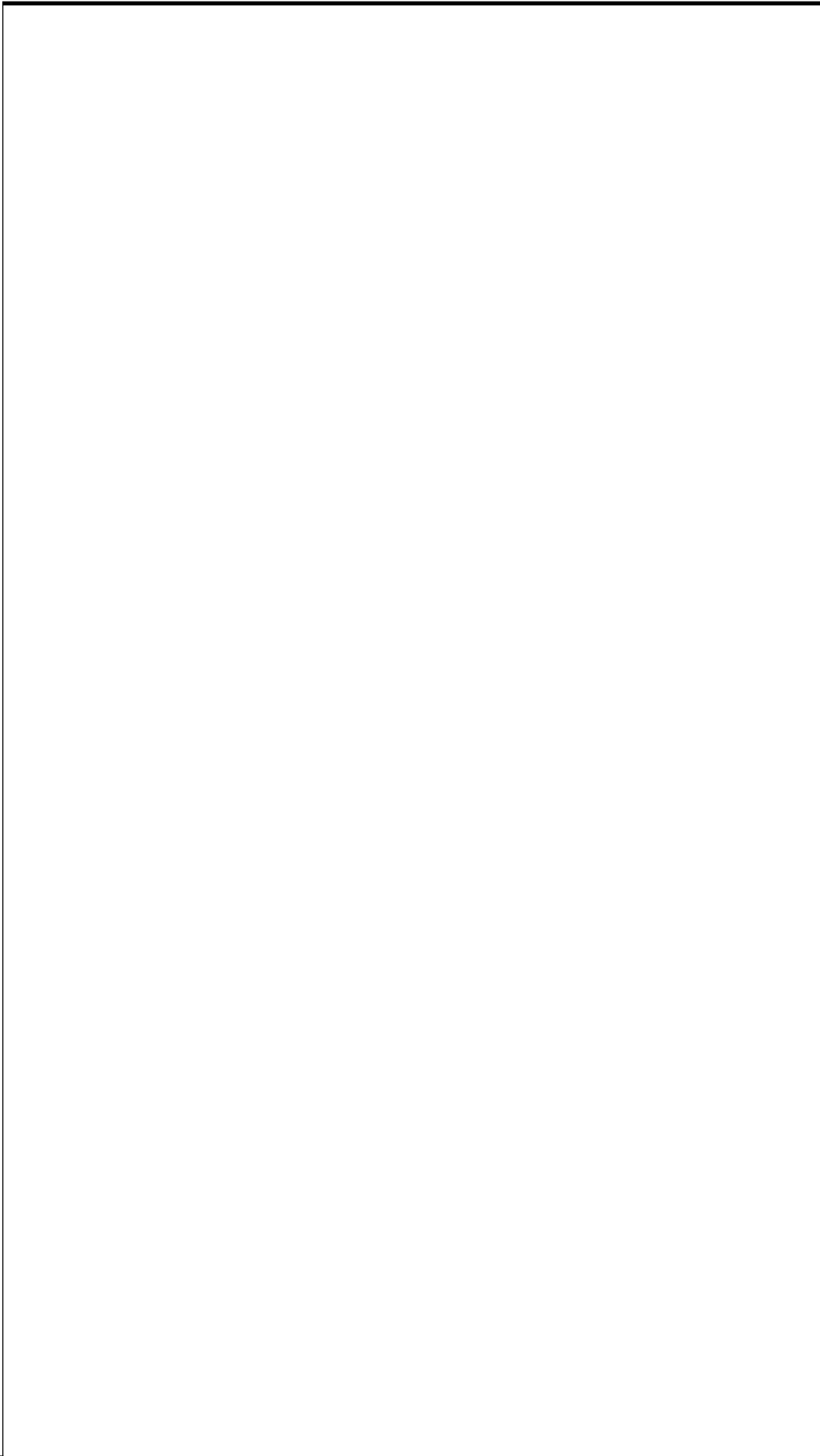
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.



WHAT ARE TEACHERS' PERCEPTIONS ABOUT SCIENCE?

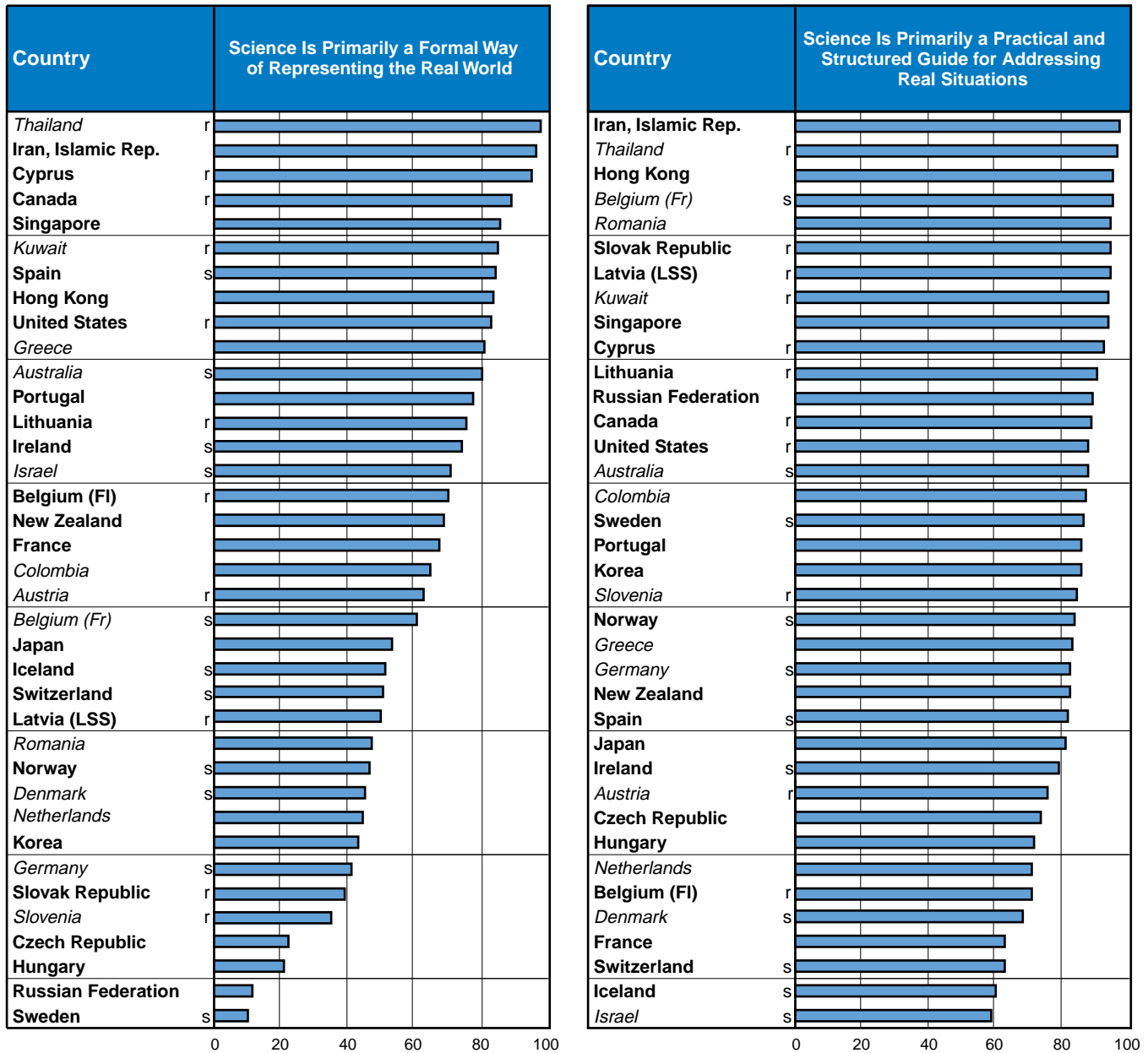
Figure 5.1 depicts the percentages of eighth-grade students whose science teachers reported certain beliefs about science and the way science should be taught. Teacher views about the nature of science varied considerably across countries. In many countries, most notably Thailand, Iran, Cyprus, Canada, and Singapore, teachers agreed that science is primarily a formal way of representing the real world, while in the Slovak Republic, Slovenia, the Czech Republic, Hungary, the Russian Federation, and Sweden, less than 40% of students had teachers holding this view. However, teachers in most countries indicated a fairly practical view of science, agreeing that it is primarily a practical and structured guide for addressing real situations. In most countries also, the majority of eighth-grade students had teachers who agreed that some students have a natural talent for science.

Regarding perceptions about how to teach science, there seemed to be widespread agreement that it is important to give students prescriptive and sequential directions for doing science experiments. Only in the Slovak Republic, New Zealand, Iceland, Denmark, and Korea did fewer than 60% of the eighth-grade students have teachers who agreed with this approach.

TIMSS also queried teachers about the cognitive demands of science, asking them to rate the importance of various skills for success in the discipline. Figure 5.2 shows the percentages of students whose teachers rated each of four different skills as very important. Internationally, most science teachers felt it was very important for students to be able to think in a sequential and procedural manner, to be able to think creatively, to understand how science is used in the real world, and to be able to provide reasons to support their conclusions. However, there was some variation across countries. In every country except Slovenia and Israel, the majority of students were taught by teachers who considered it very important that students be able to think in a sequential and procedural manner. Fewer than half of the eighth-grade students in Austria, Singapore, the Netherlands, Switzerland, Israel, Belgium (Flemish), Ireland, and France had teachers who felt it was very important to think creatively, and fewer than half in Switzerland, France, Austria and Belgium (Flemish) had teachers who felt it was very important to understand how science is used in the real world. With the current calls from business and industry on helping students improve their ability to apply scientific and solve practical problems in job-related situations, it might be rather surprising that teachers in these countries do not place more importance on these two aspects of science. In all countries except Korea, Switzerland, the Slovak Republic, Kuwait, and Austria, the majority of students had teachers who felt it was very important to be able to provide reasons to support their conclusions.

Figure 5.1

Percent of Students Whose Science Teachers Agree or Strongly Agree with Statements About the Nature of Science and Science Teaching Upper Grade (Eighth Grade*)

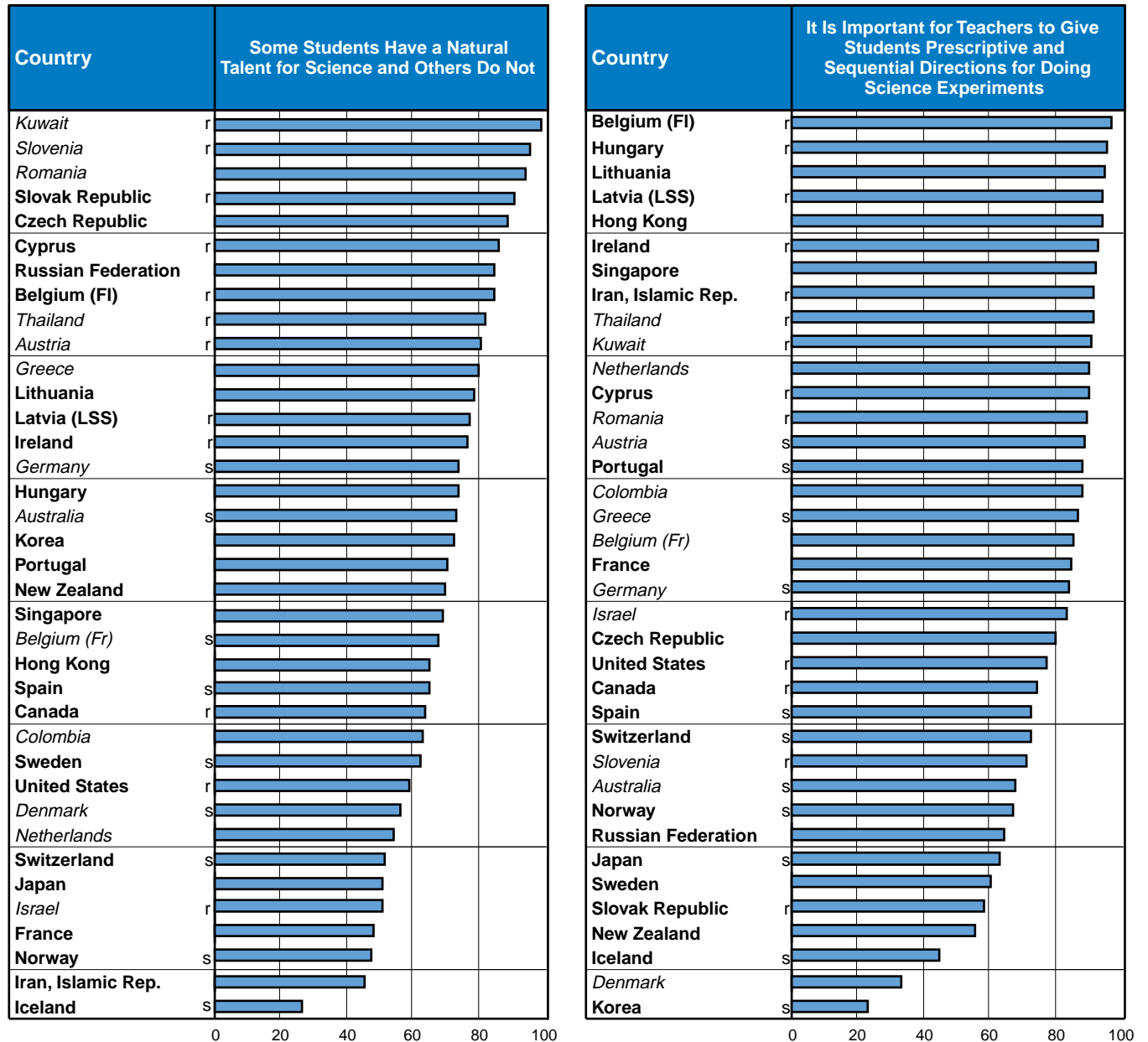


*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country. Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable. Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only. An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. Countries where data were not available or where teacher response data were available for <50% of students are omitted from the figure (England). Scotland did not ask these questions.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.1 (Continued)

**Percent of Students Whose Science Teachers Agree or Strongly Agree with Statements About the Nature of Science and Science Teaching
Upper Grade (Eighth Grade*)**



*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

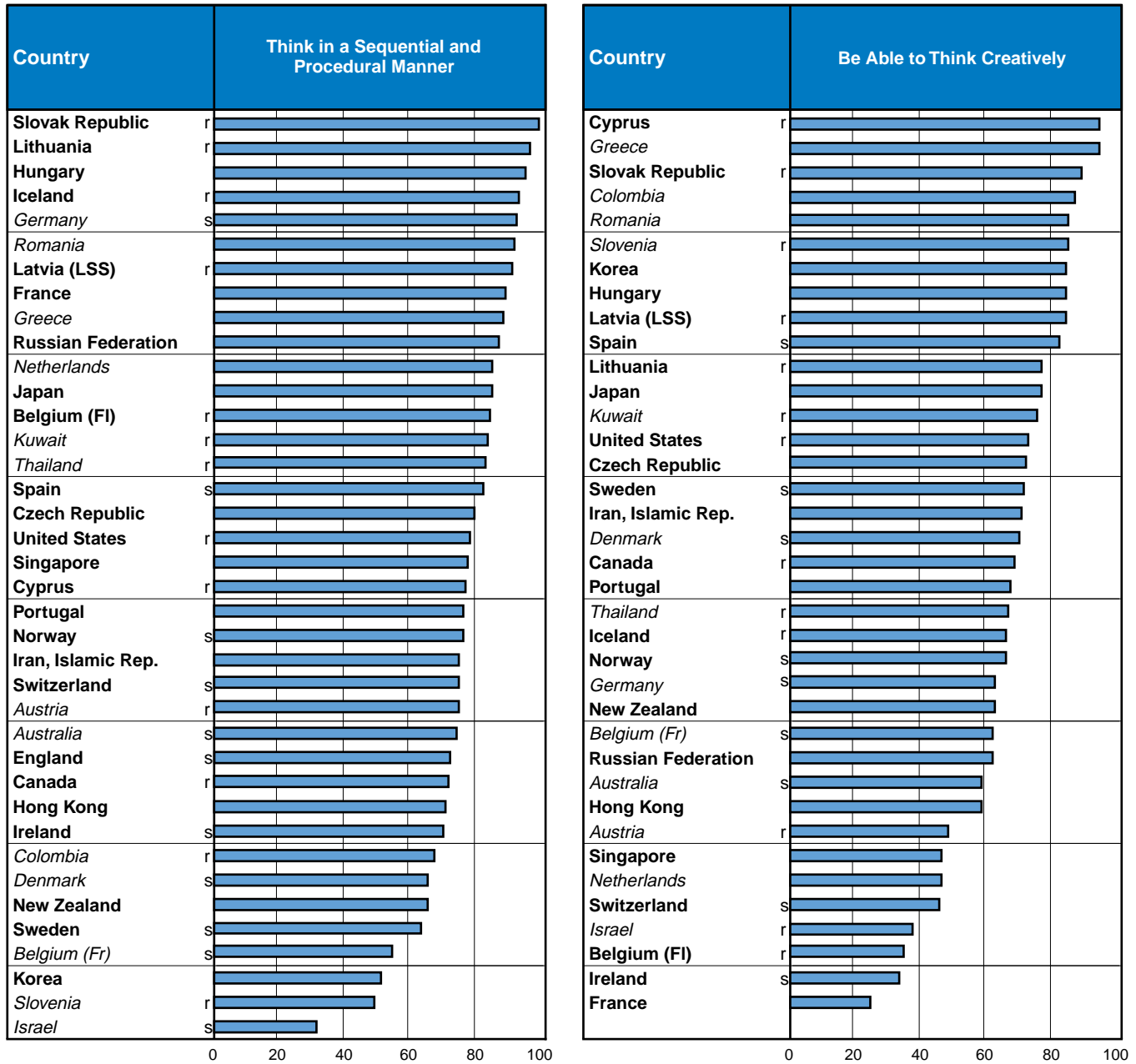
Countries where data were not available or where teacher response data were available for <50% of students are omitted from the figure (England).

Scotland did not ask these questions.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.2

Percent of Students Whose Science Teachers Think Particular Abilities Are Very Important for Students' Success in the Sciences in School - Upper Grade (Eighth Grade*)

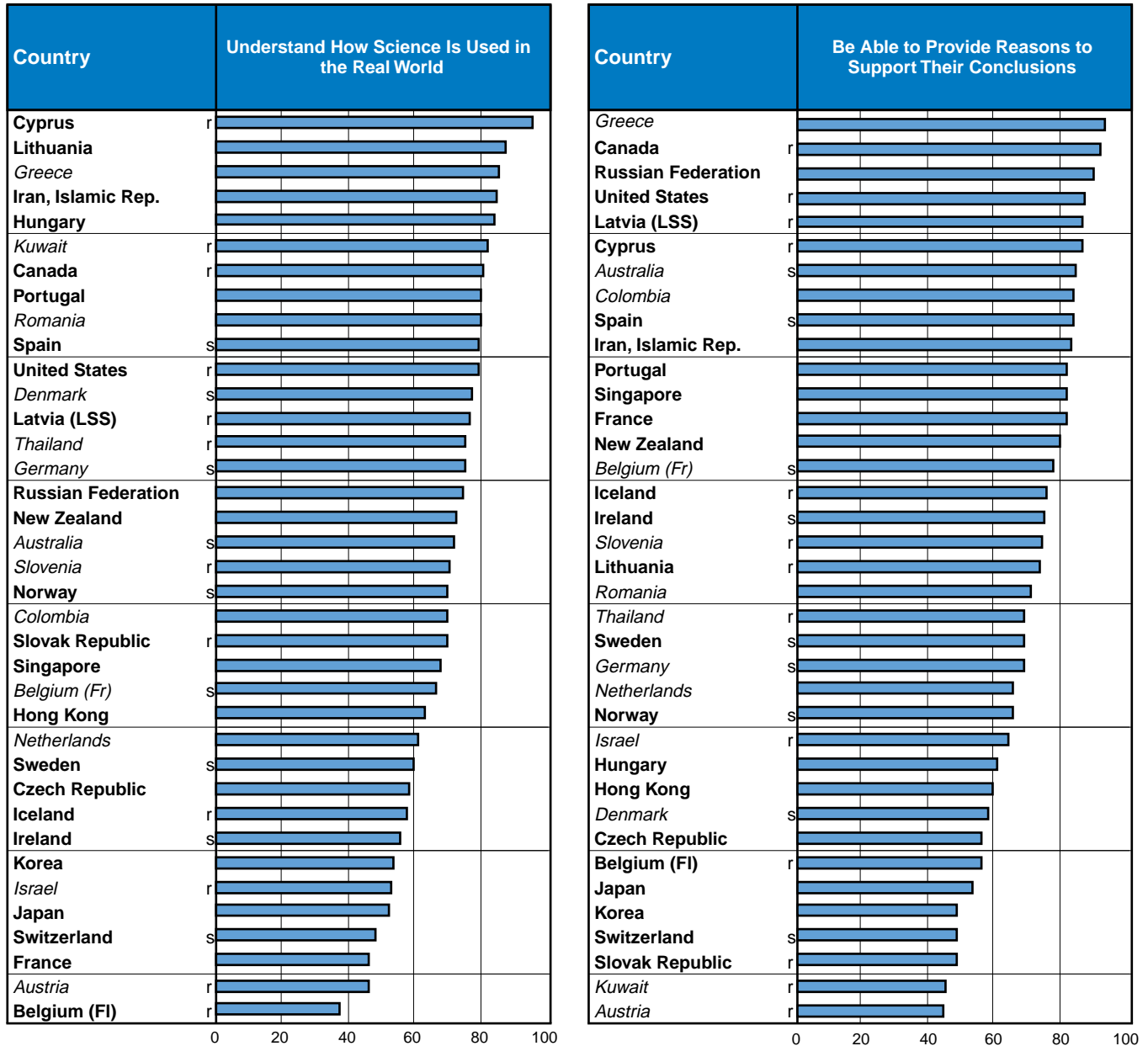


*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country. Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable. Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only. An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. Countries where data were not available or where teacher response data were available for <50% of students are omitted from the figure (England). Scotland did not ask these questions.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.2 (Continued)

Percent of Students Whose Science Teachers Think Particular Abilities Are Very Important for Students' Success in the Sciences in School - Upper Grade (Eighth Grade*)



*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country. Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable. Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only. An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. Countries where data were not available or where teacher response data were available for <50% of students are omitted from the figure (England in the second, third, and fourth panels). Scotland did not ask these questions.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

HOW DO SCIENCE TEACHERS SPEND THEIR SCHOOL-RELATED TIME?

The data in Table 5.4 reveal that in a number of countries, eighth-grade science teachers are specialists. In Belgium (Flemish), Cyprus, France, Kuwait, Latvia (LSS), Lithuania, the Netherlands, New Zealand, Portugal, the Russian Federation, and Scotland, the majority of eighth-grade students had teachers who spent at least 75% of their formally scheduled school time teaching science. For most participating countries, there was little difference in students' achievement according to whether they were taught by specialists.

As shown in Table 5.5, teachers in most countries where science is taught as an integrated subject reported that science classes typically meet for less than 3.5 hours per week, although 3.5 to nearly 5 hours was reported for more than three-quarters of the eighth-grade students in Singapore and almost half of those in New Zealand. The data reveal no clear pattern between the number of in-class instructional hours and achievement either across or between countries. Common sense and research both support the idea that increased time on task can yield commensurate increases in achievement, yet this time also can be spent outside of school on homework or in special tutoring. The ability to use straightforward analyses such as these to disentangle complicated relationships also is made difficult by the practice of providing additional in-school instruction for lower-performing students.

In addition to their formally scheduled duties, teachers were asked about the number of hours per week spent on selected school-related activities outside the regular school day. Table 5.6 presents the results. For example, on average, eighth-grade students in Australia had science teachers who spent 2.1 hours per week preparing or grading tests, and another 2.3 hours per week reading and grading student work. Their teachers spent 2.8 hours per week on lesson planning and 1.6 hours combined on meeting students and parents. They spent 1.2 hours on professional reading and development, and 3.2 hours on record-keeping and administrative tasks combined. Across countries, teachers reported that grading tests, grading student work, and lesson planning were the most time-consuming activities, averaging as much as 10 hours per week in Singapore. In general, teachers also reported several hours per week spent on keeping students' records and other administrative tasks.

Opportunities to meet with colleagues to plan curriculum or teaching approaches enable teachers to expand their views of science, their resources for teaching, and their repertoire of teaching and learning skills. Table 5.7 contains teachers' reports on how often they meet with other teachers in their subject area to discuss and plan curriculum or teaching approaches. Teachers of the majority of the students reported weekly or even daily planning meetings in Cyprus, the Czech Republic, England, Hungary, Korea, Kuwait, Norway, Scotland, the Slovak Republic, and Sweden. In the remaining countries, however, most students had science teachers who reported only limited opportunities to plan curriculum or teaching approaches with other teachers (monthly or even yearly meetings).

Table 5.4**Teachers' Reports on the Proportion of Their Formally Scheduled School Time Spent Teaching the Sciences¹ - Upper Grade (Eighth Grade*)**

| Country | Less Than 50 Percent | | 50-74 Percent | | 75-100 Percent | |
|---------------------------|----------------------|------------------|---------------------|------------------|---------------------|------------------|
| | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement |
| <i>Australia</i> | r 34 (2.7) | 539 (6.3) | 25 (3.1) | 551 (7.0) | 42 (3.2) | 554 (8.4) |
| <i>Austria</i> | r 67 (2.8) | 550 (4.1) | 16 (2.5) | 566 (6.1) | 17 (1.9) | 602 (4.3) |
| Belgium (Fl) | 20 (3.2) | 548 (6.7) | 18 (3.1) | 569 (4.5) | 61 (4.0) | 548 (6.2) |
| <i>Belgium (Fr)</i> | s 24 (4.5) | 477 (6.1) | 33 (4.6) | 487 (5.4) | 43 (5.2) | 484 (4.3) |
| Canada | 55 (3.5) | 523 (3.0) | 24 (3.5) | 549 (6.2) | 22 (2.7) | 534 (5.8) |
| <i>Colombia</i> | 27 (4.2) | 399 (11.1) | 39 (4.8) | 415 (4.5) | 34 (4.0) | 419 (4.8) |
| Cyprus | r 12 (2.0) | 448 (4.9) | 22 (3.8) | 455 (4.6) | 66 (4.0) | 463 (2.6) |
| Czech Republic | 69 (2.9) | 569 (3.7) | 18 (2.7) | 574 (6.7) | 13 (2.5) | 597 (8.2) |
| <i>Denmark</i> | s 66 (5.2) | 481 (4.0) | 20 (3.8) | 481 (8.3) | 15 (4.1) | 463 (8.6) |
| England | x x | x x | x x | x x | x x | x x |
| France | 15 (2.1) | 489 (4.3) | 8 (1.7) | 495 (10.1) | 77 (2.5) | 501 (2.6) |
| <i>Germany</i> | s 47 (3.8) | 524 (10.0) | 22 (3.4) | 534 (8.8) | 31 (3.7) | 556 (7.0) |
| <i>Greece</i> | - - | - - | - - | - - | - - | - - |
| Hong Kong | 32 (6.1) | 506 (11.0) | 26 (5.2) | 530 (8.7) | 42 (5.3) | 530 (7.5) |
| <i>Hungary</i> | - - | - - | - - | - - | - - | - - |
| Iceland | r 64 (6.5) | 488 (5.0) | 14 (6.1) | 490 (5.5) | 21 (7.1) | 486 (8.3) |
| Iran, Islamic Rep. | - - | - - | - - | - - | - - | - - |
| Ireland | r 25 (3.7) | 541 (10.2) | 36 (4.6) | 546 (7.5) | 39 (4.2) | 538 (8.7) |
| <i>Israel</i> | s 32 (9.3) | 549 (17.0) | 22 (6.4) | 548 (10.6) | 46 (9.5) | 507 (10.1) |
| Japan | 28 (3.8) | 571 (3.5) | 38 (3.9) | 574 (3.6) | 34 (4.4) | 568 (3.2) |
| Korea | 51 (3.4) | 565 (3.0) | 41 (3.4) | 563 (3.2) | 8 (1.9) | 576 (6.7) |
| <i>Kuwait</i> | r 23 (6.1) | 422 (10.2) | 26 (4.6) | 432 (4.2) | 51 (7.4) | 425 (6.0) |
| Latvia (LSS) | r 25 (2.5) | 484 (5.0) | 18 (2.0) | 484 (3.6) | 57 (3.0) | 484 (3.0) |
| Lithuania | 20 (2.0) | 481 (6.9) | 15 (1.8) | 472 (5.9) | 65 (2.3) | 476 (4.0) |
| <i>Netherlands</i> | 16 (2.5) | 539 (12.3) | 15 (2.5) | 556 (12.3) | 68 (3.7) | 569 (5.8) |
| New Zealand | 19 (3.0) | 514 (9.9) | 24 (2.9) | 527 (7.4) | 57 (4.0) | 532 (5.9) |
| Norway | 81 (3.5) | 532 (2.2) | 7 (2.2) | 513 (6.2) | 12 (3.0) | 512 (5.7) |
| Portugal | 15 (2.3) | 477 (3.5) | 22 (2.5) | 478 (3.6) | 63 (2.9) | 481 (3.0) |
| <i>Romania</i> | 81 (2.3) | 489 (5.0) | 14 (2.1) | 472 (9.3) | 4 (1.0) | 489 (13.1) |
| Russian Federation | 5 (1.2) | 537 (12.6) | 5 (1.3) | 529 (10.8) | 90 (2.0) | 538 (4.1) |
| <i>Scotland</i> | s 0 (0.0) | ~ ~ | 3 (1.5) | 499 (16.9) | 97 (1.5) | 521 (5.6) |
| Singapore | 10 (2.3) | 577 (12.6) | 56 (5.3) | 608 (7.8) | 34 (4.9) | 613 (10.4) |
| Slovak Republic | 83 (2.9) | 543 (3.7) | 14 (2.6) | 549 (6.7) | 3 (1.6) | 572 (17.2) |
| <i>Slovenia</i> | r 29 (2.5) | 558 (3.8) | 30 (3.6) | 554 (4.5) | 41 (3.4) | 561 (3.2) |
| Spain | 85 (3.3) | 515 (1.9) | 14 (3.2) | 524 (7.0) | 1 (0.9) | ~ ~ |
| Sweden | 62 (2.6) | 538 (3.1) | 28 (2.5) | 533 (5.0) | 9 (1.7) | 540 (5.8) |
| Switzerland | r 70 (3.4) | 520 (4.1) | 14 (3.1) | 507 (9.6) | 16 (2.2) | 544 (7.3) |
| <i>Thailand</i> | r 27 (5.6) | 526 (9.5) | 28 (5.3) | 528 (7.7) | 45 (6.2) | 532 (6.2) |
| United States | r 40 (3.5) | 546 (4.5) | 36 (3.9) | 541 (7.1) | 25 (3.5) | 526 (9.8) |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

¹Formally scheduled school time included time scheduled for teaching all subjects, as well as student supervision, student counseling/appraisal, administrative duties, individual curriculum planning, cooperative curriculum planning, and other non-student contact time.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.5**Teachers' Reports¹ on Average Number of Hours Integrated Science Is Taught Weekly to Their Science Classes - Upper Grade (Eighth Grade*)**

| Country | Less Than 2 Hours | | 2 Hours to < 3.5 | | 3.5 hours to < 5 | | 5 Hours or More | |
|---------------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|
| | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement |
| <i>Australia</i> | x x | x x | x x | x x | x x | x x | x x | x x |
| Canada | r 11 (2.1) | 512 (8.9) | 69 (3.9) | 540 (3.8) | 11 (2.5) | 528 (5.5) | 8 (2.1) | 517 (10.3) |
| <i>Colombia</i> | r 6 (2.3) | 416 (4.5) | 75 (4.2) | 415 (5.6) | 13 (3.2) | 404 (5.5) | 6 (2.4) | 403 (18.6) |
| Cyprus | x x | x x | x x | x x | x x | x x | x x | x x |
| England | - - | - - | - - | - - | - - | - - | - - | - - |
| Hong Kong | 7 (2.3) | 492 (29.9) | 82 (3.9) | 526 (5.3) | 9 (3.3) | 518 (8.6) | 2 (1.6) | ~ ~ |
| Iran, Islamic Rep. | - - | - - | - - | - - | - - | - - | - - | - - |
| Ireland | s 4 (1.9) | 578 (16.5) | 94 (2.1) | 540 (6.2) | 2 (0.8) | ~ ~ | 0 (0.0) | ~ ~ |
| <i>Israel</i> | s 19 (7.9) | 547 (19.6) | 77 (7.2) | 520 (9.1) | 4 (3.5) | 529 (0.0) | 0 (0.0) | ~ ~ |
| Japan | 5 (1.6) | 618 (15.2) | 94 (1.7) | 569 (1.5) | 0 (0.0) | ~ ~ | 1 (0.6) | ~ ~ |
| Korea | 43 (2.9) | 569 (3.3) | 51 (3.2) | 561 (3.1) | 1 (0.8) | ~ ~ | 5 (2.3) | 568 (12.7) |
| <i>Kuwait</i> | r 3 (2.6) | 409 (1.9) | 97 (2.6) | 426 (4.4) | 1 (0.5) | ~ ~ | 0 (0.0) | ~ ~ |
| New Zealand | 1 (0.9) | ~ ~ | 52 (4.1) | 527 (6.3) | 47 (4.2) | 525 (6.6) | 0 (0.0) | ~ ~ |
| Norway | s 27 (4.9) | 526 (3.0) | 73 (4.9) | 524 (2.6) | 1 (0.6) | ~ ~ | 0 (0.0) | ~ ~ |
| <i>Scotland</i> | s 14 (3.1) | 538 (23.4) | 83 (3.6) | 519 (4.8) | 3 (1.7) | 488 (22.5) | 0 (0.0) | ~ ~ |
| Singapore | 0 (0.0) | ~ ~ | 24 (4.4) | 618 (14.6) | 76 (4.4) | 603 (6.0) | 0 (0.0) | ~ ~ |
| Spain | r 5 (2.6) | 532 (2.5) | 84 (3.9) | 518 (2.1) | 11 (3.0) | 502 (9.4) | 1 (0.7) | ~ ~ |
| Switzerland | s 41 (4.7) | 532 (6.6) | 37 (4.4) | 524 (8.4) | 9 (3.1) | 486 (13.7) | 13 (3.5) | 519 (15.6) |
| <i>Thailand</i> | x x | x x | x x | x x | x x | x x | x x | x x |
| United States | x x | x x | x x | x x | x x | x x | x x | x x |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

¹Reported for countries using integrated science form of student questionnaire.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.6

**Average Number of Hours¹ Students' Teachers Spend on Various School-Related Activities Outside the Formal School Day During the School Week
Science - Upper Grade (Eighth Grade*)**

| Country | Preparing or Grading Tests | Reading and Grading Student Work | Planning Lessons by Self | Meeting with Students Outside Classroom Time | Meeting with Parents | Professional Reading and Development | Keeping Students' Records | Administrative Tasks |
|---------------------------|----------------------------|----------------------------------|--------------------------|--|----------------------|--------------------------------------|---------------------------|----------------------|
| <i>Australia</i> | r 2.1 (0.1) | s 2.3 (0.1) | r 2.8 (0.1) | s 1.1 (0.1) | s 0.5 (0.0) | r 1.2 (0.1) | s 1.1 (0.1) | r 2.1 (0.1) |
| <i>Austria</i> | r 1.7 (0.1) | r 2.6 (0.1) | r 3.6 (0.1) | r 0.5 (0.0) | r 0.6 (0.0) | r 1.9 (0.1) | r 0.9 (0.1) | r 1.1 (0.1) |
| Belgium (Fl) | 3.5 (0.1) | 1.5 (0.1) | 3.6 (0.1) | 0.7 (0.1) | r 0.6 (0.1) | 1.2 (0.1) | r 0.5 (0.1) | 1.4 (0.1) |
| <i>Belgium (Fr)</i> | s 3.2 (0.2) | s 1.7 (0.1) | s 3.5 (0.2) | s 0.7 (0.1) | s 0.5 (0.1) | s 1.4 (0.1) | s 0.8 (0.1) | s 1.1 (0.1) |
| Canada | 2.2 (0.1) | 2.5 (0.1) | 2.6 (0.1) | 1.4 (0.1) | 0.5 (0.0) | r 0.8 (0.1) | 1.1 (0.0) | 1.7 (0.1) |
| <i>Colombia</i> | 2.9 (0.1) | r 2.5 (0.2) | 3.1 (0.1) | r 1.5 (0.2) | r 0.9 (0.1) | r 2.4 (0.2) | r 0.8 (0.1) | r 1.4 (0.2) |
| Cyprus | r 3.4 (0.1) | r 1.6 (0.1) | r 3.5 (0.1) | s 0.3 (0.0) | r 1.0 (0.1) | r 1.0 (0.1) | s 0.5 (0.1) | r 1.3 (0.1) |
| Czech Republic | 2.5 (0.1) | 1.2 (0.1) | 4.0 (0.1) | 1.1 (0.1) | 0.5 (0.0) | 1.0 (0.1) | 0.9 (0.0) | 1.3 (0.1) |
| <i>Denmark</i> | - - | - - | - - | - - | - - | - - | - - | - - |
| England | x x | x x | x x | x x | x x | x x | x x | x x |
| France | 3.8 (0.1) | r 1.0 (0.1) | 3.6 (0.1) | 0.6 (0.0) | 0.5 (0.0) | 1.4 (0.1) | 0.9 (0.0) | 1.3 (0.1) |
| <i>Germany</i> | s 2.7 (0.1) | s 2.3 (0.1) | s 4.1 (0.1) | s 0.7 (0.1) | s 0.7 (0.1) | s 1.9 (0.1) | s 1.0 (0.1) | s 1.7 (0.1) |
| <i>Greece</i> | 2.8 (0.1) | 1.2 (0.1) | 2.4 (0.1) | 0.6 (0.1) | 0.9 (0.1) | 2.6 (0.1) | 0.4 (0.0) | 1.3 (0.2) |
| Hong Kong | 2.3 (0.2) | 3.1 (0.2) | 2.8 (0.2) | 1.9 (0.1) | 0.4 (0.1) | 1.0 (0.1) | 0.8 (0.1) | 1.8 (0.2) |
| Hungary | 2.7 (0.1) | 2.2 (0.1) | 3.7 (0.1) | 1.8 (0.1) | 0.8 (0.0) | 2.1 (0.1) | 0.7 (0.0) | 2.3 (0.1) |
| Iceland | s 1.8 (0.2) | s 2.8 (0.2) | s 4.0 (0.2) | r 0.6 (0.1) | s 0.5 (0.0) | r 1.3 (0.2) | s 1.3 (0.1) | r 2.0 (0.2) |
| Iran, Islamic Rep. | 2.5 (0.2) | 1.8 (0.2) | 2.0 (0.1) | 0.9 (0.1) | 0.7 (0.0) | 0.51(0.1) | 0.9 (0.1) | 0.8 (0.1) |
| Ireland | r 2.1 (0.1) | s 1.7 (0.1) | r 2.3 (0.1) | r 0.8 (0.1) | r 0.3 (0.1) | r 0.8 (0.1) | r 0.8 (0.1) | r 1.1 (0.1) |
| <i>Israel</i> | r 3.4 (0.3) | s 2.1 (0.2) | r 3.5 (0.3) | s 1.1 (0.2) | s 0.7 (0.1) | s 3.3 (0.3) | s 1.2 (0.2) | r 1.6 (0.2) |
| Japan | 1.8 (0.1) | 1.7 (0.1) | 3.0 (0.1) | 2.0 (0.1) | 0.5 (0.0) | 1.7 (0.1) | 1.3 (0.1) | 2.4 (0.1) |
| Korea | 1.9 (0.1) | 1.7 (0.1) | 2.4 (0.1) | 1.9 (0.1) | 0.4 (0.0) | 1.7 (0.1) | 1.1 (0.1) | 1.9 (0.1) |
| <i>Kuwait</i> | r 2.8 (0.2) | r 2.1 (0.2) | r 2.1 (0.2) | s 0.4 (0.1) | r 0.5 (0.1) | s 0.9 (0.1) | r 1.3 (0.2) | r 0.8 (0.1) |
| Latvia (LSS) | r 2.3 (0.1) | r 1.6 (0.1) | r 3.1 (0.1) | r 1.5 (0.1) | r 0.6 (0.0) | r 1.2 (0.1) | r 0.4 (0.0) | r 1.4 (0.1) |
| Lithuania | r 1.5 (0.1) | r 2.0 (0.1) | r 2.6 (0.1) | r 1.6 (0.1) | r 0.8 (0.0) | r 2.3 (0.1) | r 0.8 (0.0) | r 0.7 (0.1) |
| <i>Netherlands</i> | 3.8 (0.1) | r 1.1 (0.1) | 3.0 (0.1) | r 1.3 (0.1) | 0.6 (0.0) | 1.2 (0.1) | r 0.5 (0.0) | 1.4 (0.1) |
| New Zealand | 2.3 (0.1) | 2.1 (0.1) | 3.0 (0.1) | 1.2 (0.1) | 0.4 (0.1) | 1.3 (0.1) | 1.0 (0.1) | 2.6 (0.1) |
| Norway | 2.1 (0.1) | 1.6 (0.1) | 3.4 (0.1) | 0.7 (0.1) | 0.6 (0.0) | 0.5 (0.1) | 0.8 (0.1) | 1.7 (0.1) |
| Portugal | 3.0 (0.1) | 2.2 (0.1) | 3.7 (0.1) | 0.7 (0.1) | 0.6 (0.0) | 1.5 (0.1) | 0.9 (0.1) | 1.5 (0.1) |
| <i>Romania</i> | 2.1 (0.1) | 1.7 (0.1) | 3.3 (0.1) | 1.4 (0.1) | 1.1 (0.0) | 1.4 (0.1) | 1.5 (0.1) | 2.2 (0.1) |
| Russian Federation | 2.1 (0.1) | 2.0 (0.1) | 3.1 (0.1) | 1.9 (0.1) | 1.0 (0.0) | 2.8 (0.1) | 0.9 (0.0) | 1.9 (0.1) |
| <i>Scotland</i> | s 1.5 (0.1) | s 1.7 (0.1) | s 2.0 (0.1) | s 0.9 (0.1) | s 0.6 (0.1) | s 1.1 (0.1) | s 1.1 (0.1) | s 1.6 (0.1) |
| Singapore | 3.3 (0.2) | 4.0 (0.1) | 3.1 (0.1) | 1.4 (0.1) | 0.4 (0.0) | 1.3 (0.1) | 1.2 (0.1) | 2.3 (0.1) |
| Slovak Republic | 2.3 (0.1) | 1.6 (0.1) | 3.5 (0.1) | 1.2 (0.1) | 0.6 (0.0) | 0.9 (0.1) | 1.1 (0.1) | 1.1 (0.1) |
| <i>Slovenia</i> | r 2.2 (0.1) | r 1.2 (0.1) | r 3.4 (0.1) | r 1.2 (0.1) | r 1.1 (0.1) | r 2.2 (0.1) | r 0.6 (0.0) | r 1.6 (0.1) |
| Spain | 2.2 (0.1) | 1.5 (0.1) | 1.8 (0.1) | 0.9 (0.1) | 1.1 (0.1) | 1.6 (0.1) | 0.8 (0.1) | 1.7 (0.1) |
| Sweden | 2.3 (0.1) | 1.5 (0.1) | 4.0 (0.1) | 0.6 (0.0) | 0.8 (0.0) | 1.5 (0.1) | 0.9 (0.0) | 2.4 (0.1) |
| Switzerland | r 3.0 (0.1) | r 2.1 (0.1) | r 3.8 (0.1) | r 0.9 (0.1) | r 0.7 (0.1) | r 1.9 (0.1) | r 0.7 (0.0) | r 2.3 (0.1) |
| <i>Thailand</i> | s 2.7 (0.2) | s 2.4 (0.2) | s 2.3 (0.2) | s 1.3 (0.1) | s 0.6 (0.1) | s 1.6 (0.2) | s 1.4 (0.1) | s 1.8 (0.2) |
| United States | r 2.1 (0.1) | r 2.4 (0.1) | r 2.2 (0.1) | r 1.2 (0.1) | r 0.7 (0.1) | r 1.0 (0.1) | r 1.5 (0.1) | r 2.0 (0.1) |

¹Average hours based on: No time=0, Less Than 1 Hour=.5, 1-2 Hours=1.5; 3-4 Hours=3.5; More Than 4 Hours=5.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.7

Teachers' Reports on How Often They Meet with Other Teachers in Their Subject Area To Discuss and Plan Curriculum or Teaching Approaches Science - Upper Grade (Eighth Grade*)

| Country | Percent of Students Taught by Teachers | | | |
|---------------------------|--|--------------------------------------|--|--------------------------|
| | Meeting Never or Once/ Twice a Year | Meeting Monthly or Every Other Month | Meeting Once, Twice, or Three Times a Week | Meeting Almost Every Day |
| <i>Australia</i> | r 10 (2.0) | 50 (3.6) | 30 (3.2) | 9 (2.3) |
| <i>Austria</i> | r 20 (2.5) | 37 (3.0) | 36 (3.1) | 6 (1.9) |
| Belgium (Fl) | 48 (5.6) | 28 (4.2) | 21 (3.5) | 3 (1.2) |
| <i>Belgium (Fr)</i> | s 22 (4.2) | 34 (5.6) | 38 (5.2) | 7 (2.4) |
| Canada | 38 (2.9) | 25 (3.5) | 31 (3.8) | 6 (1.7) |
| <i>Colombia</i> | 24 (3.3) | 30 (4.4) | 42 (4.8) | 4 (1.8) |
| Cyprus | r 4 (1.7) | 6 (0.7) | 67 (3.2) | 22 (2.2) |
| Czech Republic | 22 (3.2) | 23 (2.5) | 34 (3.4) | 20 (2.3) |
| <i>Denmark</i> | - - | - - | - - | - - |
| England | s 8 (1.6) | 41 (3.1) | 51 (3.2) | 0 (0.1) |
| France | 45 (4.2) | 22 (2.8) | 29 (4.2) | 4 (1.4) |
| <i>Germany</i> | s 32 (4.5) | 31 (4.8) | 22 (3.6) | 15 (3.4) |
| <i>Greece</i> | 43 (4.2) | 26 (3.4) | 26 (3.9) | 6 (1.7) |
| Hong Kong | 33 (5.3) | 48 (5.9) | 19 (4.3) | 0 (0.0) |
| Hungary | 9 (1.6) | 16 (2.1) | 39 (2.7) | 35 (3.1) |
| Iceland | r 42 (6.1) | 29 (7.0) | 29 (8.0) | 0 (0.0) |
| Iran, Islamic Rep. | 18 (3.3) | 37 (4.4) | 34 (4.6) | 11 (3.1) |
| Ireland | r 59 (4.3) | 25 (4.1) | 14 (3.1) | 2 (0.9) |
| <i>Israel</i> | r 25 (6.9) | 34 (9.5) | 37 (8.6) | 4 (2.6) |
| Japan | 24 (3.4) | 29 (3.9) | 46 (3.7) | 1 (1.0) |
| Korea | 22 (3.0) | 26 (3.6) | 37 (4.1) | 15 (3.1) |
| <i>Kuwait</i> | r 10 (4.5) | 2 (1.1) | 66 (8.3) | 22 (7.3) |
| Latvia (LSS) | r 28 (2.5) | 46 (3.0) | 16 (2.3) | 10 (1.9) |
| Lithuania | 25 (2.5) | 36 (2.7) | 24 (2.4) | 14 (1.7) |
| <i>Netherlands</i> | 13 (2.5) | 65 (3.9) | 21 (3.1) | 2 (0.9) |
| New Zealand | 6 (1.8) | 45 (4.1) | 43 (4.0) | 6 (2.1) |
| Norway | 7 (2.3) | 20 (3.5) | 65 (4.0) | 8 (2.0) |
| Portugal | 8 (1.6) | 69 (3.0) | 18 (2.8) | 5 (1.2) |
| <i>Romania</i> | 12 (1.8) | 58 (2.6) | 14 (1.7) | 16 (1.9) |
| Russian Federation | 12 (1.9) | 57 (2.7) | 20 (2.6) | 11 (2.1) |
| <i>Scotland</i> | s 7 (1.7) | 12 (2.6) | 74 (4.0) | 8 (2.3) |
| Singapore | 15 (3.8) | 61 (4.6) | 21 (4.1) | 3 (1.4) |
| Slovak Republic | 4 (1.5) | 23 (3.6) | 35 (4.0) | 39 (4.6) |
| <i>Slovenia</i> | r 5 (1.8) | 53 (3.6) | 18 (2.8) | 24 (2.9) |
| Spain | 17 (2.9) | 48 (4.4) | 32 (4.0) | 2 (1.2) |
| Sweden | 9 (1.8) | 19 (2.5) | 46 (3.5) | 26 (2.6) |
| Switzerland | r 36 (4.0) | 32 (4.0) | 30 (3.9) | 2 (1.3) |
| <i>Thailand</i> | s 53 (6.1) | 17 (4.3) | 23 (5.2) | 6 (3.1) |
| United States | r 37 (3.3) | 31 (3.5) | 26 (4.0) | 6 (1.3) |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

HOW ARE SCIENCE CLASSES ORGANIZED?

Table 5.8 presents teachers' reports about the size of eighth-grade science classes for the TIMSS countries. The data reveal rather large variation from country to country. Scotland appeared to have the smallest eighth-grade science classes, with 99% of the students in classes of 20 or fewer students. According to teachers, science classes were relatively small in a number of countries. For example, 90% or more of the students were in science classes of 30 or fewer students in Austria, Belgium (Flemish), Belgium (French), Denmark, France, Germany, Hungary, Iceland, Ireland, Lithuania, the Netherlands, Norway, Portugal, the Russian Federation, Scotland, Slovenia, and Switzerland. At the other end of the spectrum, 89% of the students in Korea were in science classes with more than 40 students. In Colombia, Hong Kong, Japan, Korea, and Singapore, 90% of the students were in classes with more than 30 students. Extensive research about class size in relation to achievement indicates that the existence of such a relationship is dependent on the situation. Dramatic reductions in class size can be related to gains in achievement, but the chief effects of smaller classes often are in relation to teacher attitudes and instructional behaviors. The TIMSS data illustrate the complexity of this issue. Across countries, three of the four highest-performing countries at the eighth grade—Singapore, Korea, and Japan—are among those with the largest science classes. Within countries, several show little or no relationship between achievement and class size, often because students mostly are in classes of similar size. Within others, there appears to be a curvilinear relationship, or those students with higher achievement appear to be in larger classes. In some countries, larger classes may represent the more usual situation for teaching science, with smaller classes used primarily for students needing remediation or for those students in the less advanced tracks.

Teachers can adopt a variety of organizational and interactive approaches in science class. Whole-class instruction can be very efficient, because it requires less time on management functions and provides more time for developing science concepts. Teachers can make presentations, conduct discussions, or demonstrate procedures and applications to all students simultaneously. Both whole-class and independent work have been standard features of science classrooms. Students also can benefit from the type of cooperative learning that occurs with effective use of small-group work. Because they can help each other, students in groups can often handle challenging situations beyond their individual capabilities. Further, the positive affective impact of working together mirrors the use of science in the workplace.

Figure 5.3 provides a pictorial view of the emphasis on individual, group, and whole class work as reported by the science teachers in the TIMSS countries. Because learning may be enhanced with teacher guidance and monitoring of individual and small-group activities, the frequency of lessons using each of these organizational approaches is shown both with and without assistance from the teacher. Internationally, teachers reported that working together as a class with the teacher teaching the whole class is a frequently used instructional approach. In most countries, 50% or more of the eighth-grade students were taught this way during most or every lesson. Students working individually with assistance from the teacher is also a popular

Table 5.8**Teachers' Reports on Average Size of Science Class
Upper Grade (Eighth Grade*)**

| Country | 1 - 20 Students | | 21 - 30 Students | | 31 - 40 Students | | 41 or More Students | |
|---------------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|
| | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement |
| <i>Australia</i> | x x | x x | x x | x x | x x | x x | x x | x x |
| <i>Austria</i> | r 17 (3.9) | 568 (8.9) | 81 (3.9) | 561 (3.6) | 1 (0.7) | ~ ~ | 0 (0.0) | ~ ~ |
| Belgium (Fl) | r 45 (4.6) | 550 (8.4) | 53 (4.5) | 560 (8.1) | 2 (1.2) | ~ ~ | 0 (0.0) | ~ ~ |
| <i>Belgium (Fr)</i> | s 42 (6.2) | 489 (6.1) | 57 (6.1) | 484 (3.9) | 1 (1.3) | ~ ~ | 0 (0.0) | ~ ~ |
| Canada | s 10 (2.6) | 520 (11.0) | 62 (4.2) | 540 (3.9) | 25 (3.4) | 535 (6.6) | 3 (1.3) | 533 (12.0) |
| <i>Colombia</i> | r 4 (1.7) | 422 (9.8) | 6 (2.4) | 420 (21.6) | 37 (4.3) | 422 (5.2) | 53 (4.5) | 411 (4.2) |
| Cyprus | s 2 (0.1) | ~ ~ | 45 (3.5) | 460 (4.0) | 53 (3.5) | 458 (3.5) | 0 (0.0) | ~ ~ |
| Czech Republic | r 11 (2.7) | 552 (6.4) | 78 (5.1) | 576 (5.4) | 11 (4.6) | 590 (11.7) | 0 (0.0) | ~ ~ |
| <i>Denmark</i> | s 62 (6.7) | 481 (3.7) | 38 (6.7) | 485 (6.7) | 0 (0.0) | ~ ~ | 0 (0.0) | ~ ~ |
| England | x x | x x | x x | x x | x x | x x | x x | x x |
| France | 16 (3.6) | 490 (6.6) | 83 (3.6) | 501 (2.7) | 1 (0.6) | ~ ~ | 0 (0.0) | ~ ~ |
| <i>Germany</i> | s 20 (4.5) | 520 (18.4) | 73 (5.1) | 536 (5.5) | 6 (2.8) | 587 (15.7) | 0 (0.0) | ~ ~ |
| <i>Greece</i> | 6 (1.8) | 474 (7.0) | 71 (3.9) | 498 (2.6) | 22 (3.3) | 500 (4.9) | 1 (0.9) | ~ ~ |
| Hong Kong | 0 (0.0) | ~ ~ | 1 (1.2) | ~ ~ | 57 (6.5) | 520 (7.5) | 42 (6.5) | 530 (7.9) |
| Hungary | 40 (3.7) | 548 (4.1) | 56 (3.9) | 555 (4.1) | 4 (1.8) | 569 (8.9) | 0 (0.0) | ~ ~ |
| Iceland | s 38 (6.5) | 480 (5.2) | 59 (6.8) | 486 (3.7) | 0 (0.0) | ~ ~ | 3 (2.4) | 519 (0.0) |
| Iran, Islamic Rep. | r 3 (1.3) | 467 (18.0) | 23 (4.3) | 475 (6.0) | 52 (5.2) | 472 (3.9) | 22 (4.0) | 462 (6.8) |
| Ireland | s 12 (3.0) | 490 (19.4) | 80 (4.4) | 548 (5.4) | 9 (3.2) | 575 (13.0) | 0 (0.0) | ~ ~ |
| <i>Israel</i> | s 11 (5.9) | 532 (8.3) | 30 (7.0) | 533 (16.0) | 47 (9.8) | 544 (9.3) | 12 (7.4) | 466 (24.8) |
| Japan | 0 (0.2) | ~ ~ | 4 (1.4) | 570 (6.6) | 88 (2.0) | 567 (1.6) | 8 (1.5) | 615 (10.2) |
| Korea | 6 (1.8) | 573 (9.0) | 1 (0.7) | ~ ~ | 5 (1.5) | 536 (8.1) | 89 (2.5) | 566 (2.3) |
| <i>Kuwait</i> | r 0 (0.0) | ~ ~ | 48 (6.8) | 427 (5.4) | 50 (6.5) | 425 (7.3) | 2 (2.1) | ~ ~ |
| Latvia (LSS) | s 37 (4.0) | 485 (5.2) | 47 (3.8) | 488 (3.4) | 10 (2.6) | 483 (7.9) | 6 (1.6) | 477 (3.5) |
| Lithuania | r 38 (3.1) | 467 (5.4) | 59 (2.9) | 484 (5.2) | 1 (0.5) | ~ ~ | 2 (1.0) | ~ ~ |
| <i>Netherlands</i> | r 15 (5.0) | 498 (21.4) | 75 (5.7) | 567 (5.0) | 10 (3.5) | 615 (13.6) | 0 (0.0) | ~ ~ |
| New Zealand | 7 (1.8) | 501 (12.4) | 75 (3.5) | 522 (5.7) | 18 (3.0) | 556 (8.0) | 1 (0.0) | ~ ~ |
| Norway | s 27 (4.4) | 519 (4.6) | 72 (4.7) | 526 (2.8) | 2 (1.4) | ~ ~ | 0 (0.0) | ~ ~ |
| Portugal | 15 (2.9) | 469 (4.0) | 77 (3.8) | 481 (2.8) | 8 (2.5) | 487 (9.7) | 0 (0.4) | ~ ~ |
| <i>Romania</i> | 20 (2.5) | 476 (9.5) | 52 (4.5) | 474 (6.1) | 25 (4.2) | 510 (9.9) | 2 (1.3) | ~ ~ |
| Russian Federation | 15 (2.7) | 523 (11.7) | 76 (3.6) | 539 (3.9) | 9 (2.3) | 546 (14.4) | 0 (0.0) | ~ ~ |
| <i>Scotland</i> | s 99 (0.9) | 520 (5.9) | 1 (0.6) | ~ ~ | 0 (0.0) | ~ ~ | 1 (0.7) | ~ ~ |
| Singapore | 0 (0.0) | ~ ~ | 9 (2.4) | 609 (15.7) | 72 (4.2) | 604 (7.3) | 19 (4.0) | 616 (7.7) |
| Slovak Republic | r 12 (3.1) | 533 (13.9) | 69 (4.8) | 543 (4.2) | 19 (4.3) | 554 (10.1) | 0 (0.0) | ~ ~ |
| <i>Slovenia</i> | r 14 (2.8) | 554 (7.5) | 81 (3.2) | 558 (3.1) | 5 (1.5) | 575 (13.6) | 0 (0.4) | ~ ~ |
| Spain | r 9 (2.5) | 505 (8.3) | 49 (4.0) | 515 (3.4) | 35 (4.2) | 525 (3.8) | 7 (2.4) | 509 (6.3) |
| Sweden | x x | x x | x x | x x | x x | x x | x x | x x |
| Switzerland | s 50 (5.0) | 513 (7.0) | 47 (4.8) | 530 (6.2) | 3 (1.9) | 551 (7.5) | 0 (0.0) | ~ ~ |
| <i>Thailand</i> | x x | x x | x x | x x | x x | x x | x x | x x |
| United States | x x | x x | x x | x x | x x | x x | x x | x x |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

approach, as is working in pairs or small groups with teacher assistance. Working without teacher assistance is less common in most countries, although it does seem to be a feature of life in science classrooms in Canada, the Netherlands, and New Zealand.

Figure 5.3**Teachers' Reports About Classroom Organization During Science Lessons
Upper Grade (Eighth Grade*)**

| Country | Percent of Students Whose Teachers Report Using Each Organizational Approach "Most or Every Lesson" | | | | | |
|---------------------------|---|--|--|---|--|---|
| | Work Together as a Class with Students Responding to One Another | Work Together as a Class with Teacher Teaching the Whole Class | Work Individually with Assistance from Teacher | Work Individually without Assistance from Teacher | Work in Pairs or Small Groups with Assistance from Teacher | Work in Pairs or Small Groups without Assistance from Teacher |
| <i>Austria</i> | r 3 | r 65 | r 13 | r 3 | r 18 | r 12 |
| Belgium (Fl) | r 11 | r 62 | r 19 | r 6 | r 13 | r 7 |
| <i>Belgium (Fr)</i> | s 11 | s 53 | s 24 | s 8 | s 8 | s 4 |
| Canada | s 17 | r 28 | r 26 | r 23 | r 33 | s 24 |
| <i>Colombia</i> | r 33 | r 48 | r 55 | r 10 | r 43 | r 13 |
| Cyprus | s 3 | s 74 | s 35 | s 3 | s 17 | s 6 |
| Czech Republic | 11 | 70 | r 46 | 15 | 14 | 4 |
| <i>Denmark</i> | s 2 | s 22 | s 25 | s 3 | s 46 | s 13 |
| France | 16 | 57 | 34 | 16 | 27 | 12 |
| <i>Germany</i> | s 30 | s 69 | s 28 | s 7 | s 19 | s 5 |
| <i>Greece</i> | 3 | 67 | 45 | 10 | 13 | 1 |
| Hong Kong | 12 | 45 | 35 | 2 | 44 | 13 |
| Hungary | 7 | 80 | 54 | 13 | 11 | 2 |
| Iceland | s 1 | r 35 | r 30 | r 9 | r 16 | r 6 |
| Iran, Islamic Rep. | 25 | 57 | 36 | 2 | 25 | 11 |
| Ireland | s 7 | s 62 | s 25 | s 6 | s 20 | s 6 |
| <i>Israel</i> | s 17 | r 41 | r 30 | r 15 | r 32 | r 18 |
| Japan | 19 | 79 | 12 | 8 | 12 | 6 |

Percent for "Most or Every Lesson" →

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Countries where data were not available or where teacher response data were available for <50% of students are omitted from the figure (Australia, England, Sweden, and the United States).

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.3 (Continued)**Teachers' Reports About Classroom Organization During Science Lessons
Upper Grade (Eighth Grade*)**

| Country | Percent of Students Whose Teachers Report Using Each Organizational Approach "Most or Every Lesson" | | | | | |
|---------------------------|---|--|--|---|--|---|
| | Work Together as a Class with Students Responding to One Another | Work Together as a Class with Teacher Teaching the Whole Class | Work Individually with Assistance from Teacher | Work Individually without Assistance from Teacher | Work in Pairs or Small Groups with Assistance from Teacher | Work in Pairs or Small Groups without Assistance from Teacher |
| Korea | 34 | 83 | 28 | 8 | 15 | 3 |
| <i>Kuwait</i> | ^r 9 | ^r 46 | ^r 45 | ^r 0 | ^r 36 | ^r 2 |
| Latvia (LSS) | ^s 25 | ^s 84 | ^s 59 | ^s 32 | ^s 24 | ^s 8 |
| Lithuania | ^r 16 | ^r 60 | ^r 57 | ^r 22 | ^r 26 | ^r 8 |
| <i>Netherlands</i> | ^r 5 | ^r 63 | ^r 36 | ^r 23 | ^r 25 | ^r 18 |
| New Zealand | 15 | 41 | 33 | 26 | 44 | 20 |
| Norway | ^s 24 | ^s 62 | ^s 23 | ^s 1 | ^s 23 | ^s 4 |
| Portugal | 14 | 66 | 54 | 3 | 54 | 5 |
| <i>Romania</i> | 15 | 86 | 47 | 8 | 27 | ^r 2 |
| Russian Federation | 9 | 68 | 43 | 21 | 13 | 7 |
| <i>Scotland</i> | ^s 7 | ^s 22 | ^s 27 | ^s 11 | ^s 56 | ^s 19 |
| Singapore | 12 | 59 | 41 | 17 | 40 | 19 |
| Slovak Republic | ^r 48 | ^r 64 | ^r 45 | ^r 15 | ^r 3 | ^r 1 |
| <i>Slovenia</i> | ^r 7 | ^r 65 | ^r 57 | ^r 19 | ^r 34 | ^r 13 |
| Spain | ^r 14 | ^r 65 | ^r 46 | ^r 14 | ^r 18 | ^r 7 |
| Switzerland | ^s 3 | ^s 56 | ^s 21 | ^s 6 | ^s 30 | 8 |
| <i>Thailand</i> | ^r 16 | ^r 38 | ^r 33 | ^r 10 | ^r 32 | ^s 11 |

Percent for "Most or Every Lesson" →

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Countries where data were not available or where teacher response data were available for <50% of students are omitted from the figure (Australia, England, Sweden, and the United States).

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

WHAT ACTIVITIES DO STUDENTS DO IN THEIR SCIENCE LESSONS?

As shown in Table 5.9, science teachers in the participating countries generally reported heavier reliance on curriculum guides than textbooks in deciding which topics to teach. Only Japan, Korea, the Netherlands, and Thailand use textbooks more for this purpose. In contrast, in almost all countries the textbook was the major written source science teachers used in deciding how to present a topic to their classes. Internationally, the textbook appears to play a role in science classrooms in many countries. For nearly all students in all countries, teachers reported using a textbook in their science classes (see Figure 5.4).

The types of activities teachers asked eighth-grade students to do, however, varied from country to country. Teachers were asked how often they asked students to do reasoning tasks in science. The data in Table 5.10 reveal that such activities are very common in science classes, with the majority of students in all countries being asked to do some type of science reasoning task in most or every lesson. The activities TIMSS inquired about included explaining the reasoning behind an idea, using tables, charts or graphs to represent and analyze relationships, working on problems for which there is no immediately obvious solution, writing explanations about what was observed and why it happened, and putting events in order and giving a reason for the organization. In Cyprus, the Czech Republic, Hungary, Portugal, Romania, the Russian Federation, and the Slovak Republic, 90% or more of the students were asked to do at least one of these types of reasoning tasks in most or every lesson.

Students were asked about the frequency with which their teachers demonstrate an experiment or with which they themselves do an experiment or practical investigation in class. Since in almost half of the TIMSS countries science is taught not as an integrated subject but as individual science subjects (biology, chemistry, etc.), the student reports are presented to reflect this. According to students (Table 5.11), teacher demonstrations are common in almost all countries where science is taught as an integrated subject, and they are also common in chemistry and physics classes. Such demonstrations are reported much less frequently in biology and earth science classes. Countries with integrated science where students report high frequencies of teacher demonstrations usually also have high reported frequencies of student experiments or practical investigations, although there are some countries, notably Cyprus, Iran, Kuwait, and Thailand, where teacher demonstrations are reported as much more frequent than student practical work (see Table 5.12). In countries where science is taught as individual subjects, students reported more frequent teacher demonstrations than student practical work in most countries, particularly for chemistry and physics.

Students were also asked about the frequency with which they use things from everyday life in solving problems in science class (Table 5.13). Among countries with integrated science, more than half of the eighth-grade students in Canada, Colombia, Cyprus, England, Hong Kong, Iran, Scotland, Singapore, and the United States reported being asked to solve such problems on a frequent basis (pretty often or almost always). Using everyday things for science problems was reportedly less common in countries

with individual science subjects, although more than half of the students in Latvia (LSS) reported that they do so frequently in all science subject classes (biology, chemistry, and physics).

Table 5.9

Teachers' Reports on Their Main Sources of Written Information When Deciding Which Topics to Teach and How to Present a Topic Science - Upper Grade (Eighth Grade*)¹

| Country | Percent of Students Taught by Teachers | | | | | |
|---------------------------|--|----------|----------------------------|---------------------------------|----------|----------------------------|
| | Deciding Which Topics to Teach | | | Deciding How to Present a Topic | | |
| | Curriculum Guide | Textbook | Examination Specifications | Curriculum Guide | Textbook | Examination Specifications |
| <i>Australia</i> | x x | x x | - - | x x | x x | - - |
| <i>Austria</i> | r 72 (2.8) | 28 (2.8) | 0 (0.2) | r 29 (3.3) | 70 (3.2) | 1 (0.6) |
| Belgium (FI) | r 90 (3.7) | 10 (3.7) | - - | r 13 (2.6) | 87 (2.6) | - - |
| <i>Belgium (Fr)</i> | s 90 (4.5) | 10 (4.5) | - - | s 8 (2.8) | 92 (2.8) | - - |
| Canada | - - | - - | - - | - - | - - | - - |
| <i>Colombia</i> | r 68 (5.0) | 30 (5.0) | 2 (1.1) | r 34 (4.8) | 64 (5.0) | 2 (1.1) |
| Cyprus | s 89 (2.2) | 9 (2.1) | 2 (0.1) | s 36 (3.9) | 62 (3.9) | 2 (0.1) |
| Czech Republic | r 76 (2.8) | 24 (2.8) | - - | r 8 (1.3) | 92 (1.3) | - - |
| <i>Denmark</i> | - - | - - | - - | - - | - - | - - |
| England | - - | - - | - - | - - | - - | - - |
| France | 94 (1.5) | 5 (1.4) | 2 (0.9) | 32 (2.9) | 68 (2.9) | 0 (0.4) |
| <i>Germany</i> | s 88 (3.0) | 12 (3.0) | - - | s 26 (5.0) | 74 (5.0) | - - |
| <i>Greece</i> | 71 (3.5) | 29 (3.5) | - - | 12 (3.1) | 88 (3.1) | - - |
| Hong Kong | 55 (4.9) | 40 (4.9) | 5 (2.5) | 25 (4.3) | 74 (4.5) | 1 (1.3) |
| Hungary | 78 (2.5) | 19 (2.3) | 4 (1.0) | 25 (2.3) | 73 (2.3) | 2 (0.8) |
| <i>Iceland</i> | s 57 (8.1) | 27 (7.0) | 16 (3.7) | s 22 (6.9) | 78 (6.9) | 0 (0.0) |
| Iran, Islamic Rep. | r 49 (5.8) | 48 (6.1) | 3 (1.3) | r 36 (5.8) | 51 (6.4) | 14 (6.1) |
| Ireland | s 68 (4.9) | 32 (4.9) | - - | s 16 (3.1) | 84 (3.1) | - - |
| <i>Israel</i> | s 94 (4.4) | 5 (3.5) | 1 (1.4) | s 23 (8.1) | 77 (8.1) | 0 (0.0) |
| Japan | 35 (4.3) | 62 (4.4) | 3 (1.4) | 15 (3.2) | 83 (3.2) | 1 (0.9) |
| Korea | 16 (2.9) | 77 (3.7) | 7 (2.2) | 16 (2.8) | 81 (2.9) | 3 (1.6) |
| <i>Kuwait</i> | - - | - - | - - | - - | - - | - - |
| Latvia (LSS) | s 81 (2.2) | 17 (2.1) | 2 (0.7) | s 33 (2.7) | 65 (2.8) | 2 (0.8) |
| Lithuania | x x | x x | x x | x x | x x | x x |
| <i>Netherlands</i> | r 3 (1.1) | 72 (3.5) | 24 (3.4) | r 7 (1.8) | 88 (2.3) | 4 (1.4) |
| New Zealand | 91 (2.5) | 6 (2.0) | 4 (1.7) | 53 (4.6) | 47 (4.6) | 0 (0.0) |
| Norway | s 66 (4.6) | 34 (4.6) | - - | s 11 (3.5) | 89 (3.5) | - - |
| Portugal | 94 (1.5) | 6 (1.5) | - - | 63 (3.6) | 37 (3.6) | - - |
| <i>Romania</i> | 93 (1.1) | 4 (0.9) | 3 (0.8) | 35 (2.4) | 61 (2.6) | 4 (1.2) |
| Russian Federation | 83 (2.9) | 9 (1.7) | 8 (1.9) | 9 (1.9) | 88 (2.0) | 3 (1.2) |
| <i>Scotland</i> | s 68 (4.2) | 24 (3.9) | 8 (2.0) | s 49 (5.1) | 47 (5.1) | 4 (1.6) |
| Singapore | 76 (4.0) | 24 (4.0) | 0 (0.0) | 11 (2.7) | 89 (2.7) | 1 (0.4) |
| Slovak Republic | r 80 (4.4) | 20 (4.4) | 0 (0.0) | r 22 (3.8) | 78 (3.8) | 1 (0.8) |
| <i>Slovenia</i> | r 88 (2.2) | 9 (2.0) | 3 (1.1) | r 29 (2.8) | 69 (2.9) | 2 (0.9) |
| Spain | - - | - - | - - | - - | - - | - - |
| Sweden | x x | x x | - - | x x | x x | - - |
| Switzerland | x x | x x | x x | x x | x x | x x |
| <i>Thailand</i> | r 41 (6.7) | 57 (6.4) | 3 (1.6) | r 22 (5.6) | 78 (5.6) | 0 (0.0) |
| United States | x x | x x | x x | x x | x x | x x |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

¹Curriculum Guides include national, regional, and school curriculum guides; Textbooks include teacher and student editions, as well as other resource books; and Examination Specifications include national and regional levels.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

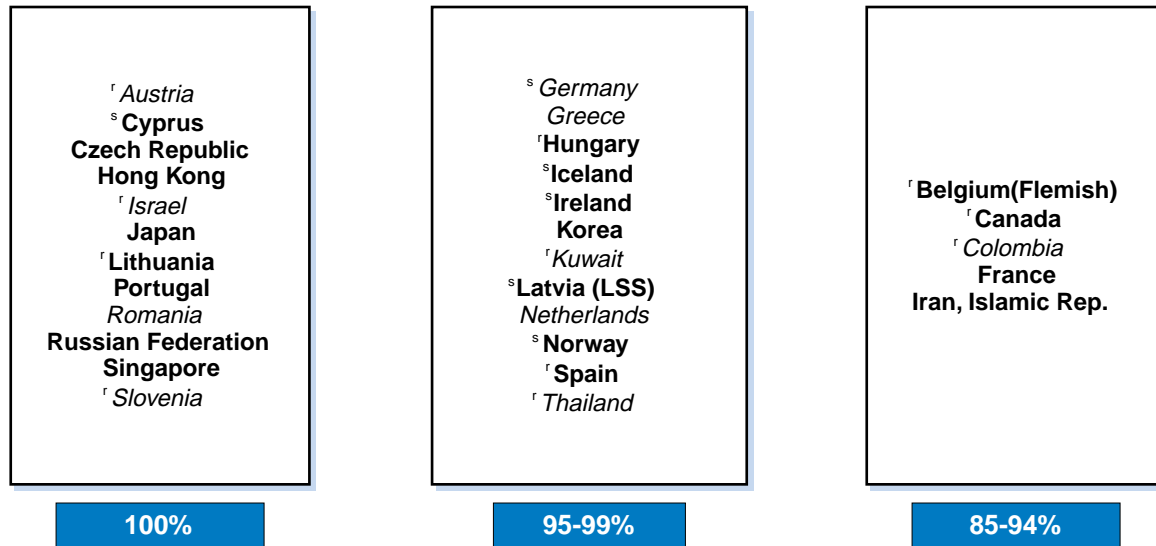
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.4**Teachers' Reports About Using a Textbook in Teaching Science
Upper Grade (Eighth Grade*)**

Countries are classified by percentage of students whose teachers reported that they use a textbook in teaching their science class.



Note: Twenty-four percent of the students in *s*Belgium(French), 70% in *s*Denmark, 71% in New Zealand, 84% in *s*Scotland, and 63% in *s*Switzerland had teachers who reported using a textbook in their science class.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Countries where data were not available or where teacher response data were available for <50% of students are omitted from the figure (Australia, England, Sweden, and the United States).

The Slovak Republic did not ask this question.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.10**Teachers' Reports on How Often They Ask Students To Do Reasoning Tasks¹
Science - Upper Grade (Eighth Grade*)**

| Country | Never or Almost Never | | Some Lessons | | Most Lessons | | Every Lesson | |
|---------------------------|-----------------------|------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|
| | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement |
| <i>Australia</i> | x x | x x | x x | x x | x x | x x | x x | x x |
| <i>Austria</i> | r 1 (0.4) | ~ ~ | 32 (3.9) | 560 (4.5) | 51 (3.6) | 562 (4.6) | 16 (2.6) | 569 (7.4) |
| Belgium (Fl) | r 5 (3.1) | 497 (66.9) | 26 (3.0) | 554 (5.3) | 53 (4.7) | 556 (6.9) | 15 (3.5) | 573 (6.0) |
| <i>Belgium (Fr)</i> | s 0 (0.0) | ~ ~ | 22 (5.5) | 481 (6.3) | 55 (5.9) | 484 (4.6) | 23 (4.4) | 485 (6.2) |
| Canada | r 0 (0.0) | ~ ~ | 13 (2.1) | 533 (8.3) | 63 (3.7) | 533 (4.4) | 24 (3.5) | 542 (6.8) |
| <i>Colombia</i> | r 0 (0.0) | ~ ~ | 18 (4.7) | 412 (22.1) | 53 (5.1) | 417 (4.3) | 29 (4.0) | 407 (6.0) |
| Cyprus | s 1 (1.3) | ~ ~ | 4 (1.5) | 445 (15.0) | 54 (4.3) | 460 (3.4) | 41 (4.0) | 458 (4.9) |
| Czech Republic | 0 (0.0) | ~ ~ | 4 (1.1) | 549 (10.5) | 60 (3.1) | 576 (4.3) | 36 (3.2) | 576 (6.4) |
| <i>Denmark</i> | s 2 (1.6) | ~ ~ | 49 (6.5) | 479 (5.2) | 46 (6.3) | 480 (4.6) | 3 (2.0) | 458 (22.2) |
| England | s 0 (0.0) | ~ ~ | 11 (1.9) | 539 (13.4) | 63 (3.1) | 561 (5.9) | 26 (2.9) | 582 (10.3) |
| France | 0 (0.0) | ~ ~ | 23 (2.7) | 503 (4.0) | 56 (3.9) | 496 (3.2) | 21 (3.4) | 505 (4.8) |
| <i>Germany</i> | s 0 (0.0) | ~ ~ | 24 (3.9) | 543 (12.4) | 63 (4.2) | 534 (6.3) | 13 (3.0) | 531 (16.2) |
| <i>Greece</i> | 1 (0.7) | ~ ~ | 19 (2.9) | 498 (4.7) | 55 (4.1) | 497 (3.4) | 25 (2.8) | 497 (3.6) |
| Hong Kong | 1 (1.2) | ~ ~ | 21 (4.7) | 510 (14.2) | 50 (5.8) | 525 (6.2) | 27 (5.1) | 522 (11.5) |
| Hungary | 0 (0.3) | ~ ~ | 4 (1.1) | 540 (11.0) | 63 (2.4) | 553 (3.1) | 33 (2.2) | 555 (4.0) |
| Iceland | s 1 (0.7) | ~ ~ | 35 (6.0) | 486 (9.3) | 58 (5.3) | 489 (3.4) | 6 (2.4) | 480 (8.3) |
| Iran, Islamic Rep. | 3 (2.6) | 493 (3.7) | 24 (4.5) | 472 (5.4) | 56 (5.1) | 468 (4.0) | 17 (4.1) | 469 (5.3) |
| Ireland | s 0 (0.0) | ~ ~ | 12 (2.6) | 539 (12.6) | 59 (4.6) | 549 (6.7) | 28 (4.5) | 528 (11.6) |
| <i>Israel</i> | r 0 (0.0) | ~ ~ | 11 (5.3) | 541 (52.2) | 45 (9.3) | 538 (10.2) | 44 (8.9) | 515 (11.8) |
| Japan | 0 (0.0) | ~ ~ | 17 (3.3) | 572 (3.7) | 55 (4.5) | 568 (3.0) | 28 (3.5) | 578 (3.6) |
| Korea | 0 (0.3) | ~ ~ | 12 (2.3) | 560 (4.7) | 62 (3.7) | 567 (2.9) | 25 (3.0) | 562 (4.3) |
| <i>Kuwait</i> | r 0 (0.0) | ~ ~ | 16 (5.5) | 438 (3.0) | 58 (6.5) | 420 (4.4) | 26 (5.1) | 434 (12.9) |
| Latvia (LSS) | s 0 (0.0) | ~ ~ | 11 (2.0) | 482 (7.4) | 71 (2.2) | 486 (2.6) | 18 (2.2) | 486 (3.9) |
| Lithuania | r 0 (0.2) | ~ ~ | 19 (1.9) | 470 (6.2) | 56 (2.4) | 482 (4.5) | 25 (1.9) | 472 (4.9) |
| <i>Netherlands</i> | r 1 (0.2) | ~ ~ | 31 (3.5) | 541 (11.2) | 52 (3.6) | 569 (6.7) | 16 (2.5) | 581 (7.7) |
| New Zealand | 0 (0.0) | ~ ~ | 18 (3.1) | 532 (11.7) | 66 (3.9) | 523 (5.4) | 16 (3.0) | 533 (12.3) |
| Norway | s 0 (0.0) | ~ ~ | 52 (5.6) | 520 (3.2) | 45 (5.5) | 531 (3.0) | 2 (1.6) | ~ ~ |
| Portugal | 0 (0.0) | ~ ~ | 7 (1.6) | 478 (4.8) | 60 (3.2) | 479 (3.1) | 33 (3.2) | 481 (3.2) |
| <i>Romania</i> | 0 (0.0) | ~ ~ | 4 (0.8) | 466 (10.0) | 29 (2.1) | 482 (6.2) | 67 (2.0) | 489 (5.3) |
| Russian Federation | 0 (0.0) | ~ ~ | 16 (2.5) | 536 (8.1) | 56 (3.6) | 537 (5.2) | 28 (3.6) | 540 (5.5) |
| <i>Scotland</i> | - - | - - | - - | - - | - - | - - | - - | - - |
| Singapore | 0 (0.0) | ~ ~ | 26 (3.9) | 592 (8.2) | 57 (4.6) | 612 (8.5) | 16 (3.6) | 611 (12.0) |
| Slovak Republic | r 0 (0.0) | ~ ~ | 0 (0.3) | ~ ~ | 46 (5.1) | 543 (5.8) | 54 (5.1) | 546 (5.1) |
| <i>Slovenia</i> | r 0 (0.0) | ~ ~ | 17 (2.8) | 560 (5.2) | 71 (3.3) | 558 (3.1) | 12 (2.5) | 548 (5.6) |
| Spain | r 0 (0.0) | ~ ~ | 21 (4.0) | 517 (4.6) | 55 (3.9) | 518 (2.7) | 24 (4.5) | 516 (4.9) |
| Sweden | x x | x x | x x | x x | x x | x x | x x | x x |
| Switzerland | s 0 (0.0) | ~ ~ | 18 (4.0) | 507 (14.2) | 73 (4.1) | 528 (4.9) | 8 (2.9) | 518 (13.8) |
| <i>Thailand</i> | r 0 (0.0) | ~ ~ | 14 (4.6) | 514 (14.7) | 56 (6.0) | 534 (6.1) | 30 (5.0) | 528 (6.2) |
| United States | x x | x x | x x | x x | x x | x x | x x | x x |

¹Based on most frequent response for: explain reasoning behind an idea; represent and analyze relationships using tables, charts or graphs; work on problems for which there is no immediately obvious method of solution; write explanations about what was observed and why it happened; and put events in order and give a reason for the organization.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.11**Students' Reports on the Frequency with Which Their Teacher Gives a Demonstration of an Experiment¹ - Science - Upper Grade (Eighth Grade*)**

| Country | Percent of Students Responding Pretty Often or Almost Always | | | | |
|----------------------------------|--|-----------------------|------------|---------------|------------|
| | Science (Integrated) | Science Subject Areas | | | |
| | | Biology | Chemistry | Earth Science | Physics |
| <i>Australia</i> | 75 (1.1) | .. | .. | .. | .. |
| <i>Austria</i> | 68 (2.0) | .. | .. | .. | .. |
| Belgium (Fl) | .. | 79 (1.7) | .. | 18 (1.6) | x x |
| ² Belgium (Fr) | s 62 (3.6) | x x | .. | .. | x x |
| <i>Canada</i> | 73 (1.5) | .. | .. | .. | .. |
| <i>Colombia</i> | 59 (1.9) | .. | .. | .. | .. |
| Cyprus | 89 (0.7) | .. | .. | .. | .. |
| Czech Republic | .. | 20 (2.0) | 70 (2.5) | 3 (0.4) | 60 (2.4) |
| ³ <i>Denmark</i> | .. | 32 (1.8) | .. | r 20 (1.4) | 81 (1.5) |
| England | 90 (0.9) | .. | .. | .. | .. |
| ⁴ France | .. | 56 (1.9) | .. | .. | 90 (1.1) |
| <i>Germany</i> | .. | 30 (1.7) | s 76 (1.8) | .. | 70 (1.6) |
| <i>Greece</i> | .. | .. | 75 (1.4) | 43 (1.5) | 77 (1.5) |
| Hong Kong | 91 (1.1) | .. | .. | .. | .. |
| Hungary | .. | 18 (1.5) | 80 (1.7) | 9 (0.8) | 68 (1.5) |
| Iceland | .. | 33 (3.6) | x x | x x | s 72 (2.3) |
| Iran, Islamic Rep. | 63 (2.3) | .. | .. | .. | .. |
| Ireland | 84 (1.7) | .. | .. | .. | .. |
| <i>Israel</i> | 73 (2.7) | .. | .. | .. | .. |
| Japan | 66 (1.6) | .. | .. | .. | .. |
| Korea | 42 (1.7) | .. | .. | .. | .. |
| <i>Kuwait</i> | 81 (1.4) | .. | .. | .. | .. |
| Latvia (LSS) | .. | 49 (1.9) | 77 (1.6) | .. | 73 (1.7) |
| Lithuania | .. | 25 (1.6) | 57 (2.1) | 10 (0.9) | 59 (1.9) |
| ⁵ <i>Netherlands</i> | .. | r 28 (2.2) | .. | 6 (0.6) | 53 (2.4) |
| New Zealand | 79 (1.2) | .. | .. | .. | .. |
| Norway | 71 (1.6) | .. | .. | .. | .. |
| Portugal | -- | -- | -- | -- | -- |
| <i>Romania</i> | .. | 49 (1.3) | 63 (1.7) | 34 (1.4) | 60 (1.6) |
| Russian Federation | .. | 30 (1.5) | 71 (1.9) | 16 (1.4) | 70 (1.6) |
| Scotland | 89 (1.1) | .. | .. | .. | .. |
| Singapore | 86 (1.0) | .. | .. | .. | .. |
| Slovak Republic | .. | 29 (1.5) | 64 (1.8) | 12 (0.8) | 58 (2.0) |
| <i>Slovenia</i> | .. | 37 (2.0) | 72 (1.7) | .. | 61 (1.8) |
| Spain | 28 (1.8) | .. | .. | .. | .. |
| Sweden | .. | 61 (1.9) | s 90 (0.9) | r 21 (1.2) | r 83 (1.0) |
| Switzerland | 51 (2.1) | .. | .. | .. | .. |
| <i>Thailand</i> | 84 (1.3) | .. | .. | .. | .. |
| United States | 68 (1.4) | .. | .. | .. | .. |

¹Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

²Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.

³Physics data for Denmark are for students taking physics/chemistry classes.

⁴Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.

⁵Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

(.) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates a 70-84% student response rate. An "s" indicates a 50-69% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.12**Students' Reports on Frequency of Doing an Experiment or Practical Investigation in Science Class¹ - Upper Grade (Eighth Grade*)**

| Country | Percent of Students Responding Pretty Often or Almost Always | | | | |
|----------------------------------|--|-----------------------|------------|---------------|------------|
| | Science (Integrated) | Science Subject Areas | | | |
| | | Biology | Chemistry | Earth Science | Physics |
| <i>Australia</i> | 77 (1.4) | . . | . . | . . | . . |
| <i>Austria</i> | 33 (2.2) | . . | . . | . . | . . |
| ² Belgium (Fl) | . . | 43 (1.8) | . . | 11 (1.1) | x x |
| Belgium (Fr) | s 36 (3.2) | x x | . . | . . | x x |
| Canada | 70 (1.8) | . . | . . | . . | . . |
| <i>Colombia</i> | 47 (1.9) | . . | . . | . . | . . |
| Cyprus | 36 (1.0) | . . | . . | . . | . . |
| Czech Republic | . . | 20 (1.6) | 35 (2.2) | 3 (0.4) | 29 (2.0) |
| ³ <i>Denmark</i> | . . | 32 (2.2) | . . | r 22 (1.4) | 79 (1.3) |
| England | 91 (0.6) | . . | . . | . . | . . |
| ⁴ France | . . | 36 (2.0) | . . | . . | 74 (2.0) |
| <i>Germany</i> | . . | 21 (1.6) | s 48 (3.1) | . . | 41 (2.1) |
| <i>Greece</i> | . . | . . | 35 (1.7) | 29 (1.6) | 40 (1.7) |
| Hong Kong | 83 (2.0) | . . | . . | . . | . . |
| Hungary | . . | 7 (0.6) | 20 (1.6) | 6 (0.6) | 20 (1.0) |
| Iceland | . . | 32 (3.8) | x x | x x | s 74 (3.0) |
| Iran, Islamic Rep. | 32 (1.4) | . . | . . | . . | . . |
| Ireland | 61 (2.7) | . . | . . | . . | . . |
| <i>Israel</i> | 53 (2.8) | . . | . . | . . | . . |
| Japan | 77 (1.5) | . . | . . | . . | . . |
| Korea | 33 (1.7) | . . | . . | . . | . . |
| <i>Kuwait</i> | 47 (2.0) | . . | . . | . . | . . |
| Latvia (LSS) | . . | 36 (1.7) | 50 (2.3) | . . | 46 (1.9) |
| Lithuania | . . | 17 (1.8) | 24 (1.6) | 8 (0.6) | 29 (1.6) |
| ⁵ <i>Netherlands</i> | . . | r 20 (2.6) | . . | 5 (0.8) | 49 (2.8) |
| New Zealand | 81 (1.3) | . . | . . | . . | . . |
| Norway | 66 (2.2) | . . | . . | . . | . . |
| ⁶ Portugal | . . | 26 (1.5) | . . | . . | 36 (1.7) |
| <i>Romania</i> | . . | 34 (1.1) | 49 (1.8) | 32 (1.3) | 49 (1.7) |
| Russian Federation | . . | 17 (1.0) | 45 (2.4) | 12 (1.0) | 44 (1.6) |
| Scotland | 87 (0.9) | . . | . . | . . | . . |
| Singapore | 85 (1.0) | . . | . . | . . | . . |
| Slovak Republic | . . | 19 (1.1) | 25 (1.5) | 12 (0.7) | 30 (1.5) |
| <i>Slovenia</i> | . . | 15 (1.3) | 25 (1.9) | . . | 31 (1.6) |
| Spain | 23 (1.6) | . . | . . | . . | . . |
| Sweden | . . | 65 (1.8) | s 92 (0.8) | r 23 (1.1) | r 82 (1.3) |
| Switzerland | 35 (1.7) | . . | . . | . . | . . |
| <i>Thailand</i> | 55 (1.2) | . . | . . | . . | . . |
| United States | 62 (1.7) | . . | . . | . . | . . |

Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

²Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.

³Physics data for Denmark are for students taking physics/chemistry classes.

⁴Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.

⁵Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

⁶Biology data for Portugal are for students taking natural science classes; physics data are for students taking physical science classes.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

(.) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates a 70-84% student response rate. An "s" indicates a 50-69% student response rate. An "x" indicates a <50% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.13**Students' Reports on Frequency of Using Things from Everyday Life in Solving Science Problems¹ - Upper Grade (Eighth Grade*)**

| Country | Percent of Students Responding Pretty Often or Almost Always | | | | |
|----------------------------------|--|-----------------------|------------|---------------|------------|
| | Science (Integrated) | Science Subject Areas | | | |
| | | Biology | Chemistry | Earth Science | Physics |
| <i>Australia</i> | 43 (0.8) | . . | . . | . . | . . |
| <i>Austria</i> | 31 (1.0) | . . | . . | . . | . . |
| Belgium (Fl) | . . | 44 (1.2) | . . | 40 (1.2) | x x |
| ² Belgium (Fr) | x x | x x | . . | . . | x x |
| Canada | 52 (1.1) | . . | . . | . . | . . |
| <i>Colombia</i> | 52 (1.4) | . . | . . | . . | . . |
| Cyprus | 65 (1.1) | . . | . . | . . | . . |
| Czech Republic | . . | 33 (1.3) | 31 (1.5) | 35 (1.5) | 39 (1.3) |
| ³ <i>Denmark</i> | . . | 23 (1.2) | . . | r 19 (1.1) | 27 (1.2) |
| England | 51 (1.2) | . . | . . | . . | . . |
| ⁴ France | . . | 41 (1.1) | . . | . . | 51 (1.5) |
| <i>Germany</i> | . . | 34 (1.5) | s 34 (1.7) | . . | 37 (1.3) |
| <i>Greece</i> | . . | . . | 48 (1.2) | 52 (1.5) | 65 (1.2) |
| Hong Kong | 57 (1.5) | . . | . . | . . | . . |
| Hungary | . . | 35 (1.4) | 29 (1.2) | 32 (1.3) | 33 (1.1) |
| Iceland | . . | 31 (2.2) | x x | x x | s 38 (1.9) |
| Iran, Islamic Rep. | 53 (1.4) | . . | . . | . . | . . |
| Ireland | 41 (1.2) | . . | . . | . . | . . |
| <i>Israel</i> | 40 (2.0) | . . | . . | . . | . . |
| Japan | 23 (0.9) | . . | . . | . . | . . |
| Korea | 17 (0.8) | . . | . . | . . | . . |
| <i>Kuwait</i> | 47 (2.0) | . . | . . | . . | . . |
| Latvia (LSS) | . . | 65 (1.4) | 73 (1.3) | . . | 77 (1.1) |
| Lithuania | . . | 24 (1.2) | 30 (1.2) | 22 (1.1) | 44 (1.4) |
| ⁵ <i>Netherlands</i> | . . | r 36 (1.5) | . . | 31 (1.4) | 31 (1.4) |
| New Zealand | 48 (1.1) | . . | . . | . . | . . |
| Norway | 31 (1.0) | . . | . . | . . | . . |
| ⁶ Portugal | . . | 35 (1.2) | . . | . . | 43 (1.4) |
| <i>Romania</i> | . . | 52 (1.2) | 41 (1.3) | 45 (1.4) | 46 (1.1) |
| Russian Federation | . . | 36 (2.7) | 32 (2.0) | 34 (1.8) | 40 (1.8) |
| Scotland | 57 (1.4) | . . | . . | . . | . . |
| Singapore | 59 (1.1) | . . | . . | . . | . . |
| Slovak Republic | . . | 35 (1.6) | 30 (1.2) | 40 (1.4) | 31 (1.2) |
| <i>Slovenia</i> | . . | 41 (1.7) | 32 (1.2) | . . | 24 (1.9) |
| Spain | 44 (1.3) | . . | . . | . . | . . |
| Sweden | . . | 37 (1.1) | s 43 (1.7) | r 33 (1.3) | r 48 (1.3) |
| Switzerland | 40 (1.1) | . . | . . | . . | . . |
| <i>Thailand</i> | 48 (1.3) | . . | . . | . . | . . |
| United States | 51 (0.9) | . . | . . | . . | . . |

¹Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

²Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.

³Physics data for Denmark are for students taking physics/chemistry classes.

⁴Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.

⁵Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

⁶Biology data for Portugal are for students taking natural science classes; physics data are for students taking physical science classes.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

(.) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates a 70-84% student response rate. An "s" indicates a 50-69% student response rate. An "x" indicates a <50% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

HOW ARE CALCULATORS AND COMPUTERS USED?

As shown in Table 5.14, nearly all eighth-grade students reported having a calculator in the home, except in Iran (61%), Romania (62%), and Thailand (68%). Internationally, fewer students reported a computer in the home, even though more than three-fourths did so in Denmark, England, Iceland, Ireland, Israel, the Netherlands, and Scotland. Between 50% and 75% so reported in Australia, Austria, Belgium (Flemish), Belgium (French), Canada, France, Germany, Kuwait, New Zealand, Norway, Sweden, Switzerland, and the United States. Fewer than 20% of the students reported home computers in Colombia, Iran, Latvia (LSS), Romania, and Thailand.

Table 5.15 provides teachers' reports about how often calculators are used in eighth-grade science classes. Even though calculators appear to be widely available in most countries, teachers reported relatively low levels of calculator use in science classrooms. Only in Hungary, Kuwait, Latvia (LSS), Lithuania, the Russian Federation, and the Slovak Republic were the majority of students reported to use calculators as often as once or twice a week. The lowest levels of usage were reported in Japan and Korea, with more than 70% of students taught by teachers who reported that calculators are never or hardly ever used in their science classes. Although using calculators can take the drudgery out of mathematical computations in science class and free the learner to concentrate on higher-order problem-solving skills, another point of view is that permitting unrestricted use of calculators may damage students' mastery of basic computational skills.

As revealed in Table 5.16, teachers reported that students use calculators in science classes for a variety of purposes. Across countries, no single use appears to predominate, although routine computation, checking answers, and solving complex problems are frequent purposes in many countries.

Table 5.17 contains teachers' reports about how often computers are used in science class to solve exercises or problems. Such usage is reportedly quite rare, and only in Canada, Denmark, England, Iceland, Israel, Kuwait, Slovenia, and Switzerland did more than 20% of the students have teachers who reported at least some usage. Table 5.18 contains students' responses to a similar question, although expressed as the percentage of students using computers to solve problems in science class at least once in a while. Internationally, teachers and students agree that the computer is rarely used in most students' science lessons. Students reported moderate use of computers (more than 20% of the students in some lessons) in Austria, Canada, Cyprus, Denmark, England, Greece, Israel, New Zealand, Romania, the Russian Federation, Scotland, Slovenia, Sweden, and the United States.

Table 5.14**Students' Reports on Having a Calculator and Computer in the Home
Science - Upper Grade (Eighth Grade*)**

| Country | Calculator | | | | Computer | | | |
|---------------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|
| | Yes | | No | | Yes | | No | |
| | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement |
| <i>Australia</i> | 97 (0.3) | 548 (3.8) | 3 (0.3) | 467 (13.8) | 73 (1.2) | 554 (4.3) | 27 (1.2) | 525 (4.2) |
| <i>Austria</i> | 100 (0.1) | 558 (3.8) | 0 (0.1) | ~ ~ | 59 (1.5) | 565 (4.0) | 41 (1.5) | 548 (4.7) |
| Belgium (Fl) | 97 (0.8) | 553 (4.0) | 3 (0.8) | 467 (11.4) | 67 (1.3) | 558 (4.2) | 33 (1.3) | 536 (5.3) |
| <i>Belgium (Fr)</i> | 98 (0.3) | 472 (2.9) | 2 (0.3) | ~ ~ | 60 (1.4) | 481 (3.0) | 40 (1.4) | 457 (3.6) |
| Canada | 98 (0.2) | 533 (2.6) | 2 (0.2) | ~ ~ | 61 (1.3) | 543 (2.5) | 39 (1.3) | 513 (3.1) |
| <i>Colombia</i> | 88 (1.5) | 415 (3.6) | 12 (1.5) | 389 (9.1) | 11 (1.2) | 431 (9.7) | 89 (1.2) | 409 (3.9) |
| Cyprus | 96 (0.4) | 466 (2.0) | 4 (0.4) | 403 (6.3) | 39 (0.9) | 472 (2.9) | 61 (0.9) | 459 (2.5) |
| Czech Republic | 99 (0.2) | 574 (4.3) | 1 (0.2) | ~ ~ | 36 (1.2) | 593 (6.0) | 64 (1.2) | 563 (3.6) |
| <i>Denmark</i> | 99 (0.3) | 479 (3.1) | 1 (0.3) | ~ ~ | 76 (1.2) | 484 (3.1) | 24 (1.2) | 464 (4.7) |
| England | 99 (0.2) | 554 (3.5) | 1 (0.2) | ~ ~ | 89 (0.8) | 553 (3.7) | 11 (0.8) | 558 (6.5) |
| France | 99 (0.2) | 499 (2.6) | 1 (0.2) | ~ ~ | 50 (1.3) | 504 (3.0) | 50 (1.3) | 492 (3.0) |
| <i>Germany</i> | 99 (0.2) | 532 (4.7) | 1 (0.2) | ~ ~ | 71 (1.0) | 538 (4.6) | 29 (1.0) | 517 (6.4) |
| <i>Greece</i> | 87 (0.6) | 504 (2.2) | 13 (0.6) | 455 (3.7) | 29 (1.0) | 512 (4.3) | 71 (1.0) | 492 (2.1) |
| Hong Kong | 99 (0.1) | 524 (4.7) | 1 (0.1) | ~ ~ | 39 (1.9) | 539 (5.0) | 61 (1.9) | 514 (4.9) |
| Hungary | 97 (0.4) | 556 (2.8) | 3 (0.4) | 496 (14.3) | 37 (1.2) | 581 (3.2) | 63 (1.2) | 539 (3.1) |
| Iceland | 100 (0.1) | 494 (4.1) | 0 (0.1) | ~ ~ | 77 (1.4) | 494 (4.6) | 23 (1.4) | 491 (3.6) |
| Iran, Islamic Rep. | 61 (1.8) | 482 (2.8) | 39 (1.8) | 457 (3.6) | 4 (0.4) | 474 (11.3) | 96 (0.4) | 472 (2.4) |
| Ireland | 97 (0.3) | 540 (4.4) | 3 (0.3) | 506 (9.0) | 78 (1.1) | 542 (4.7) | 22 (1.1) | 530 (6.0) |
| <i>Israel</i> | 99 (0.3) | 529 (5.3) | 1 (0.3) | ~ ~ | 76 (2.1) | 540 (5.8) | 24 (2.1) | 492 (4.6) |
| Japan | - - | - - | - - | - - | - - | - - | - - | - - |
| Korea | 91 (0.5) | 567 (2.0) | 9 (0.5) | 540 (5.5) | 39 (1.2) | 584 (2.7) | 61 (1.2) | 553 (2.2) |
| <i>Kuwait</i> | 84 (1.4) | 434 (3.6) | 16 (1.4) | 412 (6.0) | 53 (2.1) | 431 (5.4) | 47 (2.1) | 430 (3.3) |
| Latvia (LSS) | 94 (0.5) | 486 (2.7) | 6 (0.5) | 475 (5.9) | 13 (0.9) | 487 (5.3) | 87 (0.9) | 485 (2.6) |
| Lithuania | 90 (1.0) | 481 (3.5) | 10 (1.0) | 441 (6.4) | 42 (1.4) | 476 (3.9) | 58 (1.4) | 477 (4.1) |
| <i>Netherlands</i> | 100 (0.1) | 561 (5.2) | 0 (0.1) | ~ ~ | 85 (1.2) | 563 (6.3) | 15 (1.2) | 547 (6.6) |
| New Zealand | 99 (0.2) | 528 (4.3) | 1 (0.2) | ~ ~ | 60 (1.3) | 538 (4.8) | 40 (1.3) | 509 (4.8) |
| Norway | 99 (0.2) | 528 (1.9) | 1 (0.2) | ~ ~ | 64 (1.1) | 534 (2.4) | 36 (1.1) | 516 (3.0) |
| Portugal | 99 (0.2) | 480 (2.3) | 1 (0.2) | ~ ~ | 39 (1.8) | 493 (3.2) | 61 (1.8) | 471 (2.2) |
| <i>Romania</i> | 62 (1.5) | 495 (5.1) | 38 (1.5) | 473 (6.8) | 19 (1.2) | 504 (7.1) | 81 (1.2) | 482 (4.9) |
| Russian Federation | 92 (0.8) | 541 (3.8) | 8 (0.8) | 508 (8.8) | 35 (1.5) | 542 (4.7) | 65 (1.5) | 536 (4.7) |
| <i>Scotland</i> | 98 (0.4) | 520 (5.3) | 2 (0.4) | ~ ~ | 90 (0.6) | 518 (5.3) | 10 (0.6) | 522 (8.6) |
| Singapore | 100 (0.1) | 608 (5.6) | 0 (0.1) | ~ ~ | 49 (1.5) | 626 (6.2) | 51 (1.5) | 590 (5.4) |
| Slovak Republic | 99 (0.2) | 545 (3.2) | 1 (0.2) | ~ ~ | 31 (1.2) | 561 (3.9) | 69 (1.2) | 537 (3.5) |
| <i>Slovenia</i> | 98 (0.3) | 561 (2.5) | 2 (0.3) | ~ ~ | 47 (1.3) | 579 (3.2) | 53 (1.3) | 543 (2.9) |
| Spain | 99 (0.2) | 517 (1.7) | 1 (0.2) | ~ ~ | 42 (1.2) | 528 (2.7) | 58 (1.2) | 509 (2.1) |
| Sweden | 99 (0.1) | 536 (2.9) | 1 (0.1) | ~ ~ | 60 (1.3) | 547 (2.9) | 40 (1.3) | 518 (3.6) |
| Switzerland | 99 (0.2) | 523 (2.6) | 1 (0.2) | ~ ~ | 66 (1.2) | 530 (2.9) | 34 (1.2) | 507 (3.2) |
| <i>Thailand</i> | 68 (2.2) | 528 (4.5) | 32 (2.2) | 520 (3.1) | 4 (0.9) | 542 (10.7) | 96 (0.9) | 525 (3.6) |
| United States | 98 (0.3) | 536 (4.6) | 2 (0.3) | ~ ~ | 59 (1.7) | 555 (4.1) | 41 (1.7) | 506 (5.4) |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.15**Teachers' Reports on Frequency of Students' Use of Calculators in Science Class¹
Upper Grade (Eighth Grade*)**

| Country | Never or Hardly Ever | | Once or Twice a Month | | Once or Twice a Week | | Almost Every Day | |
|---------------------------|----------------------|------------------|-----------------------|------------------|----------------------|------------------|---------------------|------------------|
| | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement |
| <i>Australia</i> | x x | x x | x x | x x | x x | x x | x x | x x |
| <i>Austria</i> | r 61 (3.0) | 563 (3.4) | 32 (3.2) | 561 (5.2) | 4 (1.3) | 566 (9.0) | 3 (0.8) | 557 (16.4) |
| Belgium (FI) | r 61 (4.5) | 550 (8.5) | 14 (2.5) | 572 (5.5) | 9 (2.5) | 557 (4.9) | 16 (2.9) | 560 (4.8) |
| <i>Belgium (Fr)</i> | s 31 (5.9) | 479 (6.5) | 37 (5.3) | 481 (5.1) | 9 (3.0) | 506 (7.9) | 23 (3.9) | 486 (6.1) |
| Canada | r 16 (2.7) | 532 (7.7) | 38 (4.1) | 536 (6.7) | 21 (2.7) | 538 (4.2) | 25 (4.0) | 539 (5.5) |
| <i>Colombia</i> | r 50 (5.2) | 420 (4.8) | 21 (3.8) | 407 (6.6) | 17 (5.0) | 396 (18.1) | 12 (3.1) | 416 (13.1) |
| Cyprus | s 51 (3.9) | 454 (3.5) | 13 (2.5) | 467 (8.9) | 12 (3.1) | 465 (8.4) | 25 (3.7) | 462 (5.2) |
| Czech Republic | r 22 (1.9) | 572 (5.5) | 30 (3.5) | 582 (7.9) | 31 (2.8) | 572 (7.7) | 17 (2.4) | 575 (3.9) |
| <i>Denmark</i> | s 56 (5.8) | 476 (4.9) | 26 (5.3) | 478 (6.1) | 10 (3.8) | 500 (10.8) | 9 (3.6) | 479 (6.0) |
| England | x x | x x | x x | x x | x x | x x | x x | x x |
| France | r 17 (2.4) | 505 (5.0) | 39 (3.6) | 499 (3.5) | 22 (2.4) | 499 (4.4) | 22 (2.8) | 496 (3.8) |
| <i>Germany</i> | s 40 (4.5) | 536 (7.3) | 16 (3.2) | 518 (14.2) | 20 (3.5) | 560 (9.2) | 24 (3.6) | 530 (12.5) |
| <i>Greece</i> | 64 (4.0) | 496 (2.7) | 8 (1.9) | 499 (6.0) | 15 (2.7) | 495 (5.8) | 13 (2.5) | 504 (5.3) |
| Hong Kong | 59 (5.8) | 525 (7.5) | 24 (5.1) | 516 (11.5) | 5 (2.7) | 488 (26.1) | 12 (3.5) | 542 (10.5) |
| Hungary | r 31 (2.9) | 551 (4.2) | 8 (1.5) | 566 (6.9) | 20 (2.0) | 549 (4.1) | 40 (3.3) | 554 (5.4) |
| Iceland | s 31 (8.3) | 489 (11.3) | 35 (8.4) | 484 (3.6) | 17 (4.0) | 488 (7.8) | 17 (4.3) | 486 (6.3) |
| Iran, Islamic Rep. | 68 (5.3) | 469 (3.3) | 22 (4.7) | 467 (4.3) | 6 (1.7) | 489 (7.0) | 4 (1.9) | 465 (7.3) |
| Ireland | s 54 (4.8) | 536 (7.7) | 28 (3.9) | 547 (9.4) | 12 (3.5) | 567 (13.2) | 6 (2.2) | 539 (19.1) |
| <i>Israel</i> | s 53 (8.8) | 535 (11.7) | 35 (8.7) | 510 (16.1) | 4 (3.1) | 514 (46.3) | 8 (4.8) | 535 (4.1) |
| Japan | 91 (2.4) | 570 (2.1) | 9 (2.4) | 580 (8.1) | 0 (0.0) | ~ ~ | 0 (0.5) | ~ ~ |
| Korea | 73 (3.5) | 568 (2.3) | 12 (2.4) | 555 (6.1) | 11 (1.9) | 556 (5.0) | 4 (2.3) | 575 (7.6) |
| <i>Kuwait</i> | r 16 (5.5) | 419 (6.8) | 24 (5.9) | 443 (7.6) | 30 (7.5) | 418 (5.6) | 29 (7.9) | 425 (12.4) |
| Latvia (LSS) | s 27 (2.2) | 488 (3.7) | 18 (2.1) | 483 (4.6) | 27 (2.1) | 488 (3.4) | 29 (2.4) | 480 (3.4) |
| Lithuania | r 35 (2.0) | 476 (4.4) | 10 (1.3) | 472 (8.1) | 21 (2.2) | 475 (5.8) | 34 (2.4) | 479 (5.0) |
| <i>Netherlands</i> | 34 (3.0) | 548 (10.8) | 35 (3.1) | 562 (6.9) | 22 (3.5) | 586 (8.4) | 9 (1.9) | 561 (10.0) |
| New Zealand | 30 (3.9) | 511 (6.6) | 40 (4.2) | 528 (7.2) | 21 (3.4) | 549 (9.4) | 9 (2.5) | 515 (16.0) |
| Norway | s 35 (5.0) | 522 (4.2) | 34 (4.7) | 530 (3.6) | 15 (4.1) | 527 (6.8) | 17 (4.1) | 518 (6.0) |
| Portugal | 36 (2.1) | 482 (2.9) | 17 (2.2) | 481 (3.7) | 19 (2.5) | 484 (4.7) | 28 (2.0) | 473 (3.8) |
| <i>Romania</i> | 66 (2.3) | 481 (5.3) | 10 (1.3) | 484 (7.3) | 12 (1.5) | 501 (9.3) | 12 (1.6) | 499 (8.5) |
| Russian Federation | 40 (2.3) | 531 (5.2) | 6 (1.3) | 530 (10.8) | 32 (2.9) | 533 (5.8) | 22 (2.9) | 549 (5.7) |
| <i>Scotland</i> | - - | - - | - - | - - | - - | - - | - - | - - |
| Singapore | 19 (3.2) | 601 (13.7) | 31 (4.1) | 604 (10.3) | 17 (3.4) | 598 (15.4) | 32 (4.4) | 623 (9.5) |
| Slovak Republic | r 1 (0.8) | ~ ~ | 9 (2.9) | 533 (13.9) | 42 (4.6) | 545 (5.9) | 48 (5.0) | 543 (5.6) |
| <i>Slovenia</i> | r 29 (2.2) | 561 (3.1) | 27 (2.7) | 556 (5.4) | 27 (2.7) | 554 (3.3) | 18 (2.2) | 561 (4.7) |
| Spain | r 40 (4.3) | 515 (3.7) | 14 (3.6) | 517 (6.1) | 17 (3.4) | 529 (3.9) | 29 (4.3) | 513 (3.9) |
| Sweden | x x | x x | x x | x x | x x | x x | x x | x x |
| Switzerland | x x | x x | x x | x x | x x | x x | x x | x x |
| <i>Thailand</i> | r 62 (6.0) | 526 (5.8) | 20 (4.7) | 527 (9.0) | 7 (3.5) | 527 (14.8) | 11 (4.1) | 543 (13.0) |
| United States | x x | x x | x x | x x | x x | x x | x x | x x |

¹Based on most frequent response for: checking answers, test and exams, routine computations, solving complex problems, and exploring number concepts.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.16**Teachers' Reports on Ways in Which Calculators Are Used At Least Once or Twice a Week - Science - Upper Grade (Eighth Grade*)**

| Country | Percent of Students by Type of Use | | | | | |
|---------------------------|--------------------------------------|------------------|-----------------|----------------------|--------------------------|---------------------------|
| | Never or Hardly Ever Use Calculators | Checking Answers | Tests and Exams | Routine Computations | Solving Complex Problems | Exploring Number Concepts |
| <i>Australia</i> | x x | x x | x x | x x | x x | x x |
| <i>Austria</i> | r 61 (3.0) | r 5 (1.4) | r 2 (0.9) | r 5 (1.4) | r 3 (1.0) | r 2 (0.6) |
| Belgium (Fl) | r 61 (4.5) | r 17 (3.8) | r 14 (2.9) | r 20 (3.9) | r 20 (3.3) | r 8 (2.6) |
| <i>Belgium (Fr)</i> | s 31 (5.9) | s 27 (4.6) | s 23 (4.5) | s 29 (4.8) | s 23 (4.5) | s 12 (3.7) |
| Canada | r 16 (2.7) | r 34 (3.9) | r 23 (4.0) | r 39 (4.2) | r 32 (4.0) | s 21 (3.6) |
| <i>Colombia</i> | r 50 (5.2) | r 20 (5.1) | r 9 (2.7) | r 21 (5.4) | r 17 (3.6) | r 18 (3.5) |
| Cyprus | s 51 (3.9) | s 23 (4.1) | s 17 (3.4) | s 29 (3.5) | s 28 (4.0) | s 11 (2.3) |
| Czech Republic | r 22 (1.9) | r 39 (2.9) | r 17 (2.9) | r 37 (2.9) | r 29 (2.9) | r 11 (2.1) |
| <i>Denmark</i> | s 56 (5.8) | s 12 (4.4) | s 8 (3.7) | s 14 (4.6) | s 10 (3.4) | s 3 (2.2) |
| England | x x | x x | x x | x x | x x | x x |
| France | r 17 (2.4) | r 29 (3.7) | r 24 (3.4) | r 39 (3.1) | r 19 (3.3) | r 12 (3.1) |
| <i>Germany</i> | s 40 (4.5) | s 40 (4.7) | s 16 (4.4) | s 43 (4.8) | s 28 (4.6) | s 16 (4.5) |
| <i>Greece</i> | 64 (4.0) | 22 (3.5) | 6 (1.9) | 23 (3.3) | 16 (2.8) | 8 (2.2) |
| Hong Kong | 59 (5.8) | 5 (2.7) | 8 (3.3) | 16 (4.1) | 7 (3.2) | 6 (3.0) |
| Hungary | r 31 (2.9) | s 39 (3.1) | s 22 (2.8) | s 44 (3.2) | s 50 (3.1) | s 54 (3.5) |
| Iceland | s 31 (8.3) | s 27 (4.8) | s 19 (4.6) | s 32 (5.0) | s 30 (4.9) | s 20 (4.4) |
| Iran, Islamic Rep. | 68 (5.3) | 1 (0.9) | 4 (1.9) | 3 (1.8) | 6 (1.8) | 4 (1.5) |
| Ireland | s 54 (4.8) | s 12 (3.1) | s 4 (1.7) | s 15 (3.4) | s 7 (2.3) | s 2 (1.1) |
| <i>Israel</i> | s 53 (8.8) | s 7 (4.9) | s 8 (5.5) | s 13 (6.2) | s 9 (5.3) | s 6 (4.9) |
| Japan | 91 (2.4) | 0 (0.5) | 0 (0.0) | 0 (0.0) | 0 (0.5) | 0 (0.0) |
| Korea | 73 (3.5) | 5 (2.4) | 5 (2.4) | 10 (2.7) | 8 (2.2) | 8 (2.6) |
| <i>Kuwait</i> | r 16 (5.5) | r 40 (8.3) | r 27 (7.1) | r 53 (10.0) | r 43 (6.9) | r 38 (8.0) |
| Latvia (LSS) | s 27 (2.2) | s 44 (2.6) | s 25 (2.5) | s 55 (2.2) | s 38 (2.4) | s 14 (2.3) |
| Lithuania | r 35 (2.0) | s 48 (2.1) | s 16 (2.0) | s 49 (1.8) | s 46 (2.2) | s 15 (2.0) |
| <i>Netherlands</i> | 34 (3.0) | 23 (2.5) | 13 (2.5) | r 28 (2.4) | r 14 (2.3) | r 5 (1.6) |
| New Zealand | 30 (3.9) | 6 (1.8) | 5 (1.8) | 27 (3.8) | 11 (2.8) | 6 (2.3) |
| Norway | s 35 (5.0) | s 24 (4.8) | s 14 (3.9) | s 27 (4.9) | - - | - - |
| Portugal | 36 (2.1) | 40 (2.2) | 12 (1.9) | 39 (2.0) | 30 (2.5) | 17 (2.1) |
| <i>Romania</i> | 66 (2.3) | 17 (1.8) | r 4 (0.9) | r 19 (1.7) | r 19 (1.8) | r 5 (1.0) |
| Russian Federation | 40 (2.3) | 44 (2.5) | 14 (1.9) | 50 (2.1) | 43 (2.6) | 27 (2.7) |
| <i>Scotland</i> | - - | - - | - - | - - | - - | - - |
| Singapore | 19 (3.2) | 42 (4.7) | 33 (4.3) | 39 (4.9) | 38 (4.7) | 31 (4.2) |
| Slovak Republic | r 1 (0.8) | r 70 (4.1) | r 29 (4.7) | r 81 (3.8) | r 60 (4.8) | r 59 (4.6) |
| <i>Slovenia</i> | r 29 (2.2) | r 30 (2.5) | r 12 (1.8) | r 34 (2.9) | r 28 (2.6) | r 15 (2.3) |
| Spain | r 40 (4.3) | r 33 (4.8) | r 13 (3.3) | r 34 (4.7) | r 36 (4.9) | r 19 (3.5) |
| Sweden | x x | x x | x x | x x | x x | x x |
| Switzerland | x x | x x | x x | x x | x x | x x |
| <i>Thailand</i> | r 62 (6.0) | s 8 (3.5) | s 0 (0.4) | r 14 (4.7) | s 17 (5.0) | s 11 (3.9) |
| United States | x x | x x | x x | x x | x x | x x |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.17**Teachers' Reports on Frequency of Using Computers in Science Class To Solve Exercises or Problems - Upper Grade (Eighth Grade*)**

| Country | Never or Almost Never | | Some Lessons | | Most or Every Lesson | |
|---------------------------|-----------------------|------------------|---------------------|------------------|----------------------|------------------|
| | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement | Percent of Students | Mean Achievement |
| <i>Australia</i> | x x | x x | x x | x x | x x | x x |
| <i>Austria</i> | r 85 (2.6) | 565 (3.1) | 14 (2.6) | 547 (7.1) | 1 (0.2) | ~ ~ |
| Belgium (Fl) | r 98 (1.0) | 555 (5.9) | 2 (1.0) | ~ ~ | 0 (0.0) | ~ ~ |
| <i>Belgium (Fr)</i> | s 95 (2.0) | 483 (3.5) | 5 (2.0) | 491 (13.5) | 0 (0.0) | ~ ~ |
| Canada | r 76 (3.3) | 536 (2.9) | 23 (3.4) | 535 (9.9) | 0 (0.4) | ~ ~ |
| <i>Colombia</i> | r 95 (2.5) | 413 (4.5) | 3 (1.4) | 439 (51.1) | 2 (2.1) | ~ ~ |
| Cyprus | s 92 (1.1) | 456 (2.6) | 8 (1.1) | 483 (7.5) | 0 (0.0) | ~ ~ |
| Czech Republic | 93 (2.0) | 573 (4.6) | 6 (1.7) | 603 (11.0) | 2 (1.1) | ~ ~ |
| <i>Denmark</i> | s 63 (5.9) | 482 (4.4) | 35 (5.8) | 475 (5.2) | 2 (2.0) | ~ ~ |
| England | s 70 (3.3) | 567 (6.9) | 30 (3.3) | 558 (7.3) | 0 (0.0) | ~ ~ |
| France | 97 (1.2) | 499 (2.5) | 3 (1.2) | 508 (11.4) | 0 (0.0) | ~ ~ |
| <i>Germany</i> | s 95 (1.8) | 536 (6.2) | 5 (1.8) | 539 (23.1) | 0 (0.0) | ~ ~ |
| <i>Greece</i> | 93 (3.2) | 498 (2.2) | 6 (3.2) | 481 (5.0) | 0 (0.2) | ~ ~ |
| Hong Kong | 95 (2.5) | 523 (5.3) | 4 (2.2) | 487 (38.3) | 1 (1.2) | ~ ~ |
| Hungary | - - | - - | - - | - - | - - | - - |
| Iceland | s 73 (6.1) | 489 (4.5) | 22 (6.0) | 484 (4.0) | 5 (1.7) | 479 (9.2) |
| Iran, Islamic Rep. | s 99 (0.5) | 469 (2.4) | 1 (0.5) | ~ ~ | 0 (0.0) | ~ ~ |
| Ireland | s 96 (1.4) | 540 (6.0) | 4 (1.4) | 588 (14.8) | 0 (0.0) | ~ ~ |
| <i>Israel</i> | r 75 (8.0) | 538 (8.3) | 24 (7.9) | 498 (13.3) | 1 (1.1) | ~ ~ |
| Japan | 84 (2.8) | 572 (2.0) | 16 (2.8) | 569 (5.8) | 0 (0.0) | ~ ~ |
| Korea | 96 (1.7) | 566 (2.2) | 4 (1.7) | 555 (8.3) | 0 (0.0) | ~ ~ |
| <i>Kuwait</i> | r 78 (7.7) | 427 (4.5) | 21 (7.6) | 420 (7.5) | 1 (0.9) | ~ ~ |
| Latvia (LSS) | s 91 (1.5) | 485 (2.6) | 6 (1.3) | 483 (6.5) | 3 (0.8) | 479 (9.6) |
| Lithuania | r 96 (1.1) | 477 (4.2) | 3 (0.9) | 482 (13.6) | 1 (0.5) | ~ ~ |
| <i>Netherlands</i> | r 85 (2.6) | 559 (7.4) | 15 (2.6) | 578 (7.9) | 0 (0.0) | ~ ~ |
| New Zealand | 90 (2.7) | 526 (4.7) | 10 (2.7) | 527 (12.5) | 0 (0.0) | ~ ~ |
| Norway | s 96 (1.9) | 525 (2.3) | 4 (1.9) | 523 (12.8) | 0 (0.0) | ~ ~ |
| Portugal | 99 (0.5) | 480 (2.5) | 0 (0.3) | ~ ~ | 0 (0.4) | ~ ~ |
| <i>Romania</i> | r 94 (1.3) | 487 (4.7) | 4 (1.1) | 504 (11.9) | 2 (0.7) | ~ ~ |
| Russian Federation | 88 (1.7) | 538 (4.6) | 8 (1.5) | 534 (8.0) | 3 (1.0) | 528 (15.1) |
| <i>Scotland</i> | - - | - - | - - | - - | - - | - - |
| Singapore | 95 (1.5) | 606 (5.8) | 5 (1.5) | 625 (22.3) | 0 (0.0) | ~ ~ |
| Slovak Republic | r 96 (2.0) | 546 (3.9) | 4 (2.0) | 514 (7.8) | 0 (0.0) | ~ ~ |
| <i>Slovenia</i> | r 60 (3.1) | 556 (3.5) | 26 (3.1) | 559 (4.3) | 15 (2.2) | 558 (5.3) |
| Spain | r 92 (2.7) | 519 (2.1) | 7 (2.5) | 501 (8.6) | 1 (0.9) | ~ ~ |
| Sweden | x x | x x | x x | x x | x x | x x |
| Switzerland | s 78 (4.3) | 527 (4.9) | 22 (4.3) | 510 (12.7) | 0 (0.0) | ~ ~ |
| <i>Thailand</i> | r 92 (3.6) | 530 (5.3) | 3 (2.2) | 521 (15.5) | 5 (2.9) | 513 (8.2) |
| United States | x x | x x | x x | x x | x x | x x |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.18**Students' Reports on Frequency of Using Computers in Science Class¹
Upper Grade (Eighth Grade*)**

| Country | Percent of Students Responding At Least Once in a While | | | | |
|----------------------------------|---|-----------------------|------------|---------------|------------|
| | Science (Integrated) | Science Subject Areas | | | |
| | | Biology | Chemistry | Earth Science | Physics |
| <i>Australia</i> | 16 (1.4) | . . | . . | . . | . . |
| <i>Austria</i> | 23 (2.4) | . . | . . | . . | . . |
| Belgium (Fl) | . . | 9 (1.1) | . . | 8 (0.9) | x x |
| ² Belgium (Fr) | x x | x x | . . | . . | x x |
| Canada | 24 (1.5) | . . | . . | . . | . . |
| <i>Colombia</i> | 6 (0.5) | . . | . . | . . | . . |
| Cyprus | 23 (1.1) | . . | . . | . . | . . |
| Czech Republic | . . | 2 (0.5) | 5 (1.5) | 6 (2.3) | 6 (1.9) |
| ³ <i>Denmark</i> | . . | 36 (2.9) | . . | r 39 (2.6) | 17 (2.1) |
| England | 36 (2.5) | . . | . . | . . | . . |
| ⁴ France | . . | 8 (1.5) | . . | . . | 12 (1.5) |
| <i>Germany</i> | . . | 10 (0.9) | s 13 (1.6) | . . | 15 (1.6) |
| <i>Greece</i> | . . | . . | 22 (1.0) | 23 (1.4) | 24 (1.2) |
| Hong Kong | 11 (0.9) | . . | . . | . . | . . |
| Hungary | . . | 5 (0.5) | 7 (0.9) | 6 (0.6) | 8 (0.8) |
| Iceland | . . | 11 (2.5) | x x | x x | s 12 (2.4) |
| Iran, Islamic Rep. | 9 (0.9) | . . | . . | . . | . . |
| Ireland | 8 (1.3) | . . | . . | . . | . . |
| <i>Israel</i> | 21 (4.0) | . . | . . | . . | . . |
| Japan | 16 (2.4) | . . | . . | . . | . . |
| Korea | 9 (0.8) | . . | . . | . . | . . |
| <i>Kuwait</i> | 19 (1.8) | . . | . . | . . | . . |
| Latvia (LSS) | . . | 3 (0.4) | 5 (0.6) | . . | 8 (1.3) |
| Lithuania | . . | 4 (0.5) | 6 (0.7) | 6 (0.6) | 8 (0.8) |
| ⁵ <i>Netherlands</i> | . . | r 11 (1.9) | . . | 16 (2.6) | 12 (1.7) |
| New Zealand | 20 (2.2) | . . | . . | . . | . . |
| Norway | 12 (1.3) | . . | . . | . . | . . |
| ⁶ Portugal | . . | 4 (0.4) | . . | . . | 7 (0.8) |
| <i>Romania</i> | . . | 21 (1.0) | 24 (1.1) | 23 (1.1) | 25 (1.3) |
| Russian Federation | . . | 4 (0.8) | s 38 (1.9) | 6 (1.0) | 8 (1.0) |
| Scotland | 32 (2.0) | . . | . . | . . | . . |
| Singapore | 7 (1.3) | . . | . . | . . | . . |
| Slovak Republic | . . | 2 (0.3) | 4 (0.7) | 3 (0.3) | 5 (0.8) |
| <i>Slovenia</i> | . . | 8 (0.8) | 13 (0.9) | . . | 20 (1.5) |
| Spain | 9 (1.3) | . . | . . | . . | . . |
| Sweden | . . | 18 (2.0) | s 17 (1.7) | r 25 (2.1) | r 23 (2.0) |
| Switzerland | 13 (1.5) | . . | . . | . . | . . |
| <i>Thailand</i> | 9 (1.0) | . . | . . | . . | . . |
| United States | 35 (2.2) | . . | . . | . . | . . |

¹Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

²Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.

³Physics data for Denmark are for students taking physics/chemistry classes.

⁴Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.

⁵Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

⁶Biology data for Portugal are for students taking natural science classes; physics data are for students taking physical science classes.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates a 70-84% student response rate. An "s" indicates a 50-69% student response rate. An "x" indicates a <50% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

HOW MUCH SCIENCE HOMEWORK ARE STUDENTS ASSIGNED?

Although teachers often give students time to begin or review homework assignments in class, homework is generally considered a method of extending the time spent on regular classroom lessons. Table 5.19 presents teachers' reports about how often they assign science homework and the typical lengths of such assignments. Internationally, most eighth-grade students are assigned science homework at least once a week, although more than half of the students in Belgium (Flemish), Belgium (French), the Czech Republic, Denmark, Hong Kong, Japan, Korea, Scotland, and Slovenia are taught by teachers who reported that they assign homework less than once a week. Most typically, the majority of students were assigned up to 30 minutes of science homework once or twice a week. Students in Colombia, Cyprus, Greece and Iran are among those reporting most science homework, but even in those countries, less than 20% of students are taught by teachers who assign more than 30 minutes of science homework as often as three times a week.

Homework generally has its biggest impact when it is commented on and graded by teachers. Table 5.20 presents teachers' reports about their use of students' written science homework. In most countries, for at least 70% of the students, teachers reported at least sometimes, if not always, correcting homework assignments and returning those assignments to students. The exceptions were Austria, Germany, Hungary, Iran, Japan, the Netherlands, Norway, and the Slovak Republic.

Many teachers do not count homework directly in determining grades, using it more as a method to monitor students' understanding and correct misconceptions. In general for the TIMSS countries, teachers reported that science homework assignments contributed only sometimes to students' grades or marks. In some countries, however, it had even less impact on grades. According to their teachers, homework never or only rarely contributed to the grades for the majority of the students in Austria, the Czech Republic, Denmark, France, Hong Kong, Hungary, Ireland, Japan, Latvia (LSS), Lithuania, the Netherlands, Norway, Romania, Singapore, the Slovak Republic, Slovenia, Switzerland, and Thailand. At the other end of the continuum, teachers reported that homework always contributed to the grades for the majority of the students in Colombia, Kuwait, Portugal, the Russian Federation, and Spain.

Table 5.19**Teachers' Reports About the Amount of Science Homework Assigned
Upper Grade (Eighth Grade*)**

| Country | Percent of Students Taught by Teachers | | | | | | |
|---------------------------|--|--|----------------------|---|----------------------|---|----------------------|
| | Never Assigning Homework | Assigning Homework Less Than Once a Week | | Assigning Homework Once or Twice a Week | | Assigning Homework Three Times a Week or More Often | |
| | | 30 Minutes or Less | More Than 30 Minutes | 30 Minutes or Less | More Than 30 Minutes | 30 Minutes or Less | More Than 30 Minutes |
| <i>Australia</i> | x x | x x | x x | x x | x x | x x | x x |
| <i>Austria</i> | - - | - - | - - | - - | - - | - - | - - |
| Belgium (Fl) | r 16 (2.9) | 72 (4.1) | 4 (1.3) | 7 (2.2) | 0 (0.4) | 1 (0.9) | 0 (0.0) |
| <i>Belgium (Fr)</i> | s 4 (2.0) | 57 (5.4) | 4 (1.9) | 31 (4.8) | 2 (1.5) | 2 (1.1) | 1 (0.6) |
| Canada | r 4 (1.8) | 16 (2.5) | 4 (2.8) | 47 (4.1) | 8 (2.2) | 18 (2.4) | 2 (1.3) |
| <i>Colombia</i> | r 1 (1.4) | 5 (2.1) | 8 (2.2) | 26 (4.1) | 37 (5.2) | 11 (3.0) | 11 (3.0) |
| Cyprus | s 1 (1.3) | 1 (0.6) | 0 (0.0) | 27 (3.6) | 12 (3.1) | 45 (4.6) | 14 (3.8) |
| Czech Republic | r 4 (1.3) | 75 (3.6) | 0 (0.2) | 21 (3.4) | 0 (0.0) | 0 (0.1) | 0 (0.0) |
| <i>Denmark</i> | s 15 (4.7) | 49 (6.4) | 5 (3.2) | 26 (5.6) | 0 (0.0) | 6 (2.7) | 0 (0.0) |
| England | s 0 (0.0) | 10 (2.1) | 2 (0.8) | 54 (3.3) | 32 (3.0) | 2 (1.4) | 0 (0.1) |
| France | 2 (0.9) | 31 (3.6) | 3 (1.2) | 54 (3.6) | 6 (1.5) | 5 (1.5) | 0 (0.0) |
| <i>Germany</i> | s 3 (1.5) | 41 (4.1) | 0 (0.4) | 43 (3.8) | 0 (0.4) | 12 (2.8) | 0 (0.0) |
| <i>Greece</i> | 0 (0.0) | 9 (2.3) | 1 (0.9) | 28 (3.1) | 11 (3.4) | 34 (3.5) | 17 (3.1) |
| Hong Kong | 1 (1.1) | 37 (5.3) | 21 (4.6) | 36 (5.5) | 4 (2.2) | 1 (1.2) | 0 (0.0) |
| Hungary | 2 (0.7) | 27 (2.3) | 1 (0.4) | 21 (2.3) | 1 (0.5) | 42 (2.5) | 6 (1.2) |
| Iceland | s 3 (1.9) | 23 (3.9) | 2 (1.4) | 49 (6.1) | 12 (5.6) | 11 (6.6) | 0 (0.0) |
| Iran, Islamic Rep. | 2 (1.3) | 7 (3.1) | 9 (3.3) | 26 (5.8) | 41 (5.4) | 3 (1.1) | 13 (2.8) |
| Ireland | s 0 (0.4) | 5 (2.1) | 0 (0.2) | 34 (4.1) | 4 (1.8) | 53 (4.6) | 4 (1.5) |
| <i>Israel</i> | r 0 (0.0) | 19 (6.5) | 0 (0.0) | 48 (8.0) | 13 (6.3) | 18 (6.9) | 3 (2.8) |
| Japan | 10 (2.3) | 55 (4.2) | 14 (3.4) | 12 (3.1) | 5 (2.1) | 4 (1.4) | 0 (0.5) |
| Korea | 2 (1.0) | 39 (3.7) | 11 (2.6) | 29 (3.9) | 10 (2.4) | 8 (2.7) | 0 (0.4) |
| <i>Kuwait</i> | r 0 (0.0) | 0 (0.0) | 0 (0.0) | 20 (6.5) | 3 (2.5) | 68 (5.8) | 9 (4.2) |
| Latvia (LSS) | s 1 (0.6) | 23 (1.9) | 1 (0.6) | 58 (2.6) | 3 (1.1) | 14 (1.6) | 1 (0.4) |
| Lithuania | r 1 (0.4) | 19 (1.9) | 0 (0.3) | 62 (2.5) | 4 (1.0) | 13 (1.6) | 1 (0.6) |
| <i>Netherlands</i> | r 0 (0.4) | 11 (2.2) | 0 (0.0) | 76 (3.3) | 3 (1.0) | 9 (2.0) | 1 (0.6) |
| New Zealand | 0 (0.2) | 12 (2.0) | 2 (1.0) | 54 (3.9) | 2 (0.5) | 30 (3.7) | 0 (0.0) |
| Norway | s 0 (0.0) | 11 (3.5) | 1 (1.2) | 65 (5.1) | 9 (2.9) | 14 (3.6) | 0 (0.0) |
| Portugal | 0 (0.2) | 14 (2.4) | 2 (0.9) | 59 (3.0) | 5 (1.2) | 19 (2.7) | 1 (0.8) |
| <i>Romania</i> | 8 (1.2) | 35 (2.3) | 2 (0.6) | 34 (2.0) | 8 (1.3) | 6 (1.2) | 6 (1.0) |
| Russian Federation | 0 (0.0) | 1 (0.5) | 0 (0.2) | 65 (2.8) | 16 (2.4) | 12 (2.6) | 6 (1.2) |
| <i>Scotland</i> | s 2 (1.4) | 62 (4.8) | 4 (1.7) | 30 (4.5) | 2 (1.3) | 0 (0.2) | 0 (0.0) |
| Singapore | 0 (0.0) | 14 (3.5) | 3 (1.8) | 49 (4.4) | 28 (3.8) | 6 (2.3) | 0 (0.4) |
| Slovak Republic | r 2 (1.2) | 37 (4.8) | 0 (0.0) | 59 (4.7) | 0 (0.0) | 2 (1.4) | 0 (0.0) |
| <i>Slovenia</i> | r 3 (1.1) | 56 (3.4) | 2 (0.6) | 37 (3.5) | 2 (0.9) | 0 (0.3) | 0 (0.0) |
| Spain | r 0 (0.0) | 8 (2.8) | 4 (1.9) | 45 (4.9) | 5 (2.1) | 30 (4.5) | 8 (2.6) |
| Sweden | x x | x x | x x | x x | x x | x x | x x |
| Switzerland | s 4 (1.1) | 43 (5.0) | 3 (1.4) | 38 (5.2) | 3 (1.4) | 8 (2.7) | 1 (1.1) |
| <i>Thailand</i> | r 0 (0.0) | 7 (3.0) | 7 (3.4) | 34 (6.4) | 40 (6.7) | 6 (2.8) | 7 (3.0) |
| United States | x x | x x | x x | x x | x x | x x | x x |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are unavailable.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.20**Teachers' Reports on Their Use of Students' Written Science Homework¹
Upper Grade (Eighth Grade*)**

| Country | Percent of Students Taught by Teachers | | | | | | | |
|---------------------------|---|----------|-----------|----------|--|----------|-----------|----------|
| | Collecting, Correcting and then Returning Assignments to Students | | | | Using Homework to Contribute Towards Students' Grades or Marks | | | |
| | Never | Rarely | Sometimes | Always | Never | Rarely | Sometimes | Always |
| <i>Australia</i> | x x | x x | x x | x x | x x | x x | x x | x x |
| <i>Austria</i> | s 24 (3.1) | 16 (2.7) | 31 (2.9) | 29 (3.8) | s 29 (3.8) | 34 (4.1) | 26 (3.7) | 12 (2.7) |
| Belgium (Fl) | r 6 (2.0) | 16 (4.0) | 15 (3.3) | 63 (4.7) | r 16 (4.0) | 24 (6.1) | 29 (4.1) | 31 (5.0) |
| <i>Belgium (Fr)</i> | s 6 (2.6) | 3 (1.9) | 35 (5.9) | 56 (6.4) | s 5 (2.8) | 14 (3.9) | 53 (6.2) | 28 (5.1) |
| Canada | s 1 (0.7) | 3 (1.7) | 53 (5.2) | 43 (5.1) | s 7 (2.2) | 12 (2.2) | 48 (3.9) | 33 (3.6) |
| <i>Colombia</i> | r 0 (0.0) | 1 (0.9) | 14 (5.2) | 85 (5.2) | r 1 (1.0) | 5 (2.0) | 40 (4.8) | 54 (4.9) |
| Cyprus | s 5 (1.8) | 15 (3.5) | 51 (4.4) | 29 (4.3) | s 0 (0.0) | 6 (2.0) | 46 (4.4) | 49 (4.7) |
| Czech Republic | r 10 (1.9) | 11 (2.1) | 37 (3.4) | 41 (3.1) | r 28 (3.6) | 35 (3.5) | 30 (3.2) | 7 (1.3) |
| <i>Denmark</i> | s 14 (5.0) | 8 (3.3) | 31 (5.8) | 46 (6.7) | s 41 (6.6) | 17 (5.0) | 29 (6.5) | 13 (4.9) |
| England | s 1 (0.7) | 2 (0.9) | 31 (3.4) | 66 (3.6) | s 3 (1.2) | 8 (1.6) | 45 (3.0) | 44 (3.5) |
| France | 7 (1.8) | 18 (3.1) | 45 (3.7) | 30 (3.1) | 25 (2.8) | 28 (3.4) | 39 (4.2) | 8 (1.9) |
| <i>Germany</i> | s 3 (1.3) | 28 (4.3) | 56 (4.9) | 13 (2.9) | s 17 (2.9) | 22 (3.5) | 52 (4.7) | 9 (2.8) |
| <i>Greece</i> | 6 (1.8) | 17 (2.6) | 43 (3.7) | 34 (3.4) | 2 (0.9) | 12 (2.6) | 41 (3.6) | 45 (3.9) |
| Hong Kong | 0 (0.0) | 4 (2.3) | 17 (3.7) | 79 (3.8) | 26 (5.3) | 27 (5.1) | 26 (5.0) | 21 (5.1) |
| Hungary | 14 (1.6) | 32 (2.5) | 39 (2.3) | 15 (1.7) | 16 (2.0) | 39 (2.5) | 34 (2.5) | 11 (1.7) |
| Iceland | s 2 (1.4) | 22 (7.2) | 54 (7.6) | 22 (4.0) | s 4 (3.1) | 12 (4.5) | 51 (8.1) | 33 (6.8) |
| Iran, Islamic Rep. | 17 (6.4) | 22 (4.3) | 26 (5.0) | 35 (5.2) | 9 (3.0) | 25 (5.7) | 43 (5.6) | 23 (4.4) |
| Ireland | s 4 (1.9) | 15 (3.2) | 45 (4.7) | 36 (4.3) | s 23 (3.9) | 31 (4.3) | 37 (4.5) | 8 (2.6) |
| <i>Israel</i> | r 6 (4.4) | 19 (6.8) | 45 (8.8) | 29 (6.3) | r 8 (4.5) | 16 (5.4) | 51 (8.9) | 25 (5.8) |
| Japan | 23 (4.4) | 21 (3.6) | 23 (3.9) | 33 (4.5) | 20 (3.2) | 35 (3.8) | 23 (3.8) | 21 (3.6) |
| Korea | 1 (0.7) | 5 (2.2) | 58 (4.0) | 35 (3.6) | 6 (1.8) | 18 (3.0) | 57 (3.9) | 20 (3.0) |
| <i>Kuwait</i> | r 0 (0.0) | 0 (0.0) | 4 (2.9) | 96 (2.9) | r 0 (0.0) | 0 (0.0) | 26 (6.9) | 74 (6.9) |
| Latvia (LSS) | s 5 (1.2) | 11 (1.7) | 43 (2.3) | 41 (2.5) | s 37 (3.2) | 29 (3.0) | 21 (2.1) | 13 (1.7) |
| Lithuania | s 5 (1.1) | 12 (1.5) | 39 (2.3) | 44 (2.1) | s 39 (2.7) | 14 (2.0) | 33 (2.6) | 13 (2.3) |
| <i>Netherlands</i> | r 36 (3.0) | 34 (2.8) | 29 (3.3) | 1 (0.7) | r 44 (3.2) | 23 (2.9) | 25 (3.6) | 8 (1.7) |
| New Zealand | 3 (1.3) | 10 (2.5) | 50 (3.9) | 37 (3.9) | 12 (2.7) | 17 (2.9) | 58 (3.5) | 12 (2.6) |
| Norway | s 5 (2.4) | 24 (4.6) | 54 (5.6) | 17 (4.1) | s 7 (2.8) | 27 (4.7) | 53 (4.8) | 13 (3.8) |
| Portugal | 5 (1.3) | 18 (2.4) | 46 (3.2) | 30 (2.9) | 1 (0.7) | 4 (1.3) | 37 (3.0) | 57 (3.2) |
| <i>Romania</i> | r 9 (1.4) | 11 (1.7) | 33 (2.7) | 47 (2.9) | r 12 (1.6) | 18 (1.9) | 46 (2.8) | 24 (2.2) |
| Russian Federation | 1 (0.5) | 4 (1.0) | 29 (2.9) | 66 (2.8) | 1 (0.5) | 5 (0.8) | 30 (2.2) | 65 (2.5) |
| <i>Scotland</i> | - - | - - | - - | - - | - - | - - | - - | - - |
| Singapore | 0 (0.0) | 2 (1.5) | 13 (3.2) | 85 (3.2) | 30 (4.3) | 26 (3.7) | 37 (4.8) | 7 (2.8) |
| Slovak Republic | r 11 (3.2) | 20 (4.3) | 46 (5.1) | 22 (3.7) | r 38 (4.5) | 31 (4.6) | 25 (4.2) | 6 (2.2) |
| <i>Slovenia</i> | r 9 (1.8) | 15 (2.3) | 49 (3.4) | 27 (2.9) | r 36 (3.6) | 37 (3.5) | 24 (3.0) | 3 (1.1) |
| Spain | r 2 (1.3) | 7 (2.3) | 26 (4.3) | 66 (4.3) | r 2 (1.7) | 6 (2.3) | 40 (4.2) | 51 (4.5) |
| Sweden | x x | x x | x x | x x | x x | x x | x x | x x |
| Switzerland | s 8 (2.6) | 18 (4.3) | 51 (5.6) | 22 (4.2) | s 28 (4.4) | 35 (5.1) | 35 (5.6) | 2 (1.8) |
| <i>Thailand</i> | r 0 (0.0) | 1 (0.5) | 21 (5.2) | 78 (5.2) | s 9 (3.9) | 18 (4.5) | 47 (6.6) | 26 (5.4) |
| United States | x x | x x | x x | x x | x x | x x | x x | x x |

¹Based on those teachers who assign homework.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

WHAT ASSESSMENT AND EVALUATION PROCEDURES DO TEACHERS USE?

Teachers in participating countries were asked about the importance they place on different types of assessment and how they use assessment information. Their responses to these two questions are presented in Tables 5.21 and 5.22, respectively. The weight given each type of assessment varied greatly from country to country. The most heavily weighted type of assessment was teacher-made tests requiring explanations, observations of students, and students' responses in class. One or more of these assessment types was weighted heavily for 80% or more of the students in many European and Eastern European countries. In contrast, teachers were less in agreement about assessment approaches within Canada, England, Hong Kong, Ireland, Korea, New Zealand, and Thailand, where no type of assessment was weighted heavily for as many as 80% of the students. Internationally, the least weight reportedly was given to external standardized tests. In no participating country did as many as 80% of the eighth-grade students have science teachers who reported giving quite a lot or a great deal of weight to this type of assessment.

As might be anticipated, science teachers in most countries reported using assessment information to provide grades or marks, to provide student feedback, to diagnose learning problems, and to plan future lessons. Teachers in fewer countries reported considerable use of assessment information to report to parents or for the purpose of tracking or making program assignments.

As reported in Table 5.23, eighth-grade students reported quite a lot of testing in science classes. Among countries where science is taught as an integrated subject, the majority of the students reported having frequent (pretty often or almost always) quizzes and tests in Austria, Canada, Colombia, Cyprus, England, Hong Kong, Iran, Ireland, Kuwait, Singapore, Spain, Thailand, and the United States. Where the science subjects are taught separately, the majority reported frequent quizzes and tests in Belgium (Flemish), France, Germany, Greece, Lithuania, the Netherlands, Portugal, Romania, the Russian Federation, Slovenia, Spain, and Sweden. Countries with relatively little testing in science classes included Japan and Korea (integrated science), and the Czech Republic, Denmark, Hungary, Iceland, Latvia (LSS), and the Slovak Republic (separate science subjects).

Table 5.21**Teachers' Reports on the Types of Assessment Given "Quite A Lot" or "A Great Deal" of Weight in Assessing Students' Work in Science Class - Upper Grade (Eighth Grade*)**

| Country | Percent of Students Taught by Teachers Relying on Different Types of Assessment | | | | | | |
|---------------------------|---|---|------------------------------|----------------------|---------------------------------|--------------------------|------------------------------|
| | External Standardized Tests | Teacher-Made Tests Requiring Explanations | Teacher-Made Objective Tests | Homework Assignments | Projects or Practical Exercises | Observations of Students | Students' Responses in Class |
| <i>Australia</i> | x x | x x | x x | x x | x x | x x | x x |
| <i>Austria</i> | r 5 (1.6) | r 74 (3.0) | r 20 (3.3) | s 20 (3.2) | r 41 (3.6) | r 97 (1.2) | r 84 (2.4) |
| Belgium (Fl) | r 11 (5.3) | r 92 (1.8) | r 28 (4.7) | r 20 (4.1) | r 39 (4.6) | r 48 (4.2) | r 50 (4.3) |
| <i>Belgium (Fr)</i> | s 6 (2.5) | s 84 (3.8) | s 33 (5.4) | s 41 (5.2) | s 34 (6.0) | s 67 (5.5) | s 61 (5.2) |
| Canada | r 8 (2.0) | r 75 (3.8) | r 49 (4.7) | r 50 (3.9) | r 76 (3.9) | r 36 (3.1) | r 32 (3.7) |
| <i>Colombia</i> | r 18 (3.7) | r 75 (4.3) | r 63 (4.0) | r 94 (2.1) | r 84 (3.0) | r 85 (3.0) | r 87 (3.4) |
| Cyprus | s 24 (4.3) | s 79 (3.4) | s 68 (4.0) | s 91 (2.6) | s 76 (4.1) | s 82 (3.4) | s 98 (1.5) |
| Czech Republic | r 40 (2.8) | r 93 (1.3) | r 37 (3.2) | r 10 (1.7) | r 48 (4.4) | r 72 (2.9) | r 94 (1.6) |
| <i>Denmark</i> | s 30 (5.5) | s 63 (5.9) | s 24 (5.6) | s 41 (5.9) | s 91 (3.1) | s 87 (4.2) | s 89 (3.7) |
| England | x x | s 68 (2.5) | x x | s 66 (2.6) | s 74 (2.4) | s 65 (2.9) | s 61 (3.2) |
| France | 20 (2.6) | 89 (2.1) | 44 (3.7) | 37 (3.7) | 51 (3.7) | 71 (3.6) | 68 (3.9) |
| <i>Germany</i> | s 5 (2.5) | s 84 (3.5) | s 10 (2.4) | s 30 (4.4) | s 55 (4.7) | s 72 (4.9) | s 86 (2.3) |
| <i>Greece</i> | 25 (3.5) | 91 (2.0) | 55 (4.1) | 64 (3.9) | 53 (4.4) | 85 (2.5) | 97 (1.5) |
| Hong Kong | 22 (4.6) | 49 (5.7) | 78 (5.1) | 53 (5.7) | 41 (5.5) | 43 (5.6) | 43 (4.7) |
| Hungary | 46 (2.8) | 89 (1.8) | 36 (2.3) | 42 (2.8) | 82 (2.1) | 71 (2.4) | 88 (1.7) |
| Iceland | s 5 (1.6) | s 94 (2.8) | s 55 (6.6) | s 87 (4.9) | s 48 (7.5) | s 42 (7.7) | s 43 (7.6) |
| Iran, Islamic Rep. | 19 (3.6) | 89 (2.9) | 59 (6.0) | 45 (5.3) | 52 (5.0) | 42 (5.6) | 93 (2.1) |
| Ireland | s 28 (3.8) | s 69 (4.4) | s 32 (4.4) | s 67 (4.9) | s 63 (4.8) | s 69 (4.9) | s 76 (4.4) |
| <i>Israel</i> | s 21 (7.9) | r 69 (8.4) | r 92 (4.2) | r 35 (7.4) | r 48 (7.8) | r 60 (6.5) | r 71 (7.9) |
| Japan | 16 (3.2) | 72 (3.2) | 45 (4.0) | 44 (4.2) | 88 (2.8) | 79 (3.8) | 69 (3.8) |
| Korea | s 23 (4.5) | s 41 (4.2) | s 41 (4.2) | s 16 (3.6) | s 55 (4.7) | s 38 (4.9) | s 38 (4.6) |
| <i>Kuwait</i> | r 22 (6.7) | r 84 (5.5) | r 90 (4.4) | r 67 (6.7) | r 52 (6.5) | r 67 (6.8) | r 85 (4.3) |
| Latvia (LSS) | s 62 (2.5) | s 81 (2.3) | s 65 (2.6) | s 74 (2.5) | s 89 (1.7) | s 80 (2.3) | s 97 (0.9) |
| Lithuania | s 15 (1.6) | s 48 (2.6) | s 29 (2.8) | s 36 (2.7) | s 41 (3.0) | s 36 (2.8) | s 82 (2.3) |
| <i>Netherlands</i> | r 60 (3.7) | r 90 (2.4) | r 64 (3.4) | r 11 (2.8) | r 25 (3.3) | r 17 (2.6) | r 14 (2.7) |
| New Zealand | 10 (2.3) | 63 (3.8) | 56 (4.4) | 30 (4.0) | 66 (4.1) | 53 (4.4) | 36 (4.2) |
| Norway | s 6 (2.1) | s 95 (2.2) | s 8 (2.8) | s 56 (4.6) | s 68 (5.1) | s 68 (4.6) | s 74 (5.0) |
| Portugal | 13 (2.0) | 88 (1.9) | 53 (2.9) | 81 (2.5) | 71 (2.9) | 88 (2.1) | 94 (1.6) |
| <i>Romania</i> | r 21 (2.2) | 82 (1.8) | 72 (2.1) | r 72 (2.3) | 68 (2.1) | 90 (1.3) | 99 (0.6) |
| Russian Federation | - - | 96 (1.3) | 63 (2.9) | 77 (2.9) | 74 (3.0) | 97 (1.1) | - - |
| <i>Scotland</i> | - - | - - | - - | - - | - - | - - | - - |
| Singapore | - - | 80 (3.4) | 61 (4.4) | 48 (4.7) | 77 (4.2) | 47 (4.7) | 46 (4.7) |
| Slovak Republic | r 76 (4.0) | r 97 (1.7) | r 24 (3.9) | r 27 (4.1) | r 76 (4.5) | r 93 (2.4) | r 99 (0.9) |
| <i>Slovenia</i> | r 46 (3.4) | r 89 (2.0) | r 29 (3.5) | r 39 (3.7) | r 76 (3.1) | r 76 (3.2) | r 88 (2.4) |
| Spain | r 8 (2.6) | r 97 (1.6) | r 43 (4.4) | r 76 (3.9) | r 62 (4.2) | r 88 (3.4) | r 92 (2.9) |
| Sweden | x x | x x | x x | x x | x x | x x | x x |
| Switzerland | s 11 (2.8) | s 88 (3.6) | s 20 (4.0) | s 13 (3.1) | s 46 (5.0) | s 54 (5.6) | s 61 (5.1) |
| <i>Thailand</i> | s 20 (5.1) | r 63 (5.9) | r 81 (4.5) | r 64 (5.7) | r 70 (5.7) | r 67 (5.7) | r 68 (5.8) |
| United States | x x | x x | x x | x x | x x | x x | x x |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.22**Teachers' Reports on Ways Assessment Information Is Used "Quite A Lot" or "A Great Deal" - Science - Upper Grade (Eighth Grade*)**

| Country | Percent of Students Taught by Teachers Using Assessment Information | | | | | |
|---------------------------|---|-----------------------------|-------------------------------|----------------------|--|----------------------------|
| | To Provide Grades or Marks | To Provide Student Feedback | To Diagnose Learning Problems | To Report to Parents | To Assign Students to Programs or Tracks | To Plan for Future Lessons |
| <i>Australia</i> | x x | x x | x x | x x | x x | x x |
| <i>Austria</i> | - - | r 66 (3.3) | r 51 (3.2) | r 36 (4.3) | r 4 (1.2) | r 29 (3.0) |
| Belgium (Fl) | r 71 (3.6) | r 61 (5.1) | r 65 (4.8) | r 65 (4.1) | r 59 (5.0) | r 33 (5.0) |
| <i>Belgium (Fr)</i> | s 83 (4.4) | s 69 (6.2) | s 84 (5.2) | s 39 (5.4) | - - | s 73 (4.9) |
| Canada | r 90 (3.0) | r 82 (2.6) | r 55 (4.3) | r 78 (3.2) | s 29 (4.0) | r 59 (4.1) |
| <i>Colombia</i> | r 70 (4.5) | r 95 (2.0) | r 85 (3.4) | r 54 (4.8) | r 22 (4.4) | r 86 (3.4) |
| Cyprus | s 93 (2.0) | s 85 (2.9) | s 95 (2.4) | s 83 (3.0) | s 63 (4.8) | s 84 (3.2) |
| Czech Republic | r 94 (1.4) | r 92 (1.8) | r 97 (0.9) | r 53 (3.1) | r 19 (3.1) | r 79 (2.7) |
| <i>Denmark</i> | s 41 (5.5) | s 75 (5.7) | s 50 (6.0) | s 36 (6.2) | s 67 (6.1) | s 83 (5.0) |
| England | x x | x x | x x | x x | x x | x x |
| France | 91 (1.8) | 92 (1.9) | 91 (1.7) | 52 (3.4) | 38 (3.8) | 72 (3.4) |
| <i>Germany</i> | s 81 (3.4) | s 83 (3.5) | s 82 (3.5) | s 41 (4.4) | s 20 (3.6) | s 72 (4.1) |
| <i>Greece</i> | 95 (1.7) | 88 (2.6) | 93 (2.0) | 91 (2.1) | 35 (4.3) | 72 (3.5) |
| Hong Kong | 73 (5.5) | 64 (5.0) | 74 (3.8) | 13 (4.1) | 5 (2.5) | 63 (5.4) |
| Hungary | 58 (2.6) | 67 (2.4) | 90 (1.7) | 84 (1.9) | 85 (1.7) | 72 (2.1) |
| Iceland | s 73 (7.4) | s 67 (5.5) | s 55 (5.9) | s 43 (5.3) | s 6 (2.9) | s 70 (7.3) |
| Iran, Islamic Rep. | 85 (3.4) | r 63 (4.6) | 73 (5.7) | 61 (4.6) | 52 (5.6) | 73 (3.8) |
| Ireland | s 60 (4.0) | s 81 (3.4) | s 77 (4.2) | s 70 (4.0) | s 31 (4.5) | s 75 (3.9) |
| <i>Israel</i> | r 85 (6.9) | s 74 (8.9) | r 82 (7.2) | s 78 (5.8) | r 59 (8.6) | r 91 (4.9) |
| Japan | 79 (3.6) | 68 (4.3) | 64 (4.5) | 15 (2.9) | 16 (3.0) | 54 (4.4) |
| Korea | 44 (4.1) | 34 (3.9) | 50 (4.0) | 6 (1.8) | 4 (1.6) | 41 (3.9) |
| <i>Kuwait</i> | r 83 (6.7) | r 69 (7.6) | r 76 (6.2) | r 47 (8.3) | r 76 (6.7) | r 83 (6.3) |
| Latvia (LSS) | s 93 (1.4) | s 91 (1.5) | s 92 (1.7) | s 22 (1.8) | s 47 (2.4) | s 91 (1.7) |
| Lithuania | r 80 (1.9) | r 55 (2.5) | r 56 (2.9) | r 42 (2.5) | r 35 (2.6) | r 73 (2.5) |
| <i>Netherlands</i> | r 91 (2.1) | r 57 (4.2) | r 42 (3.6) | r 55 (3.5) | r 58 (3.6) | r 42 (3.7) |
| New Zealand | 91 (2.4) | 83 (3.3) | 59 (4.1) | 84 (2.9) | 21 (3.0) | 58 (3.7) |
| Norway | s 70 (4.9) | s 63 (5.2) | s 24 (4.3) | s 15 (3.2) | s 15 (3.2) | s 61 (5.1) |
| Portugal | 92 (1.9) | 87 (1.9) | 97 (1.1) | 63 (3.3) | 37 (3.0) | 89 (1.9) |
| <i>Romania</i> | 97 (0.8) | 86 (1.9) | r 90 (1.3) | 70 (2.3) | 75 (2.2) | 90 (1.6) |
| Russian Federation | 94 (1.5) | 81 (2.4) | 95 (1.2) | 29 (2.6) | 77 (2.5) | 95 (1.4) |
| <i>Scotland</i> | - - | - - | - - | - - | - - | - - |
| Singapore | 76 (4.1) | 88 (3.2) | 82 (3.7) | 33 (4.2) | 31 (4.3) | 73 (4.2) |
| Slovak Republic | r 80 (4.4) | r 85 (3.5) | r 83 (3.7) | r 63 (4.9) | r 13 (2.9) | r 76 (4.0) |
| <i>Slovenia</i> | r 66 (3.2) | r 95 (1.4) | r 87 (2.4) | r 61 (3.3) | r 30 (2.8) | r 83 (2.7) |
| Spain | r 95 (1.9) | r 89 (3.0) | r 92 (2.6) | r 91 (2.6) | r 64 (4.1) | r 90 (3.1) |
| Sweden | x x | x x | x x | x x | x x | x x |
| Switzerland | s 79 (4.4) | s 85 (3.8) | s 71 (4.5) | s 32 (4.8) | s 18 (4.0) | s 69 (5.1) |
| <i>Thailand</i> | r 73 (5.1) | r 84 (4.7) | r 86 (4.8) | r 47 (6.1) | r 76 (4.3) | r 88 (4.4) |
| United States | x x | x x | x x | x x | x x | x x |

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.23**Students' Reports on Frequency of Having a Quiz or Test in Their Science Lessons¹ - Upper Grade (Eighth Grade*)**

| Country | Percent of Students Responding Pretty Often or Almost Always | | | | |
|----------------------------------|--|-----------------------|-----------|---------------|------------|
| | Science (Integrated) | Science Subject Areas | | | |
| | | Biology | Chemistry | Earth Science | Physics |
| <i>Australia</i> | 44 (1.2) | . . | . . | . . | . . |
| <i>Austria</i> | 75 (1.5) | . . | . . | . . | . . |
| Belgium (Fl) | . . | 71 (2.0) | . . | 68 (1.8) | x x |
| ² Belgium (Fr) | x x | x x | . . | . . | x x |
| Canada | 60 (1.4) | . . | . . | . . | . . |
| <i>Colombia</i> | 75 (1.9) | . . | . . | . . | . . |
| Cyprus | 78 (1.1) | . . | . . | . . | . . |
| Czech Republic | . . | 32 (2.3) | 37 (2.1) | 30 (1.7) | 34 (1.8) |
| ³ <i>Denmark</i> | . . | 27 (1.9) | . . | r 32 (1.6) | 48 (1.9) |
| England | 54 (2.0) | . . | . . | . . | . . |
| ⁴ France | . . | 67 (1.7) | . . | . . | 83 (1.4) |
| <i>Germany</i> | . . | 57 (2.2) | x x | . . | 50 (2.1) |
| <i>Greece</i> | . . | . . | 57 (1.3) | 51 (1.2) | 56 (1.2) |
| Hong Kong | 62 (2.6) | . . | . . | . . | . . |
| Hungary | . . | 21 (1.4) | 25 (1.3) | 19 (1.1) | 24 (1.3) |
| Iceland | . . | 16 (2.5) | x x | x x | x x |
| Iran, Islamic Rep. | 66 (1.4) | . . | . . | . . | . . |
| Ireland | 50 (1.5) | . . | . . | . . | . . |
| <i>Israel</i> | 47 (2.9) | . . | . . | . . | . . |
| Japan | 32 (2.2) | . . | . . | . . | . . |
| Korea | 22 (1.3) | . . | . . | . . | . . |
| <i>Kuwait</i> | 66 (1.9) | . . | . . | . . | . . |
| Latvia (LSS) | . . | 26 (1.5) | 20 (1.1) | . . | 16 (1.1) |
| Lithuania | . . | 55 (2.2) | 67 (1.6) | 50 (2.2) | 69 (1.4) |
| ⁵ <i>Netherlands</i> | . . | r 54 (2.7) | . . | 50 (2.5) | 45 (1.9) |
| New Zealand | 49 (1.7) | . . | . . | . . | . . |
| Norway | 45 (1.7) | . . | . . | . . | . . |
| ⁶ Portugal | . . | 57 (1.4) | . . | . . | 53 (1.3) |
| <i>Romania</i> | . . | 73 (1.3) | 76 (1.2) | 73 (1.4) | 75 (1.1) |
| Russian Federation | . . | 57 (2.1) | 73 (1.4) | 57 (1.1) | 74 (1.0) |
| Scotland | 46 (1.4) | . . | . . | . . | . . |
| Singapore | 74 (1.4) | . . | . . | . . | . . |
| Slovak Republic | . . | 30 (1.8) | 48 (2.3) | 29 (2.1) | 38 (1.6) |
| <i>Slovenia</i> | . . | 44 (1.9) | 52 (1.9) | . . | 53 (1.9) |
| Spain | 75 (1.4) | . . | . . | . . | . . |
| Sweden | . . | 60 (1.9) | x x | r 66 (1.5) | r 63 (2.0) |
| Switzerland | 49 (1.4) | . . | . . | . . | . . |
| <i>Thailand</i> | 62 (1.5) | . . | . . | . . | . . |
| United States | 77 (1.4) | . . | . . | . . | . . |

¹Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

²Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.

³Physics data for Denmark are for students taking physics/chemistry classes.

⁴Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.

⁵Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

⁶Biology data for Portugal are for students taking natural science classes; physics data are for students taking physical science classes.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates a 70-84% student response rate. An "x" indicates a <50% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.