NATIONAL CENTER FOR EDUCATION STATISTICS
Statistical Analysis Report December 2001

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OFFICE OF EDUCATIONAL RESEARCH AND IMPROVEMENT
U.S. DEPARTMENT OF EDUCATION
NCES 2002–115

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USA

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COMMISSIONER'S STATEMENT

The Program for International Student Assessment is a new international assessment of 15-year-olds in reading, mathematics, and science literacy. We know that assessments serve many different purposes. At the classroom level, assessments help teachers determine how individual students are doing and what topics may need additional instruction. At the state and national level, they help administrators understand overall patterns of student performance within states and across the nation. Similarly, at the international level, assessments like PISA help policymakers, researchers, and the public understand how the performance of their students compares to that of peers in other countries.

NCES has long participated in both national and international assessments in order to fulfill its mission of reporting on the "condition of education in the United States and other nations." PISA adds another facet to NCES' collection of information. The United States joined with 27 other member countries of the Organization for Economic Cooperation and Development (OECD) and 4 non-OECD countries to assess their students' performance against international benchmarks through PISA. This OECD-sponsored assessment will provide for a regular cycle of information to compare trends over time and across nations.

PISA is built on a different framework from other national and international studies. It aims to advance understanding of how well equipped young people are for their future lives, by emphasizing items that have a real-world context. PISA content is not drawn strictly from school curricula, but rather from a framework agreed to internationally on what reading, mathematics, and science literacy mean.

Consider the possible experiences of 15-year-olds who took the PISA assessment in the United States in the year 2000. Most of them will have been in school for more than 10 years. Some will have attended public school, some private school. Some will have come from literacy rich home environments. Some will have taken advanced courses, some will have gone on field trips, and some will have used computers in their classrooms. In addition to school, some will have attended camp, had summer or part-time jobs, cared for younger siblings, or participated in sports teams, competitions, or any number of other kinds of activities. All of these experiences may be associated with their performance on PISA. The title of this report, *Outcomes of Learning*, reflects PISA's emphasis on describing performance based on the school and non-school learning experiences 15-year-olds may have had.

The results presented in this report represent only the first cycle of PISA. After 2000, PISA's results are scheduled to be available every 3 years, so that progress for each of the three subjects can be tracked over time. Future cycles of PISA will also further address new areas of assessment, such as problem solving and the use of information and communications technologies.

We here at NCES hope that the information in this report, and what will be available from future phases of PISA, will be of use to all readers—those from the education community, the business community, and the general public—who have an interest in understanding the performance of America's 15-year-olds in reading, mathematics, and science literacy.

Gary W. Phillips

Gary W. Phillips December 2001
Deputy Commissioner

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PISA IN BRIEF

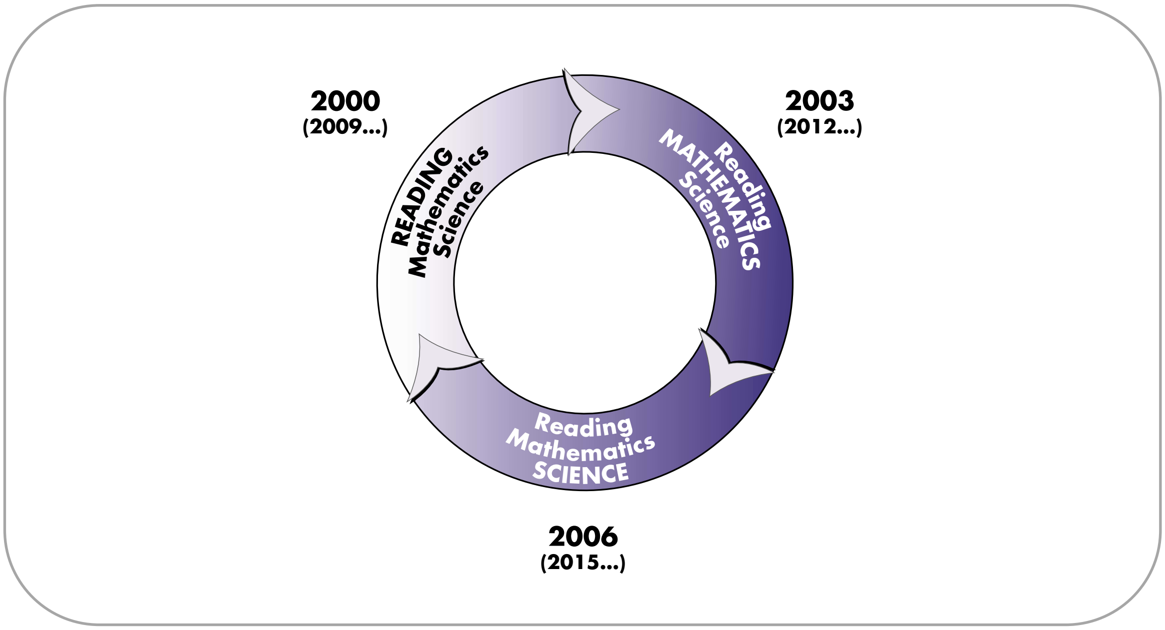
The Program for International Student Assessment (PISA) is a new system of international assessments that focus on 15-year-olds' capabilities in reading literacy, mathematics literacy, and science literacy. PISA also measures general or cross-curricular competencies such as learning strategies.

PISA will be implemented on a 3-year cycle that began in 2000. Each PISA assessment cycle focuses on one particular subject, although all three are assessed in each cycle. In this first cycle, PISA 2000, reading literacy is the major focus, occupying roughly two-thirds of assessment time. In 2003, PISA will focus on mathematics literacy, and in 2006, on science literacy (figure 1).

PISA will report on performance in reading literacy, mathematics literacy, and science literacy every 3 years, and provide a more detailed look at each domain in the years when it is the major focus. For instance, this report will provide average scores for specific reading processes such as retrieving information, interpreting texts, and reflecting on texts, as well as a combined reading literacy average score. Only single measures of mathematics and science literacy are available in PISA 2000, with more specific information to be provided for these domains in subsequent cycles. These cycles will allow countries to compare changes in trends for each of the three content areas over time. Future cycles will also include further development of the assessment of cross-curricular competencies, such as problem solving in 2003 and use of information and communications technology in 2006.

PISA is sponsored by the Organization for Economic Cooperation and Development (OECD), an intergovernmental organization of 30 industrialized nations that serves as a forum for member countries to cooperate in research and policy development on social and economic topics of common interest. PISA is a collaborative venture, with representatives from

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



NOTE: The subject in all capital letters in each assessment cycle is the major domain for that cycle.

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

Figure 2.—Participating countries in the Program for International Student Assessment (PISA) 2000

OECD countries

- Australia
- Austria
- Belgium
- Canada
- Czech Republic
- Denmark
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland
- Ireland
- Italy
- Japan
- Korea, Republic of
- Luxembourg
- Mexico
- Netherlands
- New Zealand
- Norway
- Poland
- Portugal
- Spain
- Sweden
- Switzerland
- United Kingdom
- United States

Non-OECD countries

- Brazil
- Latvia
- Liechtenstein
- Russian Federation

NOTE: Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed in this report. For information on the results for the Netherlands, see OECD (2001).

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

member country governments jointly steering the project through a Board of Participating Countries. At the international level, the Australian Council for Educational Research (ACER) leads a consortium that coordinates PISA under direction from the OECD.[1] In the United States, the National Center for Education Statistics (NCES) is responsible for U.S. data collection and represents the United States in the international management of the assessment. Westat, a private research firm, handled data collection in the United States for PISA 2000 under contract to NCES.

In 2000, 32 countries participated in PISA, including 28 OECD countries and 4 non-OECD countries (figure 2).[2]

To implement PISA 2000, each participating country selected a nationally representative sample of 15-year-olds. In the United States, this included nearly 4,000 students from both public

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[1] Other members of the PISA Consortium include the Netherlands National Institute for Educational Measurement (CITO), Educational Testing Service (ETS, USA), the National Institute for Educational Research (NIER, Japan), and Westat (USA).

[2] Another 12 countries will carry out a second round of the PISA 2000 assessment in 2002.

and nonpublic schools (table A1.1) from several different grade levels.[3] Appendix 1, Technical Notes, contains more information about sampling and other aspects of PISA 2000's design. Each selected student completed an approximately 90-minute assessment and a 20- to 30-minute questionnaire designed to gather information about his or her background and experiences related to reading, mathematics, and science literacy. Principals in schools where students took the PISA assessment also completed a background questionnaire about their schools. PISA 2000 consisted of a mix of multiple choice, short answer, and extended response questions. Assessments were conducted in the United States in the spring of 2000 by trained test administration field staff that visited each of the participating schools and administered both the assessments and the questionnaires.

PISA's Yield Measure of Learning

PISA's purpose is to represent the overall *yield* of learning for 15-year-olds. This yield is the sum of learning outcomes for 15-year-olds in reading, mathematics, and science literacy and is represented by national averages of student scores. PISA assesses the cumulative educational experiences of all students who are 15 years of age at the time of assessment, irrespective of the grade levels or type of institutions in which they are enrolled. PISA assumes that by the age of 15, young people have had a series of learning experiences, both in and out of school, that allow them to perform at particular levels in reading, mathematics, and science literacy. Clearly, formal education will have played a major role in their performance, but other factors, such as learning opportunities at home or elsewhere outside of school, also play a role. PISA's results provide a valuable indicator of the overall performance of a country's education system, but they also provide information about other factors that influence performance.

By assessing students near the end of compulsory schooling in key knowledge and skills, PISA provides information about how well prepared students will be for their future lives as they approach an important transition point for education and work. PISA is forward rather than backward looking in this sense, since it aims to show how equipped 15-year-olds are for their futures based on what they have learned up to that point.

The Unique Contribution of PISA

PISA grew out of OECD efforts to develop comparable measures of learning outcomes for policy use. By creating PISA, OECD member countries sought to develop a regular cycle of data collection in key areas. These data will provide information at the national and international level about how well countries are meeting their educational objectives. The OECD will use the data to produce indicators of educational systems, which provide a "quantitative description of the functioning of education systems that allows countries to see themselves in the light of other countries' performance" (OECD 1998, p.5).

A number of international comparative studies already exist to measure achievement in mathematics, science, and reading, including the Trends in International Mathematics and Science Study (TIMSS) and the Progress in International Reading Literacy Study (PIRLS). The Adult Literacy and Lifeskills survey (ALL) will measure the reading literacy skills of adults. In addition, the United States has been conducting its own national surveys of student achievement for more than 30 years through the National Assessment of Educational Progress (NAEP) program.

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[3] For information on distributions of students by grade in participating countries, see table A1.2, appendix 1.

Appendix 2 gives an overview of international studies in reading, mathematics, and science (tables A2.1, A2.2, and A.2.3). PISA differs from these studies in several ways.

- ***Content.*** While other studies, such as TIMSS and NAEP, have a strong link to curriculum frameworks and seek to measure students' mastery of specific knowledge, skills, and concepts, PISA is designed to measure "literacy" more broadly. PISA's content is drawn from broad content areas, such as space and shape for mathematics, in contrast to more specific curriculum-based content such as geometry or algebra.

- ***Tasks.*** In addition to the differences in purpose and age coverage between PISA and other international comparative studies, what students are asked to do on PISA tasks is also somewhat different. A study based on expert panels' reviews of mathematics and science items from PISA, TIMSS, and NAEP reports that PISA items require multistep reasoning more often than either TIMSS or NAEP (Nohara 2001). The study also shows that both PISA mathematics and science literacy items often involve the interpretation of charts and graphs or other "real world" material. The unique contribution of PISA lies in its focus on assessing students' knowledge and skills in reading, mathematics, and science in the context of everyday situations. These tasks reflect the underlying assumption of PISA: as 15-year-olds begin to make the transition to adult life, they need to know not only how to read, or understand particular mathematical formulas or scientific concepts, but also how to apply this knowledge and these skills in the many different situations they will encounter in their lives.

- ***Age-Based Sample.*** PISA collects information from an age-based sample, rather than a grade-based sample. Schools identify students who are 15 years of age, regardless of what grade they are in. In contrast, PIRLS, for example, collects reading literacy data for fourth-grade students, TIMSS 1999 collected mathematics and science data for eighth-grade students, and NAEP (main) collects data at various grade levels.[4] PISA uses an age-based sample for several reasons. First, PISA's goal is to represent outcomes of learning rather than outcomes of schooling. By placing the emphasis on age, PISA intends to show not only what 15-year-olds have learned in school, but outside of school as well and over the years, not just in a particular grade. In addition, years of education vary among countries (for example, 10th grade in the United States may not correspond to a similar educational level in other countries). Choosing an age-based sample makes comparisons across countries somewhat easier. One other international study does collect an age-based sample. The Adult Literacy and Lifeskills survey (ALL) will collect reading literacy data for adults aged 16 to 65. Although the ALL measures of reading literacy are slightly different than those for PISA, there will be efforts to link the performance of 15-year-olds to that of adults through a common set of items in order to examine the relationship of literacy to the labor market and other facets of adult life.

- ***Age Level.*** Since PISA seeks to show the overall yield of an educational system and the cumulative effects of all learning experiences, the age of 15 was chosen to represent a point in time at which these broad learning outcomes could be measured while all students were still required to be in school. The grade levels covered in other international assessments correspond roughly to the ages of 9, 13, and 17.

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[4] TIMSS does use some age criteria, but the sample of students is drawn from one grade rather than across grades as in PISA. For example, TIMSS 1999 required participating countries to assess students in the upper of the two grades with the largest proportion of 13-year-olds.

- ***Information Collected.*** The kind of information PISA collects also reflects its broad policy purpose. For example, in contrast to PISA, TIMSS collects background information intended to help provide an understanding of how teachers in different countries approach the task of teaching and provide insight into what effects these different approaches might have on student performance. The TIMSS video studies extend this work even further by actually capturing images of instruction across countries. PISA, on the other hand, collects only background information related to general school context and student demographics. No teacher questionnaires are included in this cycle of PISA. While its results can certainly inform education policy and spur further investigation into differences within and between countries, PISA is not meant to provide direct information about improving education in the classroom. Its purpose is to generate useful indicators to benchmark performance and inform policy.

The United States has been actively involved in the development of PISA since its inception, believing that PISA's differences from other studies allow it to complement the picture of U.S. performance obtained from other studies and provide a new perspective on U.S. education in an international context.

REPORT SUMMARY AND ORGANIZATION

This report focuses on U.S. results for PISA 2000. The OECD is also releasing a report discussing PISA 2000 results, but from an international perspective. The OECD report is being released at the same time as this U.S. national report, providing a wealth of information on PISA 2000.

The following chapters describe in detail PISA's definitions for reading literacy, mathematics literacy, and science literacy and U.S. performance on each of these measures. Chapter two discusses reading literacy and chapter three describes mathematics and science literacy. In addition to a discussion of national averages, chapters two and three take a closer look at the distributions of literacy across countries, including percentages of 15-year-olds meeting international benchmarks. Each of these chapters also describes sample PISA 2000 items, and discusses U.S. and international performance on selected items.

Chapter four describes differences in performance as they relate to demographic characteristics such as gender, race and ethnicity, parents' education, and others. Chapter five briefly discusses some examples of the general or cross-curricular competencies that will take on a growing role in PISA in future cycles, including attitudes toward learning and learning strategies such as memorization and elaboration. Finally, appendices provide technical information on how PISA 2000 was conducted, supporting statistical detail for the figures in the text, an overview of how PISA compares to other international studies, and a set of released sample PISA 2000 items for reading, mathematics, and science literacy.

Chapter

2 READING LITERACY

Key Findings

- On the combined reading literacy scale for PISA 2000, U.S. 15-year-olds perform about as well on average as 15-year-olds in most of the 27 participating OECD countries. Students in Canada, Finland, and New Zealand outperform U.S. students. U.S. students perform at the same level as students in 19 other participating OECD countries and Liechtenstein. U.S. students perform better on average than students from the OECD nations of Greece, Luxembourg, Mexico, and Portugal (figure 3; table A3.1).

- For each of the three specific reading process subscales, *retrieving information, interpreting texts,* and *reflecting on texts,* U.S. scores are not different from the OECD averages. Canada and Finland outscore the United States on each of the three reading process subscales, and the United States outscores at least seven other nations on each measure (figure 3; table A3.1).

- Fifteen countries, or about half of the countries participating in PISA 2000, show less variation in student performance than the United States. The remaining countries show similar variation in student performance to the United States, and U.S. variation is similar to the OECD average (table A3.3).

- The top 10 percent of OECD students score 623 or higher on the combined reading literacy scale. In the United States, 13 percent of students achieve this score or better, a percentage not different from the OECD top 10 percent benchmark. Three countries (Canada, Finland, and New Zealand) have a higher percentage of students score in the top 10 percent, while 14 countries have a lower percentage (figure 5; table A3.4).

- Percentages of U.S. students across the literacy levels are similar to the OECD average percentages, except at level 5. In the United States, 12 percent of 15-year-olds read at level 5, the highest proficiency level, a percentage higher than the OECD average. Level 1 encompasses 12 percent of students, and 6 percent of U.S. 15-year-olds are below level 1 (figure 8; table A3.5).

- Looking at the cumulative percentages of students from level to level, about one-third of U.S. students perform at the two highest levels, level 4 and level 5. In Finland, about half of the students perform at levels 4 and 5, and in Brazil, 4 percent of students do. About 60 percent of students in the United States perform at level 3 or above, and over 80 percent at level 2 or above. Finland, with the highest average combined reading literacy score, has 79 percent of students at level 3 or above, and 93 percent of students at level 2 or above (table A3.5).

Reading literacy is key in an information-abundant world. PISA builds upon the work of previous U.S. national and international studies in defining and reporting on reading literacy. This chapter describes the definition and reporting scales for reading literacy in PISA 2000, in which reading literacy is the major subject covered, and provides information on U.S. performance in an international context. Beginning with a description of national average scores, the discussion then turns to distributions of high-performing students, then to overall distributions of student scores, and finally to groups of students with particular sets of skills.

DEFINING READING LITERACY

PISA defines reading literacy as:

> ***Understanding, using, and reflecting on written texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society*** (OECD 1999, p.20).

Since PISA measures the achievement of 15-year-olds, it does not focus on the most basic reading skills. Instead, PISA seeks to measure the extent to which students can "construct, extend, and reflect on the meaning of what they have read" across a wide variety of texts associated with a wide variety of situations. PISA reading literacy tasks were constructed within three main dimensions. Mathematics and science literacy items fall within similar dimensions, as will be seen in the following chapter. The dimensions for the reading literacy tasks are:

- ***Content or Structure***—refers to types of text, such as *continuous* and *noncontinuous texts*. Continuous texts are prose texts that are largely composed of sentences organized into paragraphs. Noncontinuous texts are those that are often organized as lists or charts (sometimes referred to as documents).

- ***Processes***—consists of the kinds of processes used when reading a text, including *retrieving information, understanding texts at a general level, interpreting texts, reflecting on content of texts,* and *reflecting on form of texts.*

- ***Situations***—distinguishes the use for which texts were constructed or the context in which knowledge and skills are applied, such as *private use, public use, occupational use,* or *educational use*. For example, private use refers to novels or personal letters, public use refers to official documents or announcements, occupational use refers to manuals or reports, and educational use refers to textbooks or worksheets.

In short, PISA measures how well 15-year-olds are able to apply different reading processes to a wide range of reading materials, such as the kinds of forms they receive from their governments, the kinds of articles they read in their local newspapers, the kinds of manuals they read for work or school, or the kinds of books or magazines they read for entertainment.

The basic form of the assessment reflects this range of materials and processes. Each reading literacy assessment unit consists of a passage of text, followed by a number of questions, some with a multiple-choice format and others requiring students to construct their own answers. Examples of reading assessment items are described later in this chapter and can be found in appendix 4.

SPECIFIC SKILL AREAS IN READING LITERACY

PISA 2000 provides information on three specific reading skill areas derived from the processes described above for gaining meaning from a text, *retrieving information, interpreting texts,* and *reflecting on texts.*

Retrieving information—the ability to locate one or more pieces of information in a text. All tasks require locating information in the text. The difficulty of any task is determined by how much information needs to be accessed, how explicitly it is signaled in the text, and whether the required pieces of information are interrelated or independent.

Interpreting texts—the ability to construct meaning and draw inferences from one or more parts of a text. The easiest tasks require identifying a main idea in the text. More difficult tasks require understanding relationships within the text that are an inherent part of its organization and meaning — that is, understanding how language is being used to convey meaning in context and comparing, contrasting, and/or categorizing ideas.

Reflecting on texts—the ability to relate a text to one's own experience, knowledge, and ideas. The easiest tasks require making a basic connection between the text and what the reader already knows. More difficult tasks involve comparisons between and/or a synthesis of information from the two sources.

Specific information on reading literacy proficiency could also be derived from the contents/structures or situations described above, as has been done in previous large-scale studies, including the International Association for the Evaluation of Educational Achievement (IEA) Reading Literacy Study (which describes literacy performance for narratives, exposition, and documents) and in the International Adult Literacy Study (which describes literacy performance for prose and documents). However, the emphasis on reading processes reflects the policy objectives of PISA most closely, and it is hoped that the development of three reading literacy process scales for PISA 2000 will provide a unique insight into the understanding of reading literacy. The three process subscales are based on the set of five processes described above *(retrieving information, understanding texts at a general level, interpreting texts, reflecting on content of texts*, and *reflecting on form of texts). Understanding texts at a general level* and *interpreting texts* are grouped together because both require a reader to process information from either the whole text or one part of the text. *Reflecting on content of texts* and *reflecting on form of texts* are grouped into a single scale because the distinction between reflecting on form and reflecting on content, in practice, was found to be difficult to make. In addition, the amount of information available made reporting on three reading literacy subscales more feasible than five.

It should be noted that there is overlap between the three subscales that are presented here: in practice, most tasks make a number of different demands upon readers, and individual readers may approach a task in different ways. Despite the interdependence of the three subscales, they may reveal interesting and useful distinctions both between countries and within countries.[5] Average scores are reported for each of these three reading process subscales. Together, these three subscale scores make up the combined reading literacy score.

READING LITERACY IN PISA COUNTRIES

Perhaps the simplest and most concise way to look at a country's yield in reading literacy is to examine its national average score. Performance for 15-year-olds on PISA 2000 is reported as a score ranging from 0 to 1,000, with most scores falling between 200 and 800. The scale is constructed so that the average score for students from all OECD countries is 500.[6] Because of the statistical techniques used to sample students,

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[5] The discussion in this section draws directly from Organization for Economic Cooperation and Development. (2001, April 18–20). *Described Proficiency Scales for PISA 2000*. Discussion document presented at the PISA Board of Participating Countries meeting, Paris, France.

[6] The average score for student performance on each scale (combined reading literacy scale, mathematics literacy scale, science literacy) is set at 500 and the standard deviation at 100, with the scale calibrated with equal weightings to results in each country. Since the calibration was performed on the combined reading literacy scale, average scores for the three reading process subscales differ slightly from 500, as shown in figure 3.

simply ranking countries based on their average score is not accurate.[7] In figure 3, the shading identifies countries whose averages are higher, lower, or not different from that of the United States on the combined reading literacy scale, and for each of the three reading process subscales.[8] Non-OECD countries are shown at the bottom of the figure with shading to indicate differences from the United States; however, non-OECD countries are not included in determining the OECD average.

On the combined reading literacy scale, U.S. 15-year-olds perform about as well on average as 15-year-olds in most OECD countries. U.S. students perform better than students in the OECD countries Greece, Luxembourg, Mexico, and Portugal, and the non-OECD nations Brazil, Latvia, and the Russian Federation. Students in Canada, Finland, and New Zealand outperform U.S. students. U.S. students perform at about the same level as the other 19 participating OECD countries and Liechtenstein (figure 3; table A3.1). This finding is generally consistent with previous findings of the reading capabilities of U.S. students from a 1991 international study of reading literacy that placed U.S. 14-year-olds at levels similar to other OECD nations, and in which Finland outscored the United States (Elley 1992).

In each of the three reading process subscales, U.S. scores are not different from the OECD average. Canada and Finland outscore the United States on each of the three reading subscales, and the United States outscores at least seven other nations on each subscale (figure 3; table A3.1).

More countries outperform the United States in *retrieving information* (five countries) than in *interpreting texts* (two countries) or *reflecting on texts* (four countries). Australia and Korea, for instance, perform better than the United States in *retrieving information*, but not differently for *interpreting texts* or *reflecting on texts*.

There are clear consistencies across the three reading process subscales of *retrieving information*, *interpreting texts*, and *reflecting on texts*, which carry through to the *combined reading literacy* score. Nations with high scores in one area tend to have high scores in the others, and the correlations between the combined reading literacy scale and the specific reading subscales are high (table A3.2).

THE DISTRIBUTION OF READING LITERACY

National Percentiles

The average scores for reading literacy describe how a country performs overall compared to other nations, but they provide no information about the way scores are distributed in countries. One country with an average score similar to another could have large numbers of high- and low-scoring students, while the other country could have large numbers of students performing at about the average score. This section will discuss how distributions of scores for the combined reading literacy scale compare to one another, in order to begin to understand the variability of performance in a country as well as its average performance.

Comparing the U.S. average score to corresponding cut points in other countries provides a means to examine the variation in scoring. This can be seen graphically in figure 4, in which the 25th percentile in Finland and the 75th percentile score in Mexico correspond to approximately the U.S. average score. This

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[7] Average scores for each country are based on a sample of students, rather than all students, and are estimates of the population value of all 15-year-olds in each country. These estimates have a known degree of sampling error, the standard error, and an unknown degree of nonsampling error. The true average for any country lies within a range of approximately two times the standard error above and below the estimated score. See tables in appendix 3 for standard errors.

[8] Throughout this report, differences between averages or percentages that are statistically significant are described as "higher" or "lower." Differences that are not statistically significant are referred to as "similar to" or "not different from" each other. To determine whether differences reported are statistically significant, two-tailed t-tests at the .05 level were used. Bonferroni adjustments were made when more than two groups were compared simultaneously. See appendix 1 for more information on statistical procedures used for this report.

Figure 3.—Combined reading literacy average scores and average subscale scores of 15-year-olds, by country: 2000

		READING SUBSCALES					
Combined reading literacy score		**Retrieving information**		**Interpreting texts**		**Reflecting on texts**	
Country	Average	Country	Average	Country	Average	Country	Average
Finland	546	Finland	556	Finland	555	Canada	542
Canada	534	Australia	536	Canada	532	United Kingdom	539
New Zealand	529	New Zealand	535	Australia	527	Ireland	533
Australia	528	Canada	530	Ireland	526	Finland	533
Ireland	527	Korea, Republic of	530	New Zealand	526	Japan	530
Korea, Republic of	525	Japan	526	Korea, Republic of	525	New Zealand	529
United Kingdom	523	Ireland	524	Sweden	522	Australia	526
Japan	522	United Kingdom	523	Japan	518	Korea, Republic of	526
Sweden	516	Sweden	516	Iceland	514	Austria	512
Austria	507	France	515	United Kingdom	514	Sweden	510
Belgium	507	Belgium	515	Belgium	512	**United States**	507
Iceland	507	Norway	505	Austria	508	Norway	506
Norway	505	Austria	502	France	506	Spain	506
France	505	Iceland	500	Norway	505	Iceland	501
United States	504	**United States**	499	**United States**	505	Denmark	500
Denmark	497	Switzerland	498	Czech Republic	500	Belgium	497
Switzerland	494	Denmark	498	Switzerland	496	France	496
Spain	493	Italy	488	Denmark	494	Greece	495
Czech Republic	492	Spain	483	Spain	491	Switzerland	488
Italy	487	Germany	483	Italy	489	Czech Republic	485
Germany	484	Czech Republic	481	Germany	488	Italy	483
Hungary	480	Hungary	478	Poland	482	Hungary	481
Poland	479	Poland	475	Hungary	480	Portugal	480
Greece	474	Portugal	455	Greece	475	Germany	478
Portugal	470	Greece	450	Portugal	473	Poland	477
Luxembourg	441	Luxembourg	433	Luxembourg	446	Mexico	446
Mexico	422	Mexico	402	Mexico	419	Luxembourg	442
OECD average	500	OECD average	498	OECD average	501	OECD average	502
Non-OECD countries		Non-OECD countries		Non-OECD countries		Non-OECD countries	
Liechtenstein	483	Liechtenstein	492	Liechtenstein	484	Liechtenstein	468
Russian Federation	462	Latvia	451	Russian Federation	468	Latvia	458
Latvia	458	Russian Federation	451	Latvia	459	Russian Federation	455
Brazil	396	Brazil	365	Brazil	400	Brazil	417

NOTE: Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

▨ Average is significantly higher than the U.S. average
☐ Average is not significantly different from the U.S. average
■ Average is significantly lower than the U.S. average

means that 75 percent of Finnish students perform above the U.S. average, but 25 percent of Mexican students do.

Another way of looking at variability is to consider the number of score points (the size of the difference) between groups of students within a country. In the United States, for example, the 5th percentile score for combined reading literacy is 320. Ninety-five percent of U.S. students score above 320; in the same way, 5 percent of U.S. students score above 669, the 95th percentile score. This means the top 5 percent of U.S. students score at least 350 points higher than the bottom 5 percent (table A3.3).

Looking at the length of the bars in figure 4 gives a sense of how large the differences are between a country's highest and lowest performing students, but it does not describe how many students are high or low performing. As with average scores, because of the statistical techniques used to sample students, it is not accurate to rank countries' scoring variation based simply on the length of the bars shown in figure 4. Standard deviations of the combined reading literacy average scores give a mathematical way to tell how greatly scores are spread out from the country's average score (data not shown, see table A.3.3). Fifteen countries, or about half of the countries participating in PISA 2000, show less variation in student performance than the United States. Fifteen countries show similar variation to the United States, and no country has greater variation. Some countries that perform better on average than the United States, such as Canada and Finland, show less variation. In contrast, some countries that perform better on average also show similar variation, such as New Zealand.

International Percentiles

Another way to analyze how performance is distributed in countries is to look at what proportion of students in each country meets international benchmarks, standards of performance that are applied across countries. The international benchmarks or standards of performance used in this case are the percentages of students from each country who score in the top 10 percent, top 25 percent, top 50 percent, or top 75 percent internationally (figure 5; table A3.4).[9] Examining the top 10 and top 25 percent benchmarks allows a comparison of proportions of high-performing students between countries.

The top 10 percent of OECD students score 623 or higher on the combined reading literacy scale. In the United States, 13 percent of students achieve this score or better, a percentage not different from the OECD top 10 percent benchmark. Three countries (Canada, Finland, New Zealand) have a higher percentage of students score in the top 10 percent, while 14 countries have a lower percentage. Ten of these 14 countries have 5 percent or less of their 15-year-olds score in the top 10 percent.

The top 25 percent of all students score 571 or better on the combined reading literacy scale. Twenty-seven percent of U.S. 15-year-olds meet this benchmark (figure 5, page 14). Four countries have higher percentages of 15-year-olds at this benchmark, and 10 have lower percentages. Canada, Finland and New Zealand again have higher percentages of students meeting this benchmark than the United States; in this case, Australia's percentage of students is also higher than the U.S. percentage. Again, the U.S. percentage is similar to the OECD average, suggesting that the United States has proportions of high-performing 15-year-olds similar to other OECD countries on average.

This section describes how proportions of U.S. high-performing students compare to proportions of similarly high-performing students from other countries. Results show that the United States has similar proportions of students performing at each international benchmark to the OECD average. The following section takes a more detailed approach to analyzing variation between countries in student performance, by dividing

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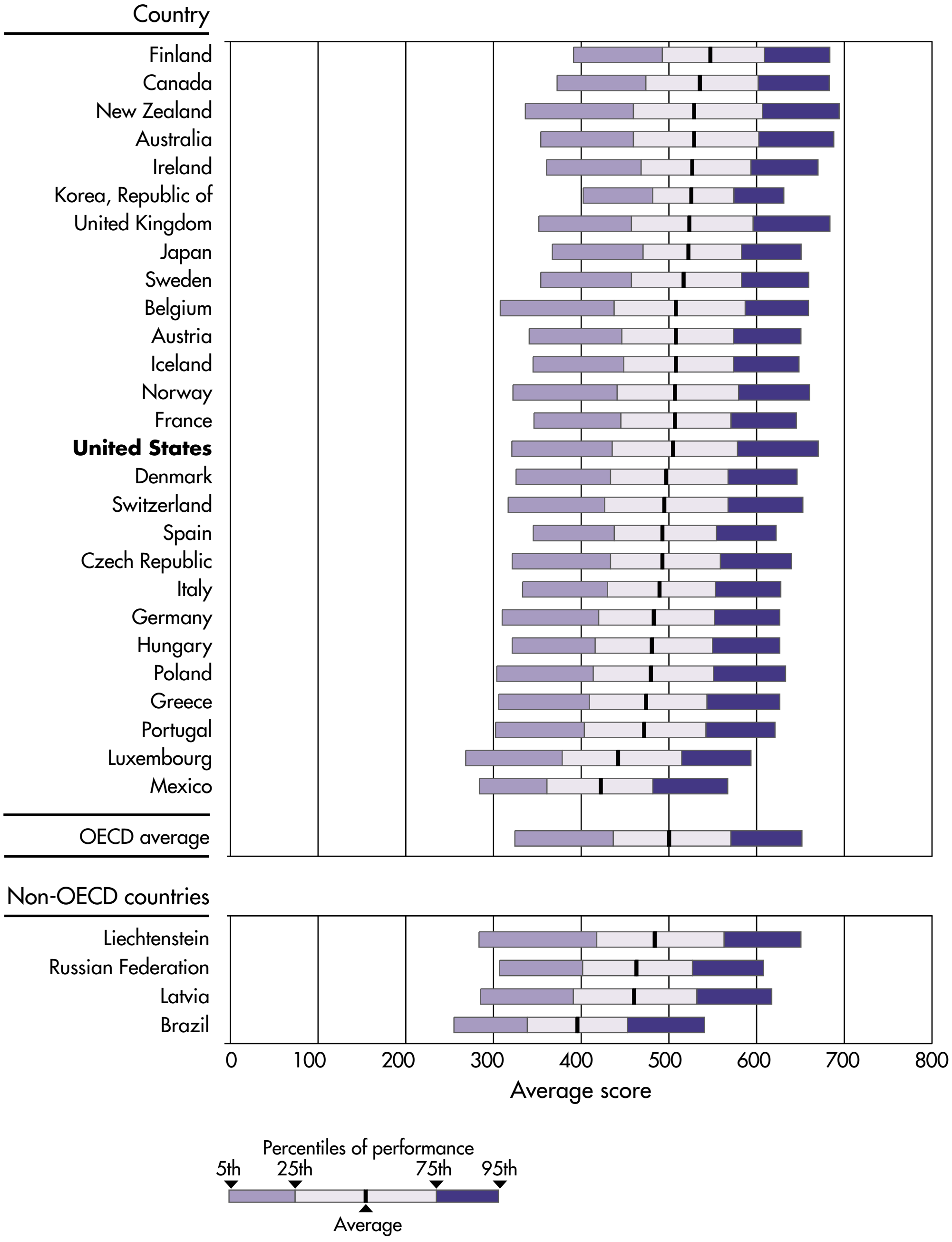
[9] To identify the score that separates the top 10 percent of students from the rest, the achievement results of 15-year-olds from all participating OECD countries are pooled. Differences in sample size between countries are adjusted so that all nations contribute equally to this pool. The 90th percentile of this distribution of scores is the cut point that identifies the top 10 percent benchmark.

Figure 4.—Distribution of combined reading literacy scores of 15-year-olds by percentiles, by country: 2000



NOTE: Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

Figure 5.—Percentage of 15-year-olds reaching the PISA top 10 percent and top 25 percent on the combined reading literacy scale, by country: 2000

Top 10 percent		Top 25 percent	
Country	Percent	Country	Percent
New Zealand	19	Finland	42
Finland	19	New Zealand	38
Australia	18	Canada	37
Canada*	18	Australia	36
United Kingdom	16	Ireland	34
Ireland	15	United Kingdom	33
United States	13	Belgium	31
Belgium	13	Japan	30
Sweden	12	Sweden	29
Norway	12	Norway	28
Japan	11	**United States**	27
Iceland	10	Korea, Republic of	26
Switzerland	10	Austria	26
Austria	9	Iceland	26
Germany	9	France	25
France	9	Switzerland	24
Denmark	9	Denmark	23
Czech Republic	7	Germany	23
Korea, Republic of	6	Czech Republic	20
Poland	6	Poland	19
Italy	6	Italy	18
Hungary	5	Spain	18
Greece	5	Hungary	17
Spain	5	Greece	16
Portugal	5	Portugal	15
Luxembourg	2	Luxembourg	9
Mexico	1	Mexico	4
Non-OECD countries		Non-OECD countries	
Liechtenstein	5	Liechtenstein	18
Latvia	4	Latvia	13
Russian Federation	3	Russian Federation	12
Brazil	1	Brazil	2

▨ Percentage is significantly higher than the U.S. percentage

□ Percentage is not significantly different from the U.S. percentage

■ Percentage is significantly lower than the U.S. percentage

*The shading of Canada in the top 10 percent category may appear incorrect; however, statistically, its placement is correct.

NOTE: Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001).

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

students into groups based on their performance on particular kinds of items.

Levels of Proficiency In Reading Literacy

Another way to describe performance in reading literacy is to examine the proportions of students who can accomplish tasks at particular levels. This kind of analysis allows a further breakdown of average scores and an examination of groups of students who show similar skills. In PISA, reading literacy is a continuum rather than a dichotomy—that is, reading literacy is not something you have or don't have, but rather every 15-year-old shows a certain level of literacy skills. PISA measures what students can do at each of five designated levels. This section provides information about PISA 2000 reading items and the percentages of U.S. 15-year-olds who perform at each level on PISA 2000 in comparison to their international peers.

In order to reach a particular level, a student must be able to answer correctly a majority of items at that level.[10] This implies that students can also correctly answer items below their identified level. Students were classified into reading levels according to their scores (figure 6).

A small number of students in each country have scores below the lowest of the defined levels, level 1; that is, they are not able to routinely demonstrate the most basic type of knowledge and skills that PISA seeks to measure. These students score below 335 points on the PISA 2000 scale. These students may have serious difficulties in reading or other learning problems, diverse language backgrounds, or they may be students who for some other reason cannot or do not successfully complete the minimum PISA 2000 items. These students are not included in the proportions for students at level 1, but are considered as below level 1 because PISA 2000's descriptions of levels cannot accurately predict what skills these students may have.

PISA 2000 defines five skill levels for the three reading processes *(retrieving information,*

Figure 6.—Cut point scores for combined reading literacy levels, by level: 2000

Level	Score*
Below 1	334 and below
1	335 - 407
2	408 - 480
3	481 - 552
4	553 - 625
5	626 and above

*Exact cut point scores are as follows: below level 1: a score equal to or less than 334.75; level 1: a score greater than 334.75 and equal to or below 407.47; level 2: a score greater than 407.47 and equal to or below 480.18; level 3: a score greater than 480.18 and equal to or below 552.89; level 4: a score greater than 552.89 and equal to or below 625.61; and level 5: a score greater than 625.61.

NOTE: The Program for International Student Assessment (PISA) uses five levels of performance to describe student performance. In order to reach a particular level, a student must be able to correctly answer a majority of items at that level. Students were classified into reading levels according to their scores.

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

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[10] Levels were defined such that students at the top of a level have a 62 percent chance of answering the hardest items in the level correctly and students at the bottom of the same level would have a 62 percent chance of answering the easiest items in that level correctly. For more information on the process for defining levels, see appendix 1, Technical Notes.

interpreting on texts, and *reflecting on texts)* and for a combined reading literacy measure. The kinds of tasks that represent each level of performance for the specific reading processes are described in figure 7.

Tasks for the combined reading literacy levels are defined by using elements from each of the specific reading process subscales. For example, the lowest level reading literacy tasks require students to locate single pieces of information with little or no competing information or draw simple inferences. The highest-level tasks require students to examine very complex texts, locate and organize multiple pieces of information, interpret language or apply unfamiliar categorization schemes, or evaluate and hypothesize about the information in the text.

As the figure illustrates, the level of the tasks for the *retrieving information* scale depends on how much information is requested, how clearly it is identified in the text, and whether or not the information stands alone or is embedded in the text. For example, given a short article about how good athletic shoes can help prevent injuries, students had to locate the answer to the question:

According to the article, why should sports shoes not be too rigid?

The answer is found at the beginning of a paragraph and uses the same wording as the question:

If a shoe is too rigid, it restricts movement.

To receive full credit, students had to write an answer that referred to a restriction of movement, either using exactly these words or others that convey this idea. This item was considered a level 1 *retrieving information* item. A more difficult level 4 *retrieving information* item requires students to read an excerpt from a play, and from stage directions and dialogue, determine where the two characters are located on stage. These original passages and others that illustrate both the different reading processes *(retrieving information, interpreting texts,* and *reflecting on texts)* and a variety of literacy levels are included in appendix 4. Other sample items may be viewed in the OECD initial PISA 2000 report *Knowledge and Skills for Life—First Results from the OECD Programme for International Student Assessment* or the OECD's Web Site for PISA, www.pisa.oecd.org, by clicking on the menu item "sample test items."

The easiest tasks in *interpreting texts* require identifying a main idea in a text. For example, a level 1 *interpreting* task using the same article about athletic shoes described above requires students to identify the author's intent from a multiple choice list. More difficult tasks for *interpreting texts* require understanding relationships within a text that are an inherent part of its organization and meaning. The most difficult tasks are of two kinds. The first requires an understanding of how language is being used to convey meaning in context, and the second requires comparing, contrasting, or categorizing ideas in the text. An example of a level 5 *interpreting* item is also shown in appendix 4, in which students must examine a tree diagram describing the labor force structure in a country, and then use information from the diagram and its footnotes to categorize examples of workers into the same structure.

For *reflecting on texts,* the easiest tasks require making a basic connection between the text and the reader's own knowledge. Again, using the athletic shoe article as an example, a level 1 *reflecting* item based on the article requires students to examine a sentence from the article. Using their own knowledge, students have to then choose a description of how the parts of the sentence relate to one another from a multiple choice list, as below:

Look at this sentence from near the end of the article. It is presented here in two parts:

(first part)	"To avoid minor but painful conditions such as blisters or even splits or athlete's foot (fungal infections),…"
(second part)	"…the shoe must allow evaporation of perspiration and must prevent outside dampness from getting in."

Figure 7.—Reading literacy subscale task descriptions, by level: 2000

	Retrieving information	Interpreting texts	Reflecting on texts
Level 1	Locate one or more independent pieces of explicitly stated information, typically meeting a single condition or criterion, with little or no competing information in the text.	Recognize the main theme or author's purpose in a text about a familiar topic, when the idea is prominent or pervasive, either by being repeated or by appearing early in the text.	Make a simple connection between information in the text and common, everyday knowledge, with explicit direction to consider relevant factors in the task and the text.
Level 2	Locate one or more pieces of information, which may need to be inferred, and may need to meet several conditions, with some competing information present in the text.	Recognize the main idea in a text when the information is not prominent. Understand relationships or construe meaning within a limited part of the text, making low level inferences. Make comparisons or contrasts based on only one feature of the text.	Make a comparison or several connections between the text and outside knowledge. Draw on personal experience and attitudes to explain a feature of the text.
Level 3	Locate and, in some cases, recognize the relationship between several pieces of information that must meet multiple conditions set by the question, with prominent competing information.	Integrate several parts of a text in order to identify a main idea, understand a relationship, or construe the meaning of a word or phrase. Take into account many features in comparing, contrasting or categorizing, where required information is not prominent.	Make connections, comparisons, and explanations, or evaluate a feature of the text. Demonstrate a fine understanding of the text in relation to familiar, everyday knowledge. Draw on less common knowledge. Infer factors to be considered.
Level 4	Locate and organize several pieces of embedded information, typically in a text whose content and form are unfamiliar.	Construe the meaning of nuances of language in a section of text by taking into account the text as a whole. Show understanding and apply categories in an unfamiliar context.	Critically evaluate a text or hypothesize about information in the text, using formal or public knowledge. Demonstrate an accurate understanding of long or complex texts.
Level 5	Locate and organize several pieces of information in unfamiliar contexts, where some information is deeply embedded and its relevance must be inferred from the text.	Demonstrate a full and detailed understanding of a text whose content or form is unfamiliar. Deal with concepts that are contrary to expectations.	Critically evaluate or hypothesize about the content of texts, drawing on specialized knowledge. Deal with concepts that are contrary to expectations.

NOTE: The Program for International Student Assessment (PISA) uses five levels of performance to describe student performance. In order to reach a particular level, a student must be able to correctly answer a majority of items at that level. Students were classified into reading levels according to their scores.

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

What is the relationship between the first and second parts of the sentence?

The second part

A. contradicts the first part.
B. repeats the first part.
C. illustrates the problem described in the first part.
D. gives the solution to the problem described in the first part.

More difficult tasks for *reflecting on texts* involve comparisons between something in the text and some element drawn from the reader's own experience, knowledge, or ideas. The most difficult tasks involve the synthesis of elements derived from both the text and outside knowledge. A level 4 *reflecting* task (shown in appendix 4) shows an information sheet on flu immunization. Students are then asked to describe why part of the text may be misleading, and must respond by critically evaluating the text in terms of potential contradictions or exaggerations.

Reading Literacy by Levels

The percentage of 15-year-olds at each level of reading literacy is shown in figure 8. In addition, figure 9 (page 20) shows the percentages of 15-year-olds at the highest and lowest levels of the combined reading literacy scale.

Overall, percentages of U.S. students across the levels are similar to the OECD average percentages, except at level 5. Twelve percent of U.S. 15-year-olds read at level 5, a percentage higher than the OECD average (table A3.5). Looking across the countries, the U.S. proportion of students at level 5 is greater than that in 14 countries and similar to that in 14 countries.

At level 4, the United States has 21 percent of students, compared to 3 percent in Brazil and 32 percent in Finland. Relative to U.S. 15-year-olds, five nations have higher percentages of their students reading at this level (Canada, Finland, Ireland, Japan, and Korea) and five nations have lower percentages of their 15-year-olds showing reading skills at level 4. Approximately one-quarter of U.S. students (27 percent) read at level 3, similar to the OECD average of 29 percent. Another 21 percent read at level 2, again similar to the OECD average percentage.

Twelve percent of 15-year-olds in the United States score at level 1, a percentage not different from that in 22 other nations or the OECD average. In other words, over two-thirds of all PISA 2000 participating countries have about the same percentages of students in level 1. Another 6 percent of 15-year-olds are below level 1 in the United States.

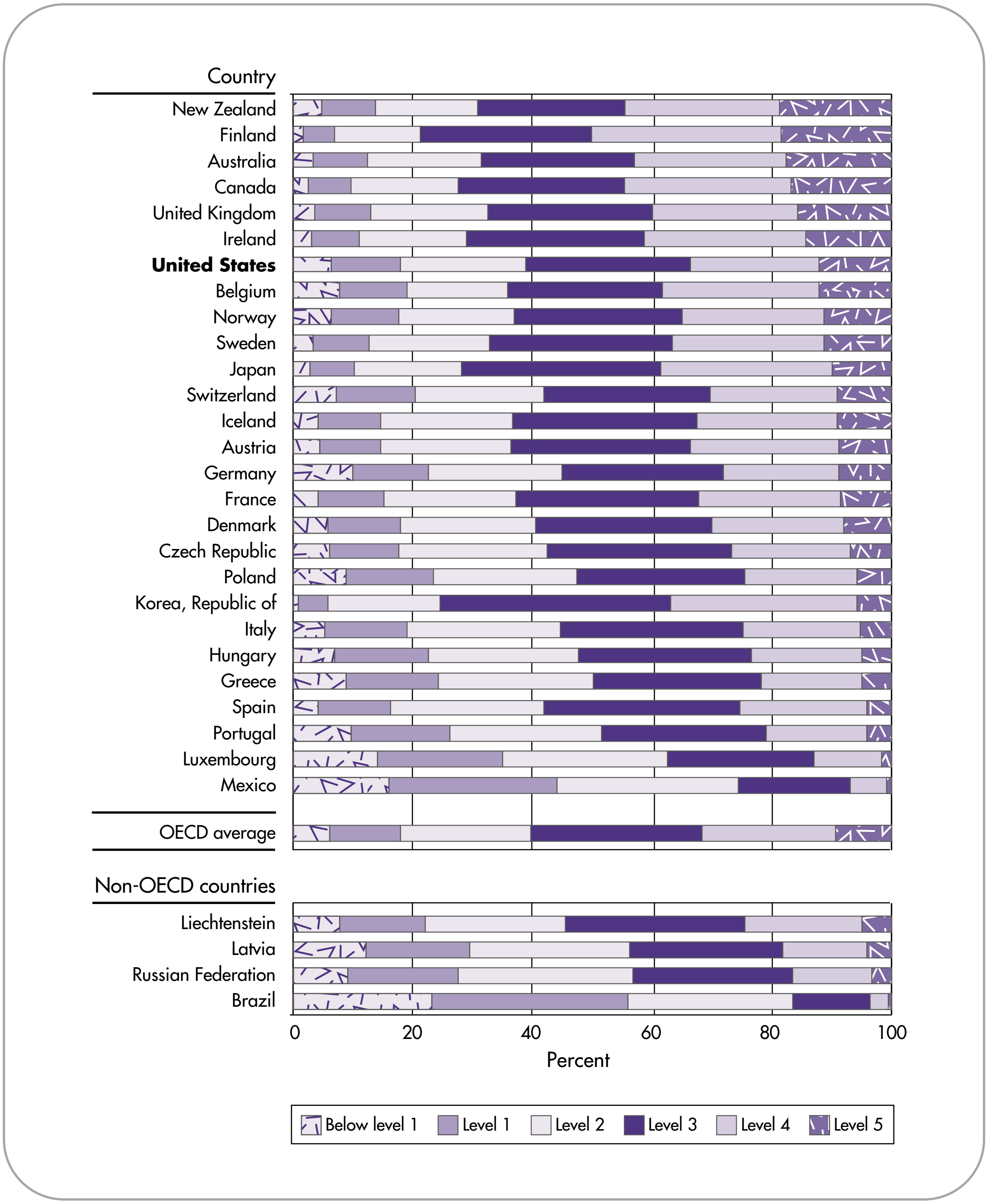
Looking at figure 8, one can see that in comparison to the United States, a few countries have large percentages of students at the highest levels and smaller numbers at the lowest levels (for example, Finland and New Zealand); a few countries have small percentages of students at the highest levels and larger numbers of students at the lowest levels (for example, Brazil and Mexico); and a few countries have large percentages of students at the middle levels and small percentages at either the lowest or highest levels (for example, Korea). Remaining countries, like the United States, have a majority of students at levels 2, 3, and 4, and relatively balanced percentages of students at the highest and lowest levels.

Another way to think about the levels is to consider not just the percentages of students at each particular level, but also to think about the cumulative percentages from level to level. For example, about one-third of U.S. students read at the two highest levels, level 4 or above. In Brazil, 4 percent of students perform at levels 4 or above, and in Finland, about half of the students do. About 60 percent of students in the United States perform at level 3 or above, and over 80 percent at level 2 or above. Finland, with a higher average combined literacy score than the United States, has 79 percent of students reading at level 3 or above, and 93 percent of students reading at level 2 or above.

Specific Skill Areas of Reading Literacy by Level

Specific measures tap the three defined processes of reading literacy described earlier: *retrieving information, interpreting texts,* and *reflecting on*

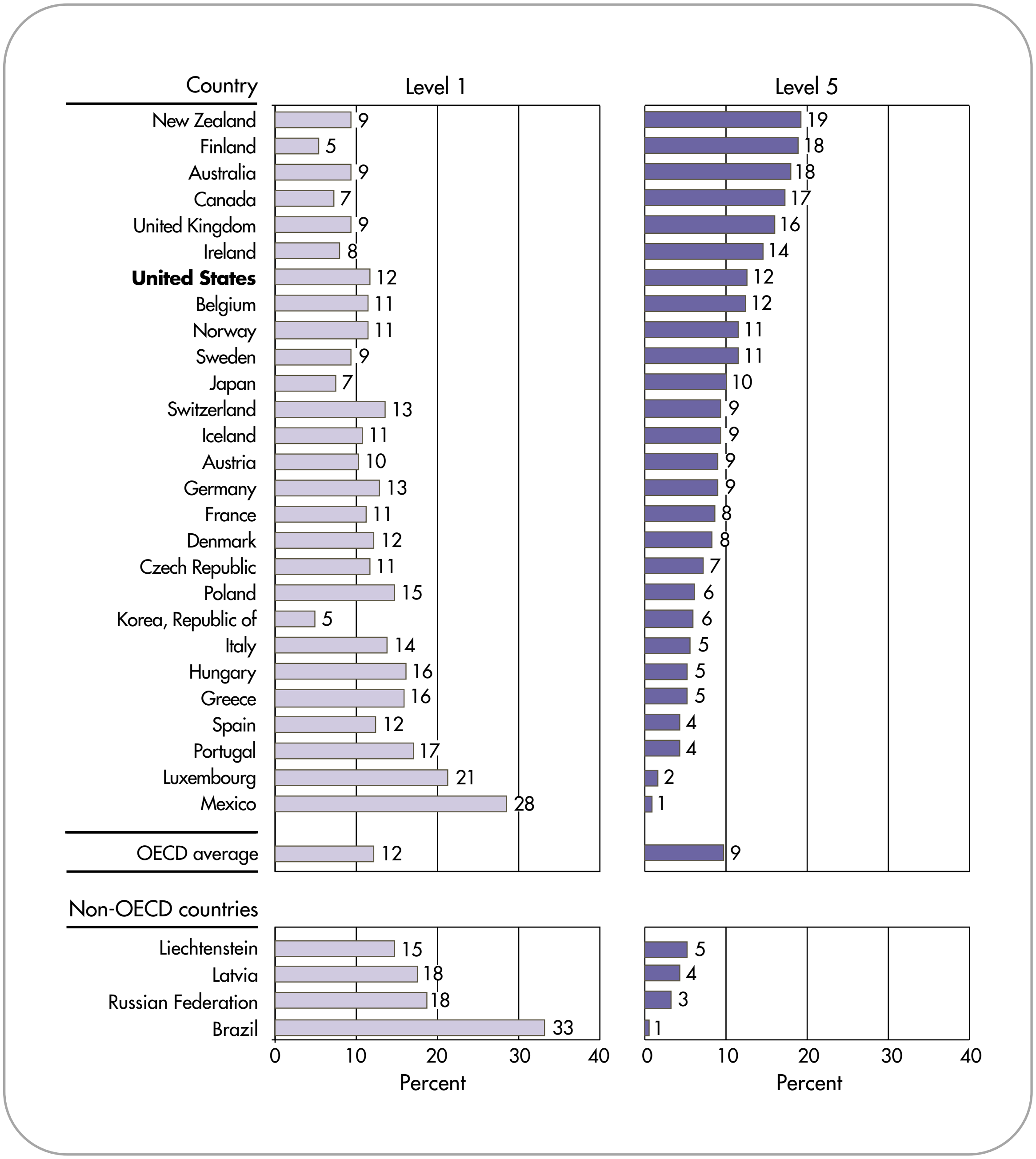
Figure 8.—Percentage distribution of 15-year-olds by combined reading literacy scores, by level and by country: 2000



NOTE: The Program for International Student Assessment (PISA) uses five levels of performance to describe student performance. In order to reach a particular level, a student must be able to correctly answer a majority of items at that level. Students were classified into reading levels according to their scores. Although the Netherlands participated in PISA in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

Figure 9.—Percentage of 15-year-olds scoring at levels 1 and 5 on the combined reading literacy scale, by country: 2000



NOTE: The Program for International Student Assessment (PISA) uses five levels of performance to describe student performance. In order to reach a particular level, a student must be able to correctly answer a majority of items at that level. Students were classified into reading levels according to their scores. Although the Netherlands participated in PISA in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

texts. Percentages of students performing at each level for each of these reading process subscales are shown in tables A3.6, A3.7, and A3.8.

Looking across the countries, at almost every level on each reading literacy subscale, U.S. percentages of 15-year-olds are similar to the OECD average.[11] In general, few countries perform differently than the United States at any given level for each of the three scales, leaving a large group of countries that perform similarly to the United States.

For example, on the *retrieving information* subscale, five countries have greater percentages of 15-year-olds at level 5 than the United States, while eight countries have lower percentages, ranging from less than 1 percent in Brazil to 26 percent in Finland. That leaves 17 countries with percentages at level 5 similar to the U.S. percentage. At the opposite end of the scale, at level 1 for the *retrieving information* scale, three countries have a smaller proportion of students performing at this level than the United States and seven have a greater proportion.

On the *interpreting* scale, two countries have higher percentages of students at level 5. At the other end of the *interpreting* scale, three countries have a smaller proportion of 15-year-olds at level 1.

The U.S. has a greater percentage of students at level 5 on the *reflecting* scale than 10 countries, while 3 countries have greater percentages than the United States at the same level. The United States has a higher percentage of students at level 1 than four countries on the same *reflecting* scale. At levels 2, 3, and 4 on the *reflecting* scale the U.S. has similar percentages to the OECD average. At least two-thirds of countries are similar to the U.S. percentages at these levels.

Although patterns of scores for the reading literacy subscales vary *across* countries, generally *within* each country proportions of 15-year-olds at each level are similar across all three reading literacy subscales, as well as the combined reading literacy scale. In the United States, for instance, about 12 percent of students are at level 5 for *retrieving information, interpreting texts, reflecting on texts*, and for the combined reading literacy scale. In fact, the percentage of U.S. 15-year-olds across the three dimensions and the combined reading literacy scale is consistent at each level: about 21 percent for *retrieving information, interpreting texts,* and *reflecting on texts* at level 4; about 27 percent for each scale at level 3; about 21 percent at level 2 for each scale; about 12 percent at level 1; and about 6 percent below level 1. That is, there is no difference between percentages of U.S. 15-year-olds performing at high and low levels for the *retrieving information, interpreting texts,* or *reflecting on texts* scales.

Linking Performance by Levels to PISA Items

What do these U.S. results mean, then, in terms of the kinds of reading literacy questions PISA asks? Given that about 92 percent of U.S. students perform at level 1 and above on the *retrieving information* scale, a large proportion of students should be able to answer the level 1 question described above (see also appendix 4) about why athletic shoes should not be too rigid. Indeed, 84 percent of U.S. students answer this question correctly. On average 80 percent of students in OECD countries answer this question correctly. About 94 percent of U.S. students also perform at level 1 and above on the *interpreting* and *reflecting on texts* scales, so similarly large proportions of students should answer the level 1 question about how parts of a sentence from the athletic shoe article relate to one another correctly as well as the question about the author's intent. Seventy-eight percent of U.S. students do answer correctly the *reflecting* item about how parts of a sentence relate to one another, and 78 percent also answer correctly the *interpreting* item about author's intent.

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[11] At level 5 for the *interpreting texts* scale, the U.S. percentage is higher than the OECD average.

In the same way, for the level 4 *retrieving* item described above in which students had to locate two characters on stage using dialogue and stage directions from a play, about one-third of U.S. 15-year-olds (those at levels 4 and 5) should be able to answer this question a majority of the time. Actual responses show that 38 percent of U.S. 15-year-olds answer this item correctly, and an average of 47 percent of OECD students answer correctly. Forty-one percent of U.S. students also receive full credit for answering the level 4 *reflecting* item (using the flu immunization sheet, also described above and included in appendix 4) correctly. About 13 percent of U.S. students perform at level 5 on the *interpreting* scale, and indeed, 15 percent of U.S. students receive full credit for a level 5 *interpreting* item using the labor force structure diagram (see appendix 4). An average of 14 percent of OECD students receive full credit for the same item.

SUMMARY

The results in this chapter show that, in general, U.S. students perform similarly to the OECD average, both for the combined reading literacy scale and in the percentages of students who perform at each level on the specific reading subscales of *retrieving information, interpreting texts*, and *reflecting on texts*. Numbers of high performing students meeting international benchmarks are also similar to the OECD benchmarks, as is variation in student performance. The next chapter will discuss results of PISA 2000 for mathematics literacy and science literacy.

Chapter 3

Mathematics and Science Literacy

Key Findings

- In both mathematics and science literacy, the United States average does not differ from the OECD average. Eight countries outperform the United States in mathematics literacy, and seven have higher average scores for science literacy. The United States has higher average scores than seven countries for mathematics literacy and seven for science literacy (figure 10; table A3.9).

- The top 10 percent of students in OECD countries score 625 or higher in mathematics literacy. In the United States, 9 percent of students score at this level or better, a percentage not different from the OECD top 10 percent benchmark. In eight countries, a greater proportion of students score in the top 10 percent, while six countries have a smaller proportion (figure 13; table A3.12).

- For science literacy, the top 10 percent of all students score 627 or higher. In the United States, 10 percent of students score at this level or better. Four countries have a higher percentage of students score in the top 10 percent, while seven countries have a lower percentage (figure 14; table A3.13).

In addition to assessing students in reading literacy, PISA 2000 tested the mathematics and science literacy of 15-year-olds in participating countries. As with reading literacy, PISA's mathematics and science literacy assessments focus on 15-year-olds' ability to apply mathematical and scientific principles and thinking in a wide variety of situations. As societies deal with changes and advances in technology, in medicine, in the environment, and in economic situations, mathematics literacy and science literacy are important skills for understanding and managing those changes.

As mentioned previously in this report, PISA 2000 concentrates on reading literacy, devoting two-thirds of testing time to this subject. The testing time remaining for the areas of mathematics and science literacy limits the number of items covering these topics in the assessment. As a result, a single scale is reported for each of mathematics and science literacy. Levels are not defined for either scale. The mathematics and science literacy scales are comparable to the combined reading literacy discussed earlier.

In discussing the results from the mathematics and science literacy portions of PISA 2000, it is important to understand the concept of mathematics and science literacy utilized by PISA. The following sections provide PISA's definitions of mathematics and science literacy and place these definitions in the context of the PISA 2000 assessments. As with the preceding chapter on reading literacy, this chapter begins by discussing national averages in mathematics and science literacy, and then examines score distributions within countries and across countries by using national and international benchmarks. Examples of mathematics and science literacy items are also presented.

DEFINING MATHEMATICS LITERACY

Just as reading literacy means more than the ability to read and write, mathematics literacy means more than the ability to add and subtract or perform other mathematical computations. PISA defines mathematics literacy as:

> ***the capacity to identify, to understand the role that mathematics plays in the world, to make well-founded mathematical judgments and to engage in mathematics, in ways that meet the needs of an individual's current and future life as a constructive, concerned and reflective citizen*** (OECD 1999, p.41).

As noted earlier, literacy in all three areas of reading, mathematics, and science is defined in terms of three dimensions—content, process, and situation. For mathematics literacy, the three dimensions are specified as follows:

- ***Content or Structure***—includes broad mathematical concepts or content underlying mathematical thinking: *chance, change and growth, space and shape, reasoning, uncertainty and dependency relationships*. In PISA 2000, *change and growth* and *space and shape* were emphasized.

- ***Process***—consists of thinking skills organized into three competency classes: *simple computations* or definitions; *connections* to be made to solve straightforward problems; and *mathematical thinking, generalization,* and *insight (reflection)* requiring students to analyze, identify mathematical elements in a given situation, and suggest new problems.

- ***Situation***—comprises the situations in which mathematics knowledge and skills are applied, classified as: *private life/personal, school life, work and sports, local community and society,* and *scientific*.

In sum, PISA mathematics literacy items seek to measure how well students are able to apply a variety of mathematical processes to an assortment of problems—the kind of problems they solve for a school assignment; the kind they solve to help make home improvements; and the kind they encounter while reading a newspaper or magazine.

DEFINING SCIENCE LITERACY

In the broad conception used in PISA, science literacy means the ability to think scientifically, understand some specific scientific concepts, and take a scientific approach to problem solving. In this sense, science literacy is defined as:

> ***the capacity to use scientific knowledge, to identify questions, and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity*** (OECD 1999, p.60).

The specifics of the three defining dimensions—content, process, and situation—in the case of science literacy are as follows:

- ***Content or Structure***—involves broad science concepts from physics, chemistry, biological sciences, and Earth and space sciences. Concepts are incorporated more particularly from themes such as *biodiversity, forces and movement,* and *physiological change*, and are organized into several broad areas of application: *science in life and health, science in Earth and environment,* and *science in technology.*
- ***Process***—includes thinking skills organized into five processes: *recognizing scientifically investigable questions, identifying evidence needed in a scientific investigation, drawing or evaluating conclusions, communicating valid conclusions,* and *demonstrating comprehension of scientific concepts.*
- ***Situation***—focuses on the situations in which scientific knowledge and skills are applied: *personal, public, global,* and situations of *historical relevance.*

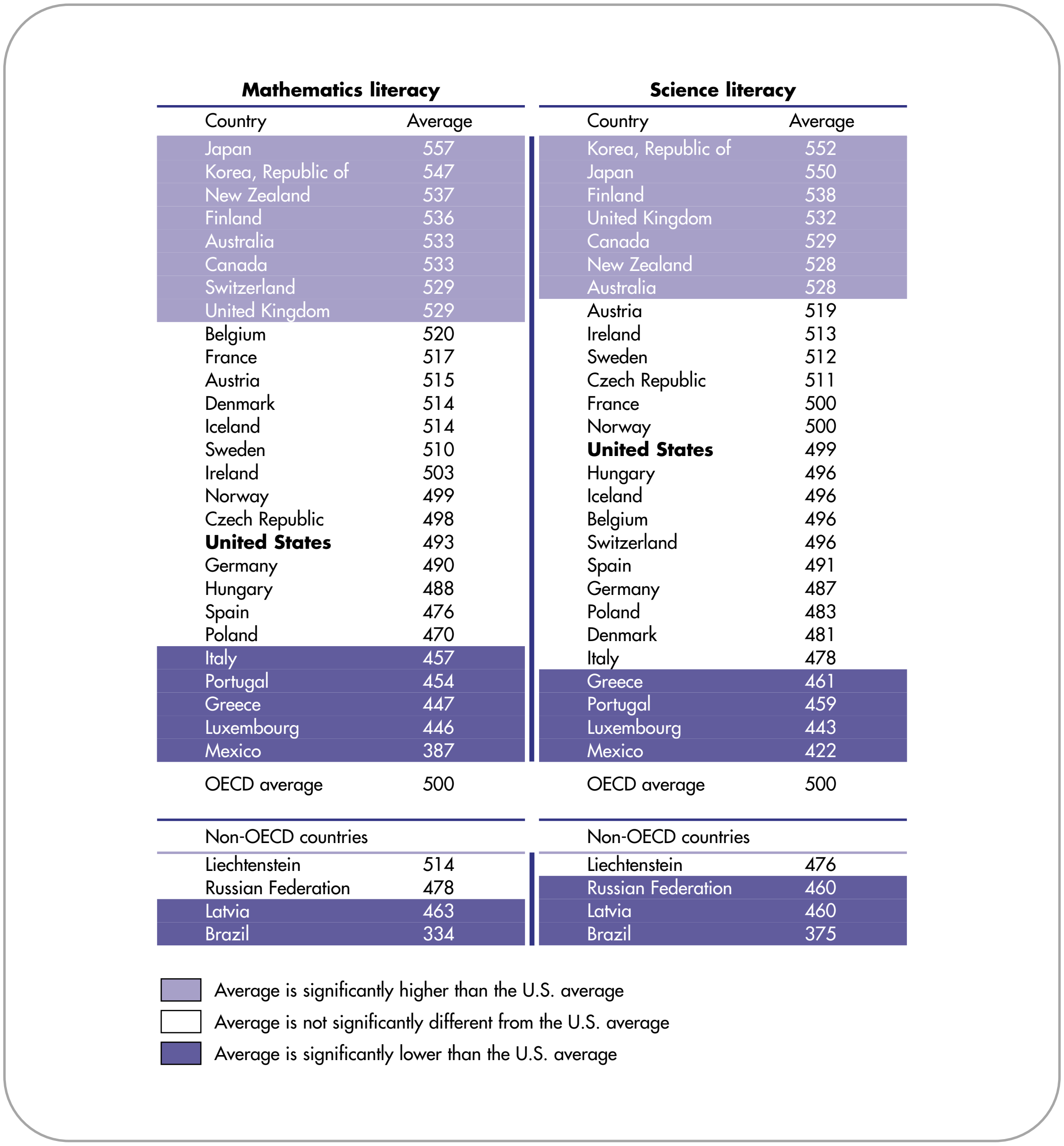
As with the other PISA items, science literacy items seek to measure how well students are able to apply a variety of scientific skills to a diverse group of situations—the kind of situations they encounter while making a decision about an environmental referendum; the kind they encounter in trying to understand their own medical care or while reading information about disease prevention; or the kind they encounter in a scientific text. These definitions of mathematics and science literacy provide a basis for the following presentation of results from PISA 2000.

MATHEMATICS AND SCIENCE LITERACY OF PISA COUNTRIES

National averages provide the simplest description of performance for mathematics and science literacy. In PISA 2000, national averages in mathematics and science literacy are strongly correlated with each other, and with national averages in reading literacy. This is not surprising, considering that both PISA mathematics and science literacy items focus on the application of mathematical and scientific thinking to real-world situations, which often entails interpreting charts or other documents. Some items, particularly in science, also require significant amounts of reading. The United States' relative position compared to its international peers is approximately the same in both mathematics and science, and the countries scoring above and below the United States are largely the same for both subjects. More countries score higher than the United States in mathematics literacy and in science literacy than on the combined reading literacy scale. With this situation in mind, the discussion that follows considers mathematics and science literacy simultaneously. Departures from this pattern are highlighted.

In figure 10 (page 26), shading identifies countries whose averages are higher, lower, or not different from that of the United States in mathematics and science literacy. Non-OECD countries are shown at the bottom of the table with shading to indicate differences from the United States; however, non-OECD countries are not included in determining the OECD average.

Figure 10.—Mathematics and science literacy average scores of 15-year-olds, by country: 2000



Mathematics literacy		Science literacy	
Country	Average	Country	Average
Japan	557	Korea, Republic of	552
Korea, Republic of	547	Japan	550
New Zealand	537	Finland	538
Finland	536	United Kingdom	532
Australia	533	Canada	529
Canada	533	New Zealand	528
Switzerland	529	Australia	528
United Kingdom	529	Austria	519
Belgium	520	Ireland	513
France	517	Sweden	512
Austria	515	Czech Republic	511
Denmark	514	France	500
Iceland	514	Norway	500
Sweden	510	**United States**	499
Ireland	503	Hungary	496
Norway	499	Iceland	496
Czech Republic	498	Belgium	496
United States	493	Switzerland	496
Germany	490	Spain	491
Hungary	488	Germany	487
Spain	476	Poland	483
Poland	470	Denmark	481
Italy	457	Italy	478
Portugal	454	Greece	461
Greece	447	Portugal	459
Luxembourg	446	Luxembourg	443
Mexico	387	Mexico	422
OECD average	500	OECD average	500
Non-OECD countries		Non-OECD countries	
Liechtenstein	514	Liechtenstein	476
Russian Federation	478	Russian Federation	460
Latvia	463	Latvia	460
Brazil	334	Brazil	375

▨ Average is significantly higher than the U.S. average
☐ Average is not significantly different from the U.S. average
■ Average is significantly lower than the U.S. average

NOTE: Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

As noted earlier, both assessments generated a single literacy score between 0 and 1,000 (with most scores falling between 200 and 800) for each student in each of the subjects. Country averages constructed from these scores provide the basis to compare countries in each subject.

In both mathematics and science literacy, the United States' average does not differ from the OECD average. Compared to the U.S. average, eight countries have higher average scores in mathematics literacy, and seven countries have higher scores in science literacy. The same seven countries appear in both groups—Australia, Canada, Finland, Japan, Korea, New Zealand, and the United Kingdom. For mathematics literacy, the average score for Switzerland is also higher than the U.S. average score. In mathematics literacy, 15 countries score similarly to the United States; in science literacy that number is 16 nations. The United States performs better than seven countries for mathematics literacy and seven countries for science literacy. Six of the same countries appear in both of those groups—Brazil, Greece, Latvia, Luxembourg, Mexico, and Portugal. In addition, the United States outperforms Italy in mathematics literacy and the Russian Federation in science literacy.

Despite differences in the frameworks for mathematics and science in TIMSS 1999 and PISA and a difference in the age of students being assessed, some countries with average scores higher than the United States in TIMSS 1999 also have higher average scores in PISA 2000. For example, Australia, Canada, Japan, and Korea have higher average scores than the United States in PISA 2000 for mathematics and science literacy, and also have higher scores for mathematics and science in TIMSS 1999. New Zealand, which has an average score not significantly different from the United States score for mathematics and science on TIMSS 1999, has a higher average score for mathematics and science literacy on PISA 2000.

THE DISTRIBUTION OF MATHEMATICS AND SCIENCE LITERACY

National Percentiles

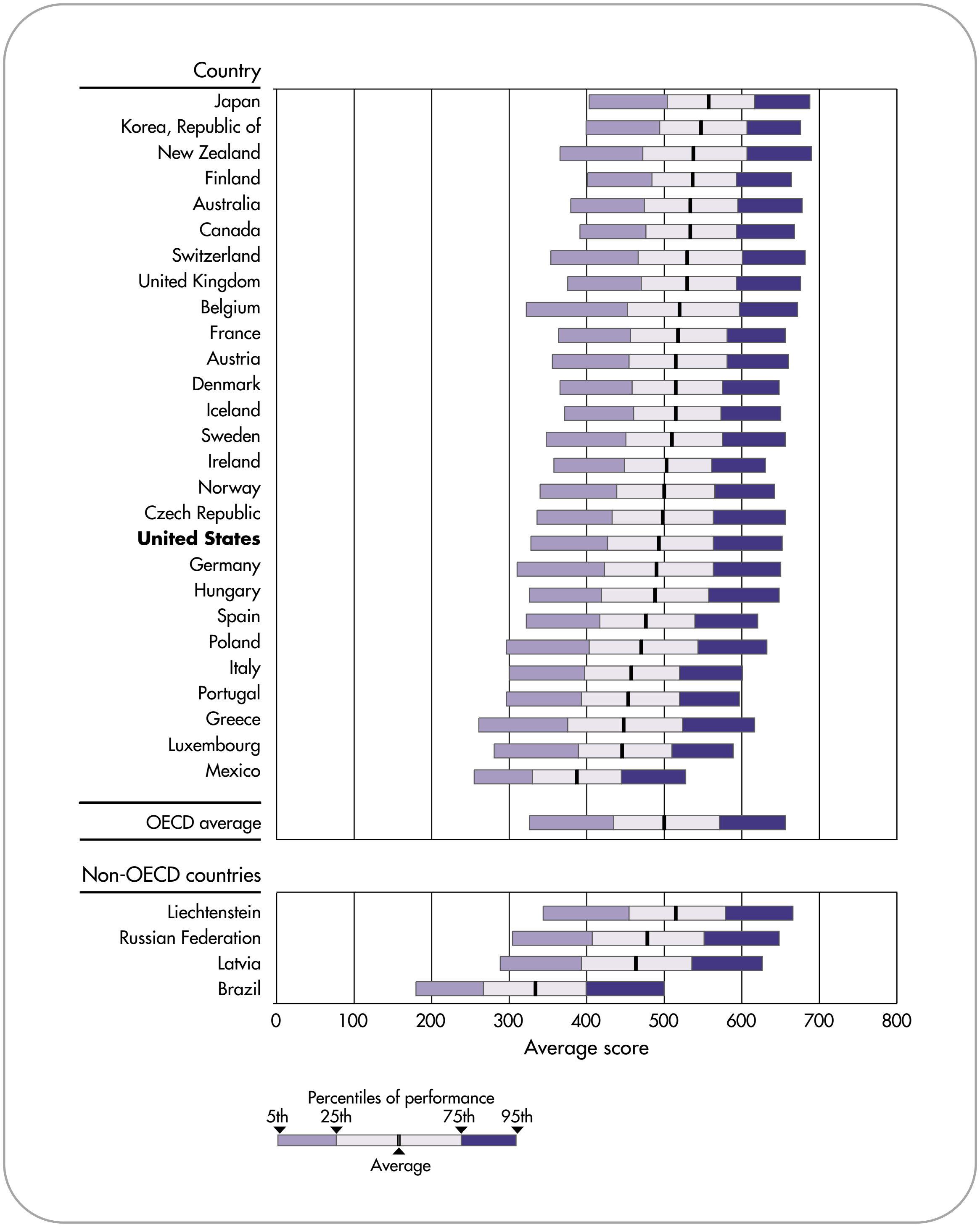
Average scores for mathematics and science literacy, while providing a concise way to describe performance, provide no information about the way scores are distributed in countries. This section, as with the previous discussion of reading literacy, looks at national percentile scores and score distributions in order to provide some information about how the scores that make up each country's average score vary.

Examining selected score cut points (for the 5th and 95th percentiles, in this case) within countries provides one means to compare distributions across countries. For example, to be among the top 5 percent of scorers in Brazil requires a score of 499 or better, in the United States it requires a score of 652 or better, and in New Zealand it requires a score of 689 or better. The cutoff point to identify the bottom 5 percent of scorers begins at 179 in Brazil, 327 in the United States, and 402 in Japan.

It is also possible to compare the U.S. average score to corresponding cut points in several countries. Figure 11 (page 28) shows graphically that while the average U.S. mathematics literacy score is 493, that is the 25th percentile score in Korea. This means that 75 percent of Korean students score at or above the U.S. average. Similarly, a score of 493 is just under the 90th percentile score in Mexico, which means that about 10 percent of Mexican students perform at or above the U.S. average for mathematics literacy.

An examination of the size of the score point difference between the top 5 percent and bottom 5 percent of scorers in a country also gives a sense of the variability of scores. The bottom 5 percent of U.S. students score 327 or less, but the top 5 percent score 652 or better, which means that there is at least a 325 point difference between the top 5 percent and bottom 5 percent of 15-year-olds for mathematics literacy in the United States. The length of the bars in figure 11 gives a visual indication of these kinds of differences in scores between a country's highest and lowest performing students.

Figure 11.—Distribution of mathematics literacy scores of 15-year-olds by percentiles, by country: 2000



NOTE: Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

It is not accurate to rank countries' scoring variation based on the length of these bars because of the statistical techniques used to sample students, but standard deviations of the scores give a technical way to examine variations in scores within a country to learn how greatly scores within a country differ from their average scores (data not shown; see table A3.10). For mathematics literacy, seven countries have less variation in performance than the United States. No country has greater variation in performance than the United States, but U.S. variation in performance is similar to that in 23 other countries. It is also similar to the OECD average variation.

For science literacy, the story is similar to mathematics literacy. Looking at the U.S. average for science literacy in comparison to selected cutpoints for other countries shows differences in distributions of scores (figure 12, page 30). The average score for science literacy in the United States is 499, and, as with mathematics literacy, about 75 percent of Korean 15-year-olds score above the U.S. average. That is, the U.S. average for science literacy corresponds to the 25th percentile in Korea. The U.S. science literacy average also corresponds to approximately the 90th percentile in Mexico, showing that about 10 percent of Mexican 15-year-olds perform above the U.S. average for science literacy.

Again, the figure gives a sense of the spread of scores for each country. In the United States, the top 5 percent of 15-year-olds score at or above 658, while the bottom 5 percent score at or below 330, a difference of 328 points at a minimum. Comparing standard deviations of the average scores for science literacy gives a statistically accurate way to describe variation in performance, and shows that, as with mathematics literacy, a few countries (6 countries) have less variation in performance than the United States (data not shown; see table A3.11). The majority of countries (24 countries) show similar variation in performance to the United States, and the U.S. variation is similar to the OECD average.

International Percentiles

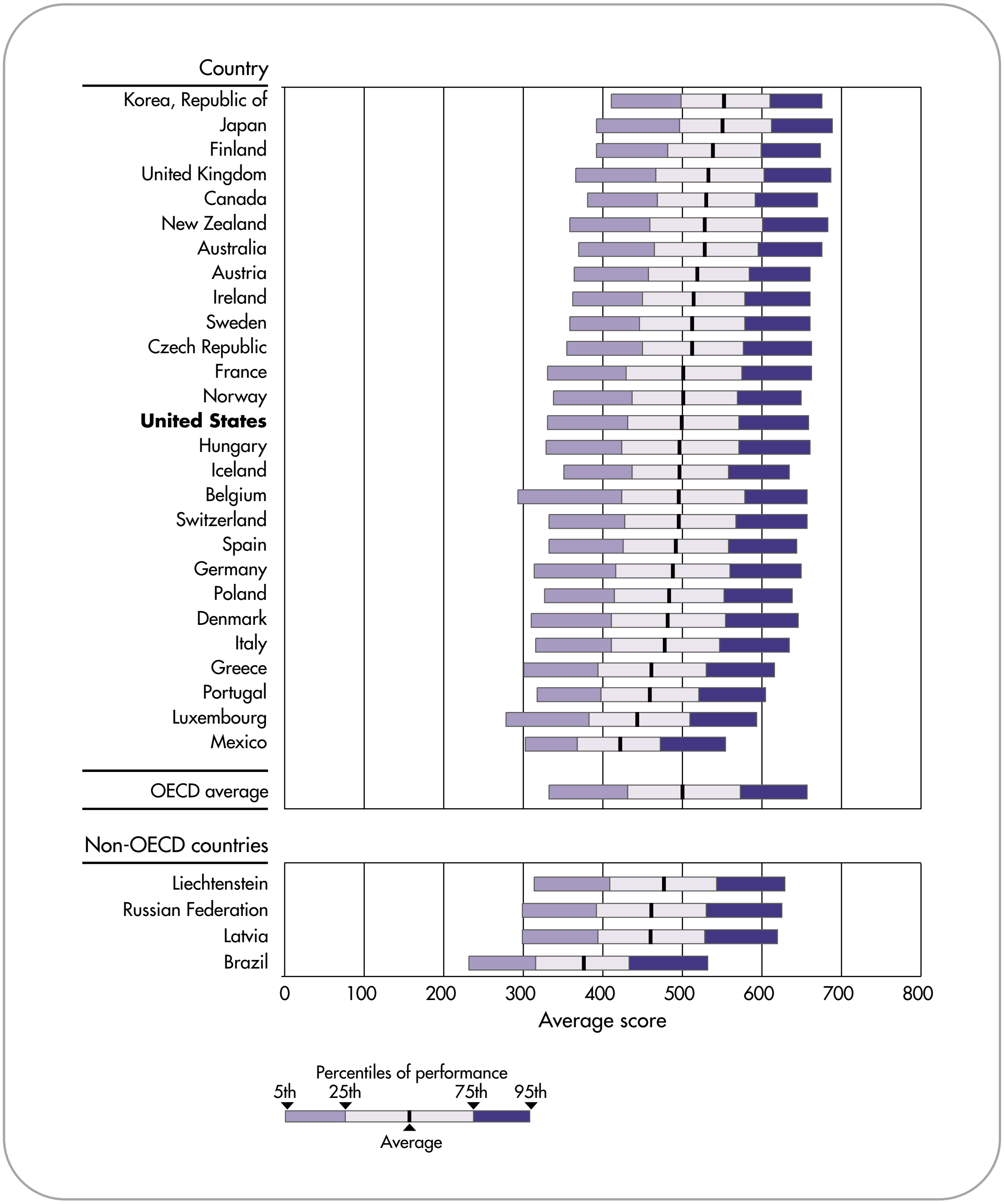
Scores for 15-year-olds from each PISA 2000 participating country can also be analyzed by sorting them into groups that meet international benchmarks—in this case, proportions of students from each country who are among the top 10 and top 25 percent of students from all countries combined. This provides another means to examine how scores are distributed across countries by showing which countries have greater proportions of students performing at high levels internationally.

The top 10 percent of students in OECD countries score 625 or higher in mathematics literacy. In the United States, 9 percent of students achieve this score or better, a percentage not different from the OECD top 10 percent benchmark. Eight countries have a greater proportion of students score in the top 10 percent, while six countries have a smaller proportion (figure 13, page 31; table A3.12).

Twenty-two percent of U.S. 15-year-olds meet the top 25 percent international benchmark, which requires a score of 571 or better. Nine countries have higher percentages at this benchmark, and six have lower percentages. The same eight countries that have higher percentages of students in the top 10 percent than the United States also have a greater percentage in the top 25 percent, with the addition of Belgium for this benchmark.

Figure 13 shows that Japan, for instance, has the same percentage of students (22 percent) reaching the top 10 percent benchmark as the United States has of students reaching the top 25 percent benchmark (also 22 percent). This means that 22 percent of Japanese students score at or above 625 in mathematics literacy, compared to 9 percent of U.S. students. Similarly, Mexico has about the same percentage of students in the top 50 percent (8 percent; data not shown, see table A3.12) as the United States has in the top 10 percent. This means that about 8 percent of Mexican students score at or above 505 in mathematics literacy, compared to about 46 percent of U.S. students.

Figure 12.—Distribution of science literacy scores of 15-year-olds by percentiles, by country: 2000



NOTE: Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

Figure 13.—Percentage of 15-year-olds reaching PISA international benchmarks in mathematics literacy, by country: 2000

Top 10 percent		**Top 25 percent**	
Country	Percent	Country	Percent
Japan	22	Japan	46
New Zealand	19	Korea, Republic of	41
Korea, Republic of	17	New Zealand	39
Switzerland	17	Switzerland	36
Belgium	16	Belgium	35
Australia	15	Finland	34
United Kingdom	15	Australia	34
Canada	14	Canada	34
Finland	13	United Kingdom	33
Austria	11	France	29
France	11	Austria	29
Sweden	10	Denmark	27
Czech Republic	10	Sweden	26
Iceland	9	Iceland	26
United States	9	Norway	23
Denmark	9	Czech Republic	23
Germany	9	Germany	22
Hungary	8	**United States**	22
Norway	8	Ireland	21
Poland	6	Hungary	21
Ireland	6	Poland	16
Spain*	4	Spain	15
Greece	4	Greece	13
Italy	2	Italy	10
Portugal	2	Portugal	10
Luxembourg	2	Luxembourg	8
Mexico	#	Mexico	1

Non-OECD countries		Non-OECD countries	
Liechtenstein	12	Liechtenstein	30
Russian Federation	8	Russian Federation	20
Latvia	5	Latvia	15
Brazil	#	Brazil	1

▒ Percentage is significantly higher than the U.S. percentage

□ Percentage is not significantly different from the U.S. percentage

■ Percentage is significantly lower than the U.S. percentage

*The shading of Spain in the top 10 percent category may appear incorrect; however, statistically, its placement is correct.
#Too small to report.

NOTE: Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001).

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

For science literacy, the top 10 percent of all students score 627 or higher. In the United States, 10 percent of students achieve this score or better. Four countries have a higher percentage of students in the top 10 percent, while seven countries have a lower percentage (figure 14; table A3.13).

Four of the eight countries with higher percentages of students in the top 10 percent than the United States for mathematics literacy (Japan, Korea, New Zealand, and the United Kingdom) also have higher percentages than the United States for science literacy. In both cases, Japan has about double the percentage of students in the top 10 percent than the United States.

Twenty-five percent of U.S. students score at or above the cut point score of 572 for the top 25 percent benchmark in science literacy. Seven countries have a higher percentage, and seven have lower percentages. The same four countries (Japan, Korea, New Zealand, and the United Kingdom) that have higher percentages of students in the top 10 percent than the United States for science literacy also have more students in the top 25 percent, with the addition of Australia, Canada, and Finland for this benchmark.

Four countries (Japan, Korea, New Zealand, and the United Kingdom) have more students meeting both the 10 percent and 25 percent benchmark in mathematics *and* science literacy than the United States. In general, however, more countries have higher percentages of students meeting the international benchmarks than the United States for mathematics literacy than science literacy. The United States percentages for both the 10 percent and 25 percent benchmarks in mathematics and science literacy are consistent.

EXAMPLES OF MATHEMATICS ITEMS

One way of developing a deeper understanding of what types of mathematics questions are asked of students in PISA 2000 is to examine actual mathematics items from the assessment. Because mathematics literacy is a minor area in the 2000 assessment, there are not enough released items at this point in time to show the broad range of content, process, and situations students are presented with in PISA 2000. However, the items described below do provide a glimpse into the mathematics component of PISA 2000.

As is the case of reading literacy, PISA mathematics items are divided into units that contain a short text or picture, and several questions or items that require the use of the text or picture to answer. For example, in the unit “Continent Area” students are provided with a map of Antarctica and a companion scale, and are asked to estimate the area of the continent using the map scale. This item and other mathematics and science items are shown in appendix 4. Students are also asked to show their work and explain how they made their estimate. Full credit answers require students to provide a correct estimate. The correct estimate is from 12 million to 18 million square kilometers. Students show evidence of using a correct method through drawing a square, rectangle, or circle around the continent and using those dimensions to estimate the area. In addition, students can add the areas of several regular geometric figures they draw on the map. Students who provide a correct estimate and show evidence of other correct methods, or just provide the correct estimate, also receive full credit. This question corresponds to a score of 722 on the mathematics literacy scale.[12] This means that a student with a score of 722 or higher could answer this question a majority of the time. This is above the score of 625 at which the top 10 percent of all students score. Ten percent of U.S. students receive full credit for the

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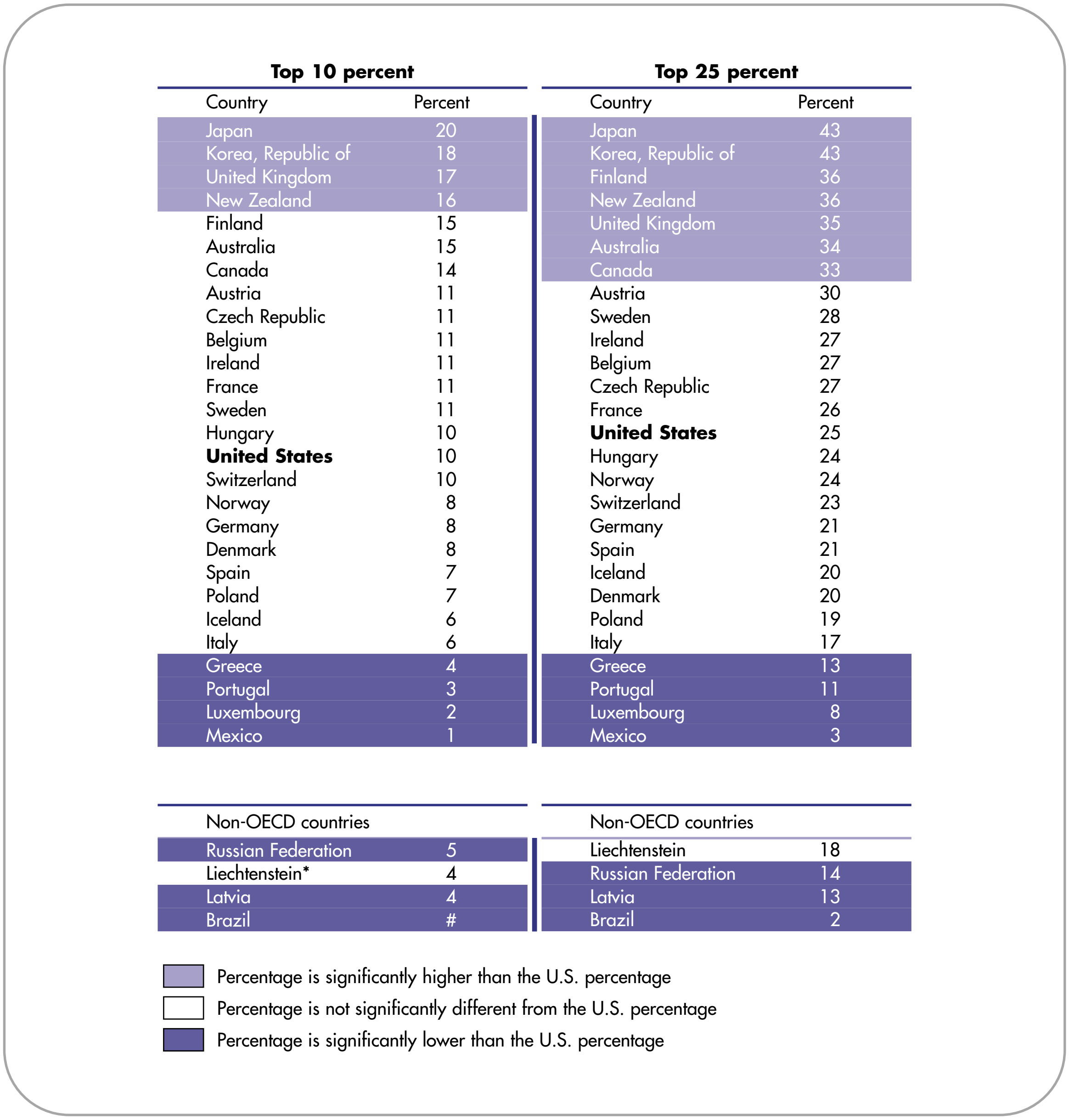
[12] PISA’s items are scaled such that for an item corresponding to a score of 722, students who score 722 on that scale will have a 62 percent probability of answering the item correctly. Students with a score above 722 will have a higher probability of answering the item correctly, and students with scores lower than 722 will have a lower probability of answering the item correctly.

Figure 14.—Percentage of 15-year-olds reaching PISA international benchmarks in science literacy, by country: 2000



Top 10 percent

Country	Percent
Japan	20
Korea, Republic of	18
United Kingdom	17
New Zealand	16
Finland	15
Australia	15
Canada	14
Austria	11
Czech Republic	11
Belgium	11
Ireland	11
France	11
Sweden	11
Hungary	10
United States	10
Switzerland	10
Norway	8
Germany	8
Denmark	8
Spain	7
Poland	7
Iceland	6
Italy	6
Greece	4
Portugal	3
Luxembourg	2
Mexico	1

Non-OECD countries	
Russian Federation	5
Liechtenstein*	4
Latvia	4
Brazil	#

Top 25 percent

Country	Percent
Japan	43
Korea, Republic of	43
Finland	36
New Zealand	36
United Kingdom	35
Australia	34
Canada	33
Austria	30
Sweden	28
Ireland	27
Belgium	27
Czech Republic	27
France	26
United States	25
Hungary	24
Norway	24
Switzerland	23
Germany	21
Spain	21
Iceland	20
Denmark	20
Poland	19
Italy	17
Greece	13
Portugal	11
Luxembourg	8
Mexico	3

Non-OECD countries	
Liechtenstein	18
Russian Federation	14
Latvia	13
Brazil	2

▨ Percentage is significantly higher than the U.S. percentage
☐ Percentage is not significantly different from the U.S. percentage
■ Percentage is significantly lower than the U.S. percentage

*The shading of Liechtenstein in the top 10 percent category may appear incorrect; however, statistically, its placement is correct.
#Too small to report.

NOTE: Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001).

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

question, with another 38 percent getting partial credit. On average in OECD countries, 20 percent of students receive full credit and another 40 percent receive partial credit for this question.

This problem falls under the content category of *space and shape*, and requires students to demonstrate their mathematical skills and knowledge in a *private life/personal* situation. In terms of process, this item requires making *connections* to solve the problem.

Another mathematics unit ("Triangles," shown in appendix 4) asks students to determine which of five figures presented fits a specific geometric description. This item corresponds to a score of 546 on the mathematics literacy scale.[13] In the United States, 46 percent of students answer this question correctly, while an average of 62 percent of students in OECD countries answer correctly.

This question is also from the content category *space and shape*, and requires a *computation* process in a *scientific* situation.

These items show, in a limited way, the kind of applied reasoning and real-life contexts that PISA seeks to employ in its assessment items. As noted, additional examples of items can be found in the OECD international report on PISA 2000 *Knowledge and Skills for Life—First Results from the OECD Programme for International Student Assessment* and on the OECD PISA Web Site, www.pisa.oecd.org. The next cycle of PISA in 2003, in which mathematics literacy will be the major subject, will contain a much larger range of items in terms of content areas as well as processes and situations.

EXAMPLES OF SCIENCE ITEMS

Similar to the situation with mathematics, the number of released science literacy items from PISA 2000 is relatively small, and does not allow the opportunity to discuss the broad range of content, process, and situations students are faced with in the science literacy portion of PISA 2000. However, the following items are illustrative of some of the types of questions students are presented in PISA 2000. Again, the full text of these samples and others can be found in appendix 4.

In one example, students are presented with a brief passage from an article on the ozone layer. Using the passage, students are asked to answer the following question:

> Lines 14 and 15 state: "Without this beneficial ozone layer, humans would be more susceptible to certain diseases due to the increased incidence of ultra-violet rays from the Sun."
>
> Name one of these specific diseases.

To receive full credit, students must refer to skin cancer (or melanoma). This question requires students to *demonstrate understanding of scientific concepts* in a *global* situation, and draw on their everyday knowledge of *physiological change (science in life and health)* related to sun exposure. This question corresponds to a score of 560 on the science literacy scale.[14] This is 10 points below the score at which the top 25 percent of all students can be identified. In the United States, 63 percent of students answer this question correctly; on average in the OECD, 63 percent of students also answer correctly.

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[13] See footnote 12.

[14] See footnote 12.

Another question based on the same ozone article asks:

> At the end of the text, an international meeting in Montreal is mentioned. At that meeting lots of questions in relation to the possible depletion of the ozone layer were discussed. Two of those questions are given in the following table.
>
> Which of the questions below can be answered by scientific research?
>
> Circle Yes or No for each.

Question:	Answerable by scientific research?
Should the scientific uncertainties about the influence of CFCs on the ozone layer be a reason for governments to take no action?	Yes / No
What would the concentration of CFCs be in the atmosphere in the year 2002 if the release of CFCs into the atmosphere takes place at the same rate as it does now?	Yes / No

To receive full credit, students must indicate "No" for the first question and "Yes" for the second. This item required students to use their knowledge of *science in the Earth and environment* and to *recognize scientific questions*. This item corresponds to a score of 542 on the science literacy scale.[15] Sixty-four percent of U.S. students respond correctly to this question, and an average of 59 percent of students in OECD countries respond correctly.

As with the mathematics literacy items above, these examples show in a limited way the kind of applied reasoning and real-life contexts that PISA seeks to employ in its assessment items. Science literacy will be the main PISA subject in 2006. During that cycle, science literacy items will take on a greater role in PISA, and the breadth of items will be much greater than those used in PISA 2000.

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[15] See footnote 12.

SUMMARY

The results presented in this chapter show that, in general, the United States performs similarly to the OECD average for both mathematics literacy and science literacy. However, more countries outperform the United States for mathematics and science literacy than for reading literacy. At the same time, more countries have similar variation to the United States in mathematics and science literacy (23 countries and 24 countries, respectively) than for reading literacy, where 15 countries are similar to the United States. This suggests that while more countries have less variation in average scores than the United States for reading literacy, this does not necessarily mean that they perform better than the United States.

Percentages of U.S. students meeting international benchmarks are also similar to OECD percentages, showing a distribution similar to most OECD countries. A few countries have higher percentages of students meeting top benchmarks in several areas. For example, New Zealand has higher percentages of students in the top 10 percent than the United States for reading literacy, mathematics literacy, and science literacy. Korea, in contrast, has a lower percentage of students in the top 10 percent for reading literacy than the United States, but a higher percentage for mathematics and science literacy. These percentages help illustrate in which areas different countries perform particularly well compared to the United States.

The next chapter will examine how different subgroups of students—such as males and females, students with different language backgrounds, students with parents of varying educational backgrounds, and different racial and ethnic groups in the United States—perform on reading, mathematics, and science literacy in PISA 2000.

Chapter

4

DEMOGRAPHIC PROFILES OF READING, MATHEMATICS, AND SCIENCE LITERACY

Key Findings

- On the combined reading literacy scale, females outperform males in every country. On the PISA 2000 mathematics literacy assessment, performance of males and females in the United States is similar, as it is in 16 other countries. For most countries (26 out of 31 countries), including the United States, males and females perform similarly on the science literacy assessment (figure 15; tables A3.14, A3.18, and A3.19).

- In the United States, parents' education is strongly linked to differences in student performance in reading, mathematics, and science literacy (figure 16; tables A3.20, A3.21, and A3.22).

- In the United States, increases in socioeconomic status are associated with increases in scores for reading literacy, mathematics literacy, and science literacy. Most participating countries do not differ significantly from the United States in terms of the strength of the relationship between socioeconomic status and literacy in any subject (figure 17; table A3.23).

- In the United States, parents' national origin is linked to performance in reading literacy and mathematics literacy only for those students with two foreign-born parents compared with students with two native-born parents. There was no difference in science literacy achievement between students with native and foreign-born parents (figure 18; tables A3.24, A3.25, and A3.26).

- In the United States and most other countries, the reading literacy achievement of students who speak the test language at home is higher than that of students not speaking this language at home. The United States and most other countries also show advantages for test-language speakers in mathematics and science literacy (figure 19; tables A3.27, A3.28, and A.3.29).

- The pattern of between-group differences for racial and ethnic groups in the United States is identical across the three literacy areas. In reading, mathematics, and science, the average literacy scores for Whites and "other" students are higher than for Hispanic and Black students (figure 20; table A3.30).

In the United States and many other countries, policymakers are not only interested in overall achievement, but also in achievement by specific population groups. The preceding chapters have discussed differences in student performance, but not differences among students themselves and how these might relate to performance. This chapter focuses on the performance of various demographic groups within the population of students aged 15 years in each participating country. Differences in reading, mathematics, and science literacy are presented for gender, parents' education, socioeconomic background, parents' national origin, and language spoken at home. Countries differ not only in average performance, but also in the performance of these population groups, and in the extent to which these groups differ from each other. In addition, this chapter presents performance results for PISA 2000 by race and Hispanic origin for the United States.

GENDER

Equity between males and females in educational opportunity is an important education policy goal in OECD countries, since it can have far-reaching consequences for economic opportunities and quality of life. Patterns of gender differences in student achievement by subject matter and across countries can point to areas of strength and weakness within educational systems seeking to provide equal access to learning for both males and females.

Previous studies have shown that, on average, females tend to perform better on reading assessments, and males tend to perform slightly better in mathematics and science, particularly at higher grade levels (Donahoe et al. 2000; Braswell et al. 2001; Mullis et al. 2000; Gonzales et al. 2000). Gender differences in mathematics and science achievement are more variable than in reading achievement across assessments, countries, and grades (Elley 1992, Mullis et al. 2000). The Third International Mathematics and Science Study (TIMSS) found a gender gap favoring males in mathematics and science achievement in more countries among eighth-graders than among fourth-graders, and the differences were more pronounced in eighth grade (Mullis et al. 2000).

The differences between the assessment scores of males and females for each country in each of the three subjects assessed by PISA are shown in figure 15. A bar extending under the females' side of the center divide indicates that females outperform males in that country, and vice versa. The size of the bar represents the difference in score points between males and females. The color of the bar indicates whether this difference is statistically significant: a dark bar indicates a significant difference; a light bar does not. For example, on the combined reading literacy scale in Australia, females outperform males by over 30 points on average, and that difference is statistically significant.

On the combined reading literacy scale, females outperform males in each of the 31 nations for which results are presented here. With few exceptions, the same holds true for performance on the three process subscales on the reading assessment *(retrieving information, interpreting texts,* and *reflecting on texts;* data not shown, see tables A3.15, A3.16, and A3.17).[16]

The size of the difference between females and males in reading literacy in the United States is similar to that of most other OECD nations, with the exception of Finland, where the gap on the combined reading literacy scale is larger than that of the United States. Finland's gender gap is greater than that of the United States not only on the combined reading literacy scale but in each of the three reading process subscales as well (data not shown; see tables A3.15, A3.16, and A3.17). The difference between combined reading literacy scores for males and females in Finland is 51 points, and the difference in the United States is 29 points. In addition, the gap between females'

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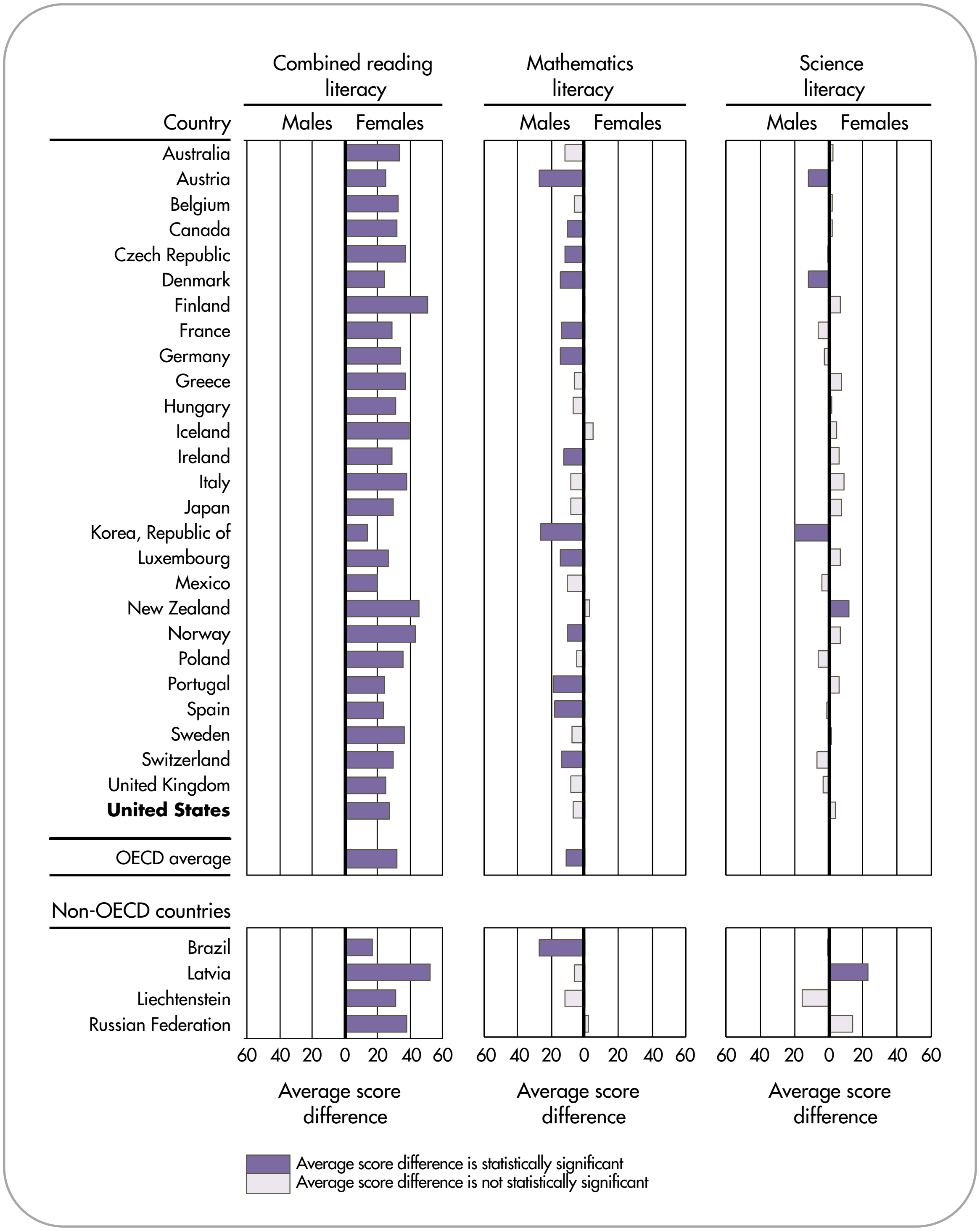
[16] In Brazil, Liechtenstein, and Mexico the gender difference is not significant for the *retrieving information* dimension, and for Korea the difference for *interpreting texts* is also not statistically significant.

Figure 15.—Differences in average scores in reading, mathematics, and science literacy of 15-year-olds by gender, by country: 2000



NOTE: Each bar above represents the average score difference between males and females on combined reading, mathematics or science literacy. Some of these differences are statistically significant and indicated by darker bars. For instance, the United States has a 29 point score difference favoring females in combined reading literacy, which is statistically significant. The score differences between U.S. males and females in mathematics literacy and science literacy are 7 points and 5 points, respectively, but neither is a statistically significant difference. Average score difference is calculated by subtracting scores of males from scores of females. Detail may not sum to totals due to rounding. Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

and males' performance for *reflecting on texts* is higher in Iceland and Norway than in the United States. Among non-OECD nations, Latvia has a gender gap that is larger than that of the United States for the combined reading literacy scale and for the *interpreting texts* scale and the *reflecting on texts* scale.

On the PISA 2000 mathematics literacy assessment, performance of males and females in the United States is similar, as it is in 16 other countries. Fourteen countries show higher performance for males than females. The size of the gender difference in the United States is not different than that of other countries.

For most countries, including the United States, males and females perform similarly on the science literacy assessment. However, in Austria, Denmark, and Korea, males outperform females. In Latvia and New Zealand, females outperform males.

PISA 2000's findings for males and females in mathematics for the United States, in which males and females perform similarly, are generally consistent with the findings of other studies of these subjects such as NAEP and TIMSS, despite differences in frameworks and in some cases age of students assessed (Braswell et al. 2001; Mullis et al. 2000; Gonzales et al. 2000). NAEP, TIMSS, and TIMSS-R do, however, show differences in performance for science achievement of eighth-grade males and females that PISA 2000 does not.

PARENTS' EDUCATION

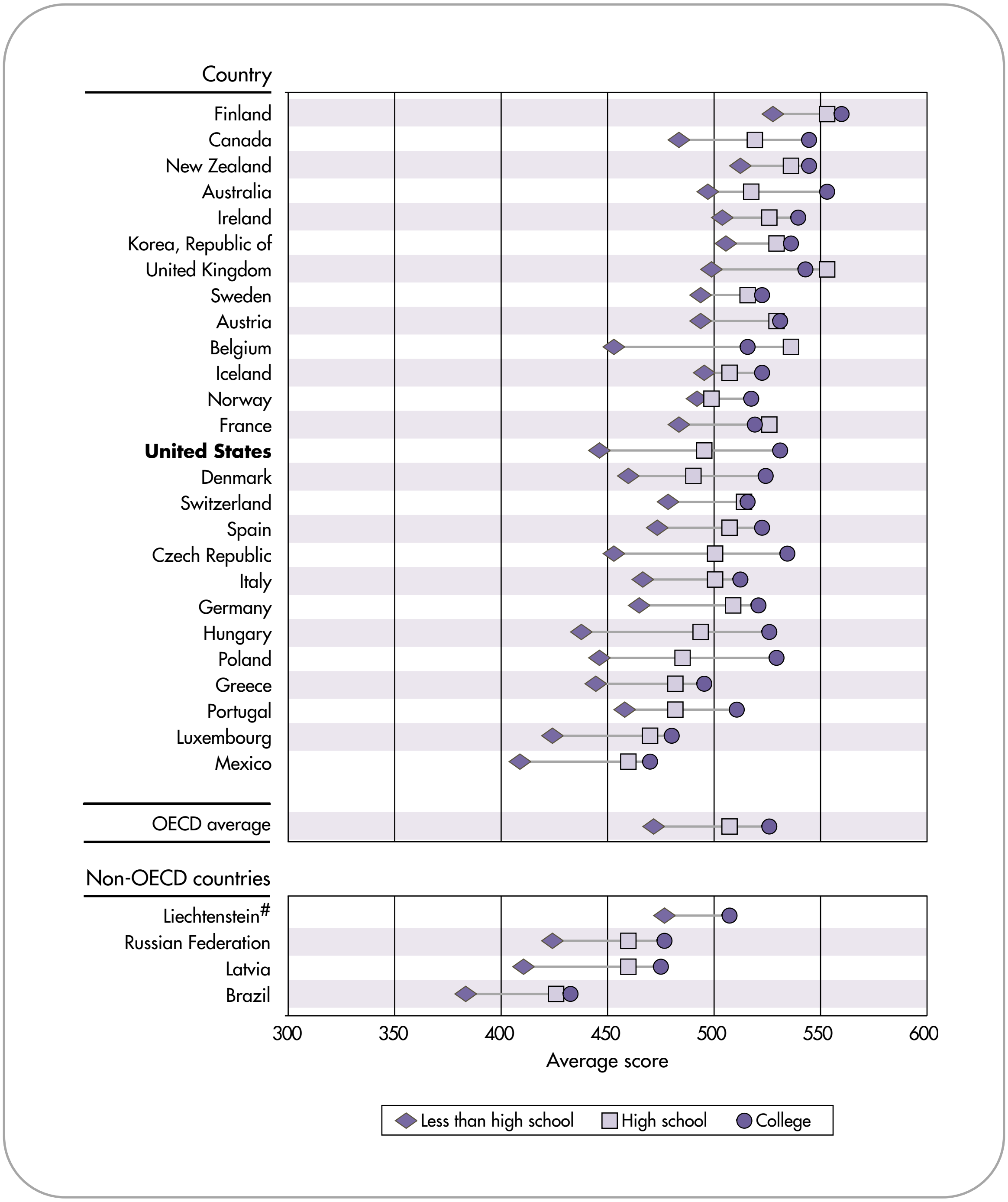
Students with more highly educated parents tend to perform better on assessments, as shown for instance in NAEP and TIMSS (Braswell et al. 2001; Gonzales et al. 2000). Research has shown that more highly educated parents are able to create enriched environments at home in which students are exposed to reading materials and other educational stimuli. More highly educated parents are also more likely to be involved in and show interest in their child's school, to help with homework, and to have higher expectations for their child's performance in school, all of which can influence student performance on assessments (Hernandez 1993). Parents' education is an important student background factor that may be especially influential on assessments of everyday literacy, such as PISA, since the acquisition of everyday literacy is less dependent on school curricula than skills that are gained almost exclusively through schooling, such as knowledge of specific mathematical formulas, for instance. The range of student performance on PISA according to the educational level of their parents can provide important information about the relative influence of parents' education on students' literacy performance across countries.

In the PISA 2000 background questionnaire, students are asked whether their parents have less than a high school diploma, a high school diploma, or a college degree. The highest level of education attained by either parent as reported by the participating 15-year-old is used in this analysis. Figure 16 (table A3.20) displays average scores on the PISA 2000 combined reading literacy scale for students in each country, grouped according to the level of education of their parents. The results for mathematics and science literacy show a similar pattern, and are therefore not shown to avoid repetition.

It can be seen from the distance between the average scores that parents' education has a strong relationship to reading literacy. In all of the 29 countries with data except Norway, students whose parents have less than a high school education perform at lower levels than students whose parents have a high school degree. In all countries, students whose parents have less than a high school education perform less well than those whose parents have a college degree. In 13 countries, students whose parents have a high school degree perform less well than those with a college degree, but in 15 other countries, there is no difference in scores between these two groups. In Belgium, students whose parents have a high school diploma score *higher* than those whose parents have a college degree.

In the United States, there is a 93 point gap in performance between students whose parents went to college and those whose parents have

Figure 16.—Differences in combined reading literacy scores of 15-year-olds by parents' level of education, by country: 2000



#Data for country in one or more reporting categories are too small to report.

NOTE: The points on each line displayed above represent the national averages for students based on the highest level of education attained by one or both parents: parents with less than a high school diploma, parents with a high school diploma, and parents who graduated college. For example, U.S. students whose parents graduated college averaged a score of 536 in reading literacy compared to 497 for students with parents who held only a high school diploma, and 443 for students whose parents possess less than a high school diploma. Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

not completed high school on the combined reading literacy scale. No other country has a larger point difference. Norway, in contrast, shows a 28 point difference for the same two groups of students.

In mathematics literacy, student performance is higher in all countries among students whose parents completed college than among those whose parents did not complete high school (data not shown; see table A3.21). The gap between these two groups' performance is 99 points in the United States and 20 points in Norway. Comparisons of student performance by the other levels of parents' education yield more of a mixed picture. In most countries, including the United States, there is a difference in the mathematics literacy of students whose parents have not completed a high school degree and those who have. About half of the countries (14), including the United States, show a difference between the scores of students whose parents have completed high school and those whose parents have completed college.

Science literacy follows similar patterns as described above (data not shown; see table A3.22). In science literacy, Sweden is the only country in which students whose parents do not have a high school degree and those who do score similarly. In 12 of the 29 countries with data, including the United States, students with college-educated parents score higher than those with parents who have completed high school. In the United States, there is a difference of 96 points between the performance of students whose parents have not completed high school, and those whose parents have completed college. The size of that difference is similar to ten other countries, or about a third of the countries with data. By contrast to the United States, in Sweden, the gap between the scores of those same groups of students is 31 points.

The level of parents' education, then, varies somewhat in its relationship to literacy across countries, but in the United States, it is strongly linked to differences in student performance in reading, mathematics, and science literacy. Students whose parents complete college show a clear advantage over students whose parents do not, and particularly over those whose parents have not completed high school.

SOCIOECONOMIC STATUS

The socioeconomic status of students' parents consistently has been found to be among the strongest student background characteristics that influence student outcomes in the United States, including performance on assessments (Coleman et al. 1966; West, Denton, and Reaney 2000; Williams et al. 2000). The measure of student's socioeconomic status used in PISA 2000 is based on the occupation of the student's father and/or mother as reported by the student.[17] This in turn is transformed into an International Socioeconomic Index (ISEI) developed by Ganzeboom, De Graaf, and Treiman (1992), which allows direct comparisons between nations. The ISEI is keyed to the International Standard Classification of Occupations (ISCO).[18]

Students are assigned numbers ranging from about 16 to 90 on the index based on their parents' occupations, so that they are arrayed on a continuum from low to high socioeconomic status, rather than placed into discrete categories.[19] The linkage of socioeconomic status to literacy scores is shown as the relationship between the two, rather than a

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[17] The measure is based on the student's report of father's occupation, except in cases where information on father's occupation is missing. In those cases, mother's occupation was used if available. The OECD international report on PISA 2000, *Knowledge and Skills for Life—First Results from the OECD Programme for International Student Assessment*, bases its ISEI measure on the highest of the father's or mother's occupation.

18 For details on the construction of this index see Ganzeboom, H., De Graaf, P., and Treiman, D. (1992) and Ganzeboom, H., and Treiman, D. (1996).

[19] See footnote 17. The range of ISEI scores given for the 1988 ISCO occupations listed in Ganzeboom and Treiman (1996) goes from 16, the lowest (agricultural laborer), to 90, the highest (judge).

difference between group averages. Each one-point increase in the ISEI is associated with a specific increase in literacy scores, on average, for each country. The greater this increase in literacy scores in a country, the stronger the relationship between socioeconomic status and literacy scores is in that country.

Figure 17 (page 44; table 3.23) displays the relationship of socioeconomic status to reading, mathematics, and science literacy scores for each participating country. For each country, the relationship between the ISEI and the literacy score is indicated in the table. For example, in the United States each point difference on the ISEI scale is associated with a 2.1 point difference in reading literacy on average. In Japan, socioeconomic background differences in achievement are at a minimum—a one-point difference in ISEI is associated with less than a one-point difference in literacy. By contrast among students in the Czech Republic, Germany, or Hungary, a one-point difference in ISEI is associated nearly a 3 point difference in literacy.[20] An ISEI difference of 50 points is roughly equivalent to the difference in socioeconomic status in the United States between a medical doctor and a motor vehicle mechanic, or an architect and a garbage collector (Ganzeboom and Treiman 1996, appendix A). This 50-point ISEI difference would translate to a score difference of approximately 105 points in reading—more than one level on the literacy scale.

Within any one country, the relationship between socioeconomic status and literacy for each subject may vary. In the United States, the relationship of socioeconomic status to literacy levels is about the same for each subject. By contrast, in France, the relationship of socioeconomic status to literacy varies according to whether that literacy is reading, mathematics or science.

In every subject area, Finland, Iceland, Japan, Korea, and Latvia have a smaller relationship between ISEI and average scores than does the United States. That is, average scores are less affected by a student's socioeconomic background in these countries than they are in the United States. For example, the size of the relationship of socioeconomic background to reading literacy achievement is smaller in Finland, Iceland, Japan, Korea, and Latvia than in the United States. The same countries have smaller relationships between ISEI and average scores in science literacy than the United States does. For mathematics literacy, in addition to those same countries, Canada and Italy also have relationships of ISEI to average scores that are smaller than the relationship in the United States.

There is only one case in which the size of a country's relationship between ISEI and average scores is greater than that in the United States, in Germany for reading literacy. This means that socioeconomic background is associated with a larger change in average scores for reading literacy in Germany than in the United States. In every other case, the size of the relationship between socioeconomic background and average scores in the United States is similar to other countries. Out of 31 countries, the United States has a similar relationship of ISEI to average scores to 24 countries in reading literacy, 23 countries for mathematics literacy, and 25 countries for science literacy.

In short, although a few countries show consistently smaller relationships of socioeconomic background to average scores than does the United States, most of the participating countries do not differ from the United States in terms of the size of the relationship between socioeconomic status and the literacy of their 15-year-olds as measured by PISA 2000.

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[20] Since the ISEI index has a range of 74 points (from 16 to 90), in Japan students with the lowest positions on the socioeconomic index would differ from those with the highest socioeconomic index positions by about 37 points. In the same way, students with the lowest positions on the socioeconomic index in Germany, the Czech Republic, or Hungary would differ from those with the highest by about 192 points, or close to two standard deviations, a substantial difference.

Figure 17.—Relationship between parents' socioeconomic status and combined reading literacy, mathematics literacy, and science literacy scores, by country: 2000

	AVERAGE SCORE POINT INCREASE WITH A ONE UNIT INCREASE ON THE ISEI INDEX		
Country	**Combined reading literacy**	**Mathematics literacy**	**Science literacy**
Australia	1.9	1.8	1.6
Austria	2.2	1.9	2.1
Belgium	2.3	2.3	2.5
Canada	1.6	1.3	1.4
Czech Republic	2.7	2.6	2.6
Denmark	1.8	1.5	2.0
Finland	1.3	1.2	1.1
France	1.9	1.6	2.1
Germany	2.8	2.4	2.5
Greece	1.7	1.9	1.6
Hungary	2.4	2.6	2.7
Iceland	1.2	1.0	0.8
Ireland	1.9	1.6	1.8
Italy	1.6	1.3	1.5
Japan	0.4	0.6	0.5
Korea, Republic of	0.9	1.3	1.2
Luxembourg	2.4	2.0	2.0
Mexico	1.9	1.8	1.6
New Zealand	2.0	1.9	1.9
Norway	1.8	1.6	1.6
Poland	2.2	2.2	2.0
Portugal	2.4	2.1	2.0
Spain	1.6	1.7	1.9
Sweden	1.7	1.9	1.5
Switzerland	2.5	2.1	2.5
United Kingdom	2.4	2.1	2.3
United States	2.1	2.2	2.1
OECD average	2.1	2.0	2.0
Non-OECD countries			
Brazil	1.6	2.0	1.6
Latvia	1.3	0.9	1.2
Liechtenstein	2.0	1.4	2.2
Russian Federation	1.6	1.5	1.5

NOTE: Socioeconomic status is measured by the International Socio-Economic Index (ISEI), a measure based on the occupations of the student's parent(s). The measure used in these analyses was based on the parent with the highest ISEI. Students can be placed anywhere from about 16 to 90 on the ISEI index. The numbers shown in the table indicate the strength of the relationship between the socioeconomic status and literacy in each of reading, mathematics and science. Each number is interpreted as follows: a one-unit difference in ISEI is associated with an n-unit difference in literacy, where 'n' is the number shown in the table. Thus, the larger the number, the greater the association between socioeconomic status and literacy. Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

PARENTS' NATIONAL ORIGIN

Children who are foreign-born or who are children of foreign-born parents face challenges during the process of acculturating and adjusting to a new country, and their achievement in school and general literacy may suffer accordingly (Lollock 2001). Other OECD countries as well as the United States are home to large populations of children whose parents are foreign-born, and it has become an important goal in these countries to prevent the social exclusion of these children from educational and economic opportunity. In the United States, 14 percent of students have both parents born outside the United States.[21] Australia, Canada, Latvia, Liechtenstein, Luxembourg, New Zealand, and Switzerland all have 20 percent or more students with two foreign-born parents. The Czech Republic, Finland, Italy, Iceland, Japan, Poland, and Brazil, in contrast, have 1 percent or less of their students with two foreign-born parents (table A3.24).

Figure 18 (page 46) presents the reading literacy of students in each country by whether their parents were born in that country. The categories are: both parents are born in the country; one parent is native-born and one parent is foreign-born; and both parents are foreign-born.

In the United States and 18 of the 26 other countries with data, students with two foreign-born parents score lower on the combined reading literacy scale than students with two native-born parents. For example, in Belgium, the difference between groups is almost 109 points, while in the United States it is a 40 point gap. Belgium, Germany, Luxembourg, and Switzerland have significantly larger differences between these two groups than the United States. Likewise, in all but six countries, students with two foreign-born parents score lower than those with one native-born and one foreign-born parent. The difference in performance between these two groups in the United States is not significant. In most countries (22 of the 29 countries with data), including the United States, there is no difference between the reading literacy achievement of students with two native-born parents and those with one foreign-born and one native-born parent.

In mathematics literacy, fewer countries have a gap in performance between students with foreign-born parents and the other two groups of students (data not shown; see table A3.25). In 15 of the 26 countries with data, or about half of the PISA 2000 participating countries, including the United States, the difference between students with two foreign-born parents and students with two native-born parents is significant. For the U.S., this gap is about 40 points. There are no differences in the United States between students with two foreign-born parents and those with one native-born and one foreign-born parent, or between students with one native-born and one foreign-born parent and students with two native-born parents. These results suggest that the acquisition of mathematics skills is less influenced by parents' place of birth than is the acquisition of reading skills.

Science literacy varies less by parental nativity than reading literacy, but more than mathematics literacy (data not shown; see table A3.26). In 17 of the 26 countries with data, but not the United States, students with two foreign-born parents perform at lower levels in science literacy than students with two native-born parents. Fifteen-year-olds with one native and one foreign-born parent also outperform students with two foreign-born parents in 17 countries. In only four countries do students with one foreign-born and one native-born parent score differently than those with two native-born parents. In the United States, there is no difference in science literacy by parental nativity.

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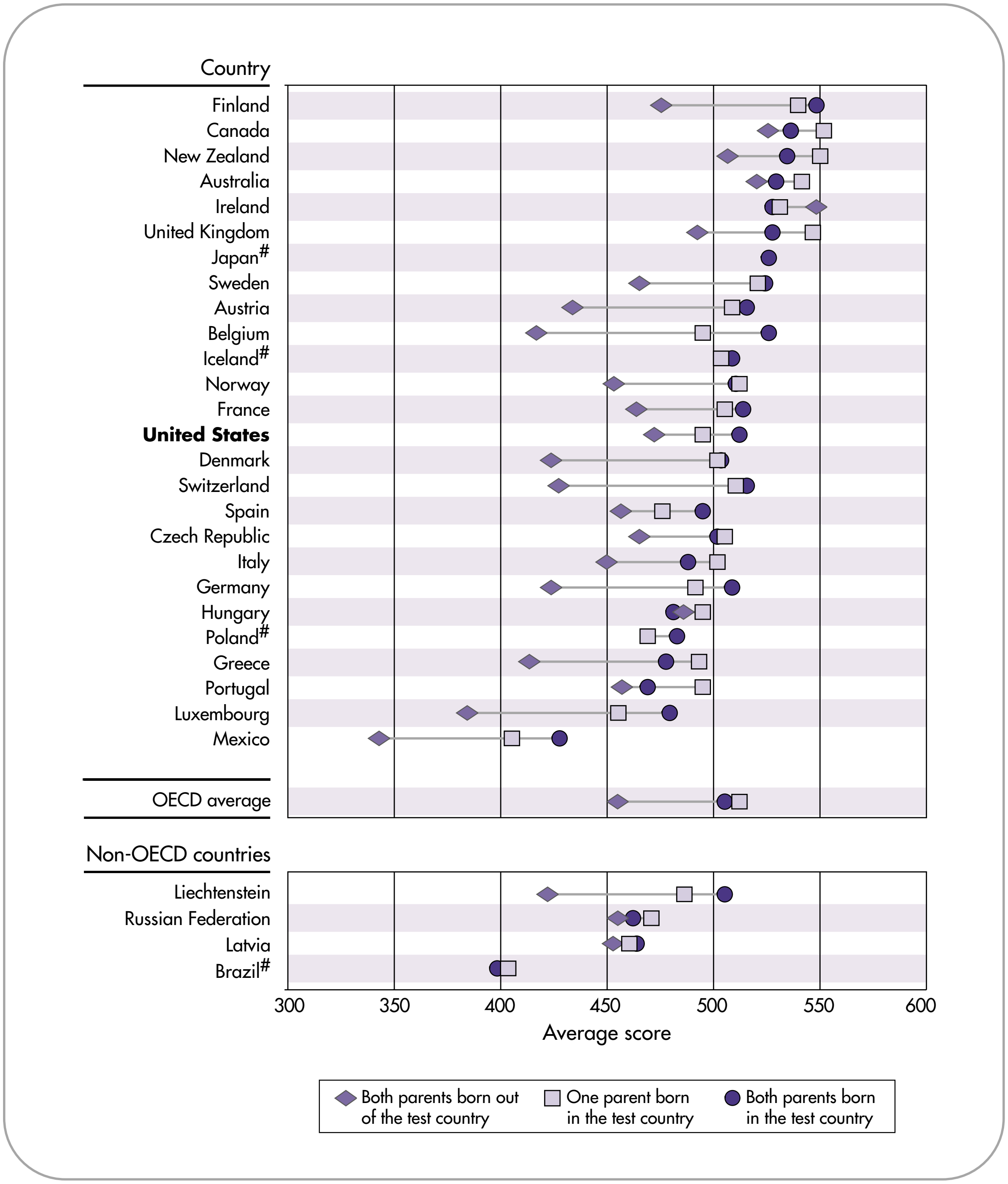
[21] Percentages are for the reading literacy part of the assessment; there are small differences in the percentages reported for reading literacy, mathematics literacy, and science literacy because of slight differences in the numbers of students taking each part of the assessment. For example, in the United States percentages reported for students with both parents born outside the country are 14 percent for reading literacy and science literacy and 13 percent for mathematics literacy.

Figure 18.—Differences in combined reading literacy scores of 15-year-olds by parents' national origin, by country: 2000



#Data for country in one or more reporting categories are too small to report.

NOTE: The points on each line displayed above represent the national averages for students based on their parents' national origin: students with both parents born in the test country, students with one parent born in the test country, and students with parents both born outside of the test country. For example, U.S. students whose parents were born in the United States averaged a score of 512 in reading literacy compared to 494 for students with one parent born in the United States, and 472 for students whose parents were born outside of the United States. Data for the Republic of Korea are not available. Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 26 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

LANGUAGE SPOKEN AT HOME

Over the last two decades, the percentage of students in U.S. schools speaking a language other than English at home has more than doubled to 17 percent in 1999 (Federal Interagency Forum on Child and Family Statistics 2001). These students may face greater challenges progressing in school and in the labor market, once they leave school (Federal Interagency Forum on Child and Family Statistics 2001). The United States is not unique in this respect. Other OECD nations are also educating students whose first language is not the language of instruction in the country and/or who speak another language at home.

Students who speak a language at home other than the language in which the assessment is given may be more likely to lack a facility in the language of the assessment, which could affect performance in reading, mathematics, and science literacy. In PISA 2000, students were asked what language they speak at home most of the time—the language of the assessment, English, or another language.[22] Two countries, Hungary and Korea, do not report information for this question. One other, Japan, has numbers of students reporting speaking a language other than Japanese that are too small to reliably estimate scores for that group. The percentage of students who respond that they speak the test language most of the time at home ranges from 69 percent in Canada to 99 percent in Brazil. In the United States, 89 percent of students report that they speak the language of the assessment (English) at home most of the time (table A3.27).[23]

Dividing students into two categories—those who speak the test language at home most of the time, and those who do not—allows a comparison of their performance. Achievement differences between these two groups are shown in figure 19 (tables A3.27, A3.28, and A3.29) for reading, mathematics, and science literacy in each of the participating nations.

In most countries, there is a gap in reading achievement for students who speak a language other than the assessment language at home. Except for Brazil, the Czech Republic, Ireland and Spain, the reading achievement of students who speak the test language at home is higher than that of students not speaking this language at home. The size of the difference is similar to that of the United States for most countries; however, Australia, Belgium, and Canada show a smaller achievement difference than the difference between these groups of students in the United States.

The second graph in figure 19 (page 48) displays the differences in performance for mathematics literacy by the language spoken in the home. Again, students who speak the language of the test show an advantage in most countries. Nineteen of the 28 nations that report results show an advantage for test-language speakers in mathematics literacy, including the United States. In two countries, Canada and Spain, the difference favors students who do not speak the language of the test at home “most of the time.” Six countries (Australia, Belgium, Canada, Finland, Italy, and Spain) have smaller achievement differences in mathematics literacy between students who speak the test language and those who do not than does the United States. The U.S. difference between test and non-test language speakers is larger than the OECD average difference for mathematics literacy.

The third graph in figure 19 displays the differences between the two language-defined groups in science literacy achievement. As in the case of reading and mathematics, the findings point to an advantage in speaking the language

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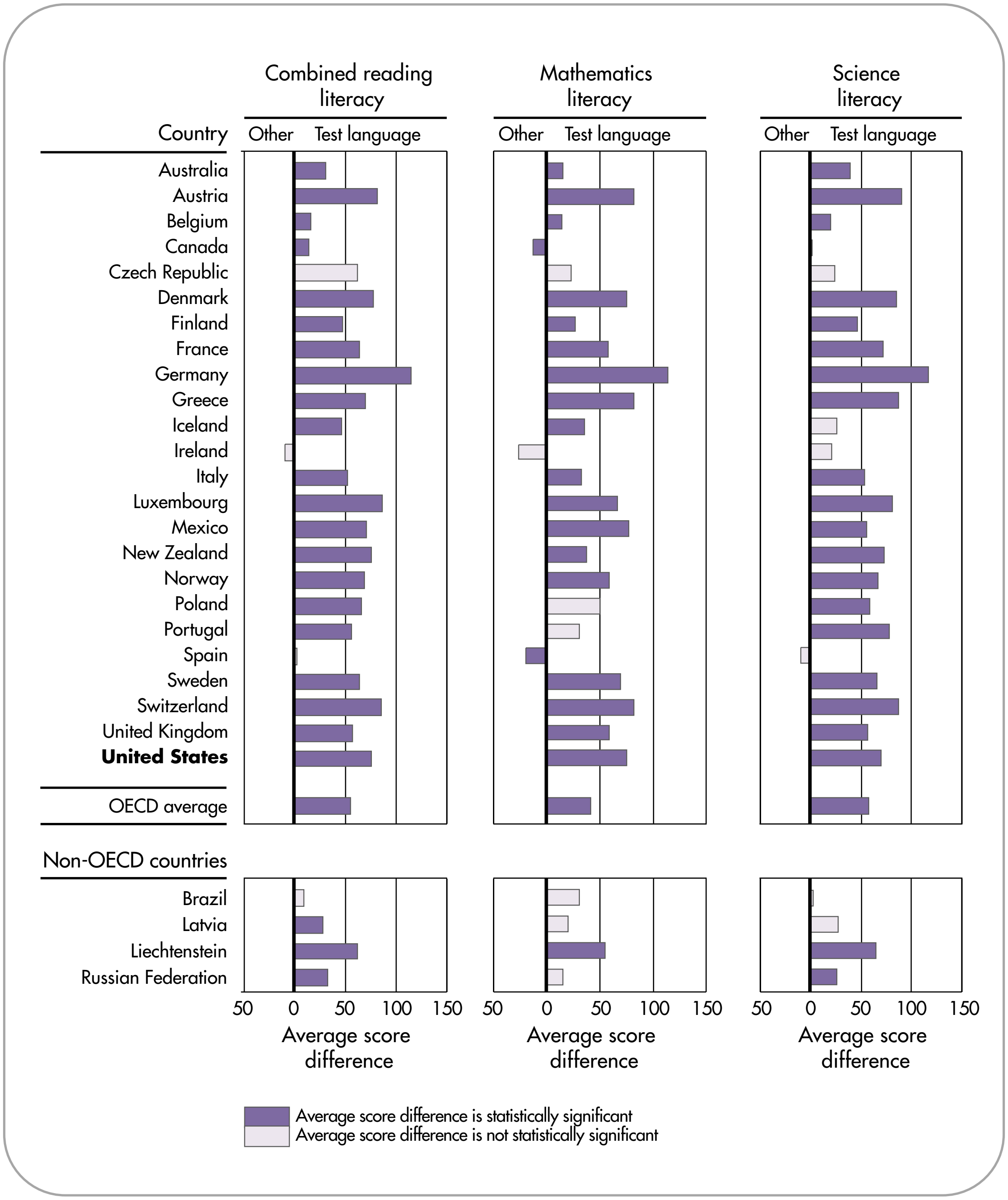
[22] Other PISA countries included response options for students to choose an official national language or a national dialect. In this report, for these countries, all these responses are grouped as languages other than the test language.

[23] See footnote 21.

Figure 19.—Differences in combined reading literacy, mathematics literacy and science literacy scores of 15-year-olds by language spoken at home, by country: 2000



NOTE: Each bar above represents the average score difference on combined reading, mathematics or science literacy between students who speak the test language at home and those who speak another language. Some of these differences are statistically significant and indicated by darker bars. For example, in the United States, students who speak English at home outperform students who speak another language at home in all three subject areas. These score differences are 76 points in combined reading literacy, 73 points in mathematics literacy and 68 points in science literacy. Data for Hungary and the Republic of Korea are not available. Data for Japan on students who speak other languages at home are too small to report, and therefore, data for Japan are not presented. Average score difference is calculated by subtracting the average score for those who speak other languages at home from average scores for those who speak the test language at home in each country. Detail may not sum to totals due to rounding. Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 25 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

of the test. In 21 of the 28 nations that report results for this question, including the United States, test-language speakers perform better than speakers of other languages. The remaining countries show no differences in performance for science literacy. Belgium has a smaller difference between these groups than the United States does.

Overall, while there is some variability among countries in this respect, in the United States and in most other countries, the language that students speak at home is linked to their performance on PISA 2000's reading, mathematics, and science literacy assessments.

RACE AND HISPANIC ORIGIN

Differences in performance by race and Hispanic origin on the National Assessment of Educational Progress (NAEP) have been documented for more than two decades (Campbell et al. 1996). White students tend to score higher on assessments than Blacks and Hispanics.[24] This same pattern emerges from the U.S. components of international assessments as well (Binkley and Williams 1996; Gonzales et al. 2000). A substantial amount of research addresses these between-group differences, focusing on social and economic background, differences in quality of social and educational environments, and inequality of opportunity brought on by direct and indirect discriminatory practices (Wilson 1996; Hedges and Nowell 1999).

Racial and ethnic groups vary between countries, so it is not possible to compare their performance across countries on international assessments. Thus this section refers only to findings for the United States. Students' race and Hispanic origin is obtained through student responses to a two-part question. Students are asked first whether they are Hispanic, and then asked whether they are members of the following racial groups—American Indian/Alaska Native, Asian, Black or African American, Native Hawaiian or Pacific Islander, or White. Multiple responses are allowed so students can be identified as multiracial. Students identifying themselves as Hispanic and also Black or White are included in the Hispanic group. Because of small numbers of students, all identifications other than the three major groups of White, Black, and Hispanic are grouped as "other." This includes multiracial students. Comparisons among these four groups are presented for reading, mathematics, and science literacy using these categories.

Figure 20 (page 50; table A3.30) displays the average performance levels of U.S. 15-year-olds in reading, mathematics, and science literacy for each of the four identified racial and ethnic groups. The chart presents a comparison of each group by each other group. Average scores for each group appear to the right of the chart. The letters in the chart indicate (by the first letter of the word for the group) differences in achievement between groups being compared. In reading literacy, for example, Whites outperform both Hispanics and Blacks.

Figure 20 makes it clear that the pattern of between-group differences is identical across the three literacy areas. In reading, mathematics, and science, the average literacy scores for Whites and other students are higher than for Hispanic and Black students. This pattern of performance on PISA 2000 by race and Hispanic origin is similar to that on NAEP and other assessments (Campbell et al. 1996).

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[24] Whites refers to non-Hispanic Whites and Blacks to non-Hispanic Blacks.

Figure 20.—Comparisons of reading, mathematics and science literacy average scores of U.S. 15-year-olds, by race/ethnicity: 2000

Combined reading literacy

	White	Other	Hispanic	Black	Student group average
White students			W	W	538
Other students*			O	O	504
Hispanic students	W	O			449
Black students	W	O			445

Mathematics literacy

	White	Other	Hispanic	Black	Student group average
White students			W	W	530
Other students*			O	O	495
Hispanic students	W	O			437
Black students	W	O			423

Science literacy

	White	Other	Hispanic	Black	Student group average
White students			W	W	535
Other students*			O	O	510
Hispanic students	W	O			438
Black students	W	O			435

W White students outperformed compared racial/ethnic group
O Other students outperformed compared racial/ethnic group
☐ No significant score differences between compared groups

*The "other" group comprises students identifying themselves as American Indian/Alaska Native, Asian, Native Hawaiian/Pacific Islander, or multiracial since numbers of these students are too small to report by individual categories.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Program for International Student Assessment (PISA), 2000.

SUMMARY

Just as the chapters on reading, mathematics, and science literacy began with a simple measure of average performance for a country and then presented additional information on how performance varies within and between countries, this chapter shows further variations in performance based on background characteristics of 15-year-olds. Most comparisons are both within and across nations, although comparisons by race and Hispanic origin are for the United States only. The next chapter will show some of the initial steps PISA has taken to measure general outcomes of learning such as attitudes toward learning and learning strategies, and will continue some of the discussion begun in this chapter about gender differences in learning outcomes.

Chapter 5

CROSS-CURRICULAR COMPETENCIES AND THE FUTURE OF PISA

Key Findings

- Thirty percent of U.S. 15-year-olds agree or strongly agree that reading is a favorite hobby, a lower percentage than the OECD average. Percentages range from 62 percent of students agreeing that reading is a favorite hobby in Mexico to 24 percent in Norway (figure 21; table A3.31).

- In every country, females agree more frequently than males that reading is a favorite hobby. Thirty-seven percent of females in the United States agree that reading is a favorite hobby, compared to 22 percent of males (figure 22; table A3.31).

- About half of U.S. 15-year-olds report trying to memorize as much as possible often or always when studying. The U.S. percentage in this case is higher than the OECD average, suggesting that a greater proportion of U.S. students often use memorization as a learning strategy than the average proportion of OECD country students (figure 23; table A3.32).

- The percentages of students who respond that they often or always try to relate new material to things they have already learned range from 15 percent in Italy to 90 percent in Hungary. Fifty-nine percent of U.S. students report using this strategy frequently, a higher percentage than the OECD average (figure 25; table A3.33).

One of PISA's main objectives is to measure student performance on general or nonacademic learning outcomes in addition to outcomes for reading, mathematics, and science literacy. These "cross-curricular competencies," or CCCs, will have a growing importance in PISA as it develops over time. The measurement of these kinds of competencies is part of PISA's mission to measure a variety of important knowledge and skills needed in adult life.

In 2003, for example, PISA will assess students' abilities to solve problems. Plans for PISA 2006 include the development of an assessment of students' abilities to use information and communications technologies.

As a first step toward the measurement of cross-curricular competencies, in PISA 2000, student questionnaire items sought information in two major learning areas, student attitudes toward learning and learning strategies. These data can be viewed both as an input for student learning as well as outcomes of students' school and life experiences up until the age of 15. For example, are certain kinds of learning strategies associated with higher performance in reading, mathematics, or science literacy? By the age of 15, what kind of learning strategies and what kinds of attitudes toward learning do students have? This chapter will present information on student reports for questions related to these topics, including some discussion of gender differences.[25]

ATTITUDES TOWARDS READING

Proficiency scores for reading literacy describe how well 15-year-olds can apply a variety of reading processes in different kinds of situations. They do not address, however, students' attitudes toward reading or how likely students are to apply their reading literacy skills. To develop a fuller picture of what 15-year-old students are like as learners, PISA 2000 also included a number of questions for students about their attitudes toward reading and math and time spent reading. Only information related to reading is discussed here.[26]

One indication of how students view reading and how important it is to them is the extent to which they read in their free time (figure 21). PISA 2000 asked students to provide information on this issue by rating the statement "Reading is one of my favorite hobbies."[27]

Thirty percent of U.S. students agree or strongly agree that reading is a favorite hobby, a lower percentage than the OECD average. Percentages range from 62 percent of students agreeing that reading is a favorite hobby in Mexico to 24 percent in Norway.

In the United States and in every other country, females agree more frequently than males that reading is a favorite hobby (figure 22, page 54; table A3.31). Thirty-seven percent of females in the United States agree that reading is a favorite hobby, compared to 22 percent of males. In a number of countries (Austria, Canada, Czech Republic, Finland, Germany, Ireland, Portugal, and Switzerland), the difference between males and females is greater than in the United States.

By the age of 15, greater proportions of young people in other OECD countries cite reading as a favorite pastime than in the United States. Why do greater percentages of non-U.S. students say this? Also, why do more females consider

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[25] Analysis of attitudes toward learning and learning strategies was limited to differences by gender for this initial report on PISA 2000 because of the restricted nature of the measures of the cross-curricular competencies discussed in this report. Differences for other population subgroups (such as racial or ethnic groups) could be analyzed in future reports or cycles of PISA.

[26] PISA 2000 created indices of interest in reading and mathematics from a series of student questions. Only an illustrative question is discussed here. For further information about these indices, see the PISA international report *Knowledge and Skills for Life — First Results from the OECD Programme for International Student Assessment* (OECD 2001).

[27] In interpreting these results, readers should keep in mind that these are students' own descriptions of their behaviors, and that differences in responses may be in part attributable to cultural differences or social norms in participating countries.

Figure 21.—Percentage of 15-year-olds who agree or strongly agree that reading is a favorite hobby, by country: 2000

Country	Percent
Mexico	62
Portugal	54
Czech Republic	52
Italy	45
Finland	41
Poland	39
Greece	37
Japan	36
Ireland	36
Spain	35
Switzerland	35
Korea, Republic of	35
Canada	34
New Zealand	33
France	33
Luxembourg	31
Australia	31
Denmark	31
Austria	30
United States	30
United Kingdom	30
Sweden	29
Hungary	29
Germany	29
Iceland	27
Belgium	26
Norway	24
OECD average	35
Non-OECD countries	
Brazil	49
Latvia	37
Liechtenstein	31
Russian Federation	43

▨ Percentage is significantly higher than the U.S. percentage
☐ Percentage is not significantly different from the U.S. percentage
■ Percentage is significantly lower than the U.S. percentage

NOTE: Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

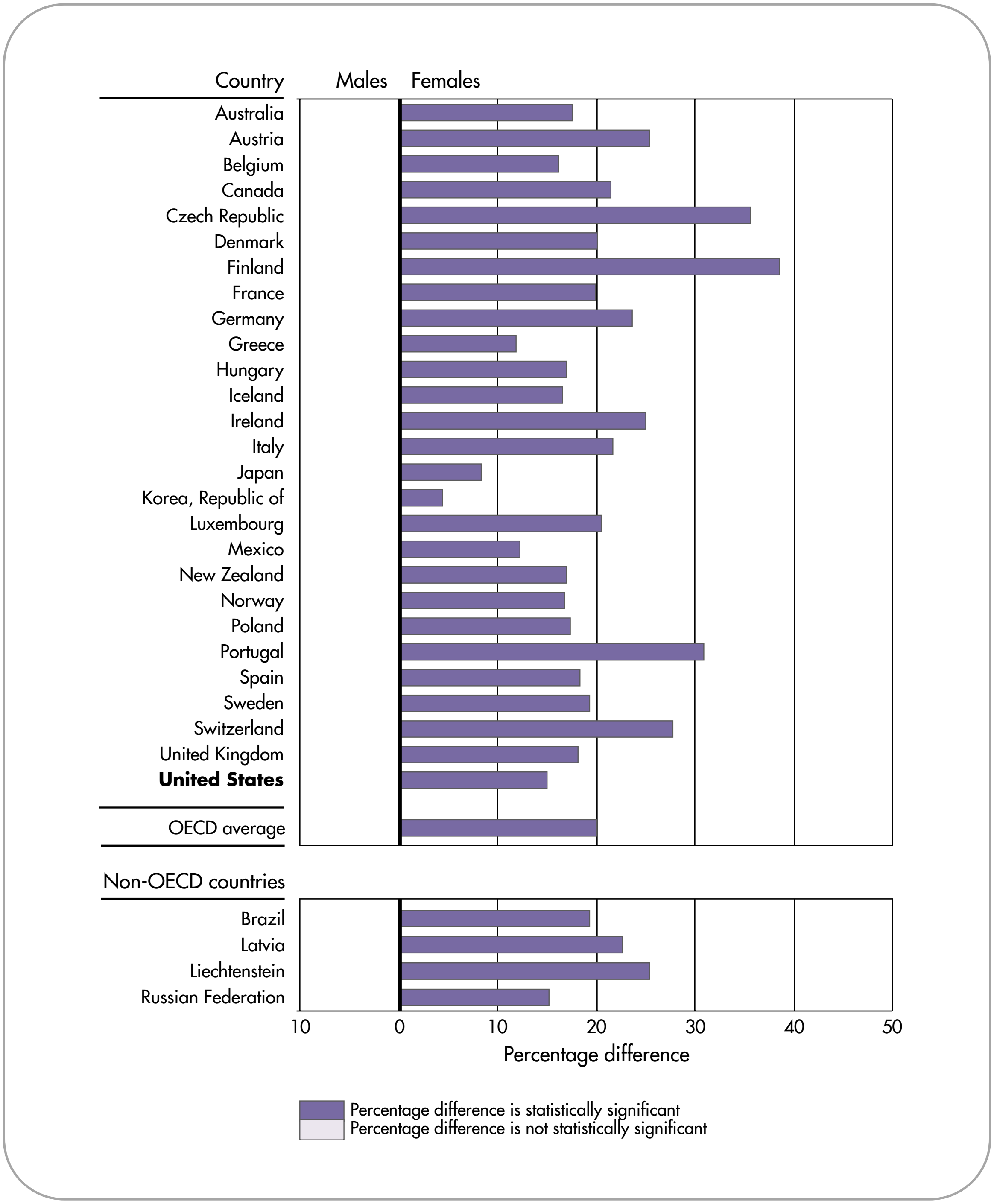
SOURCE: Organization for Economic Cooperation and Development, Program for International Student Assessment (PISA) 2000.

reading a favorite hobby both in the United States and elsewhere? These data raise more questions than PISA 2000 alone can answer, but further study of this issue could hold lessons for schools, parents, and policymakers about reading.

LEARNING STRATEGIES

The idea of lifelong learning has become an important part of the educational landscape in the past few years. The notion is that formal

Figure 22.—Percentage differences by gender of 15-year-olds who agree or strongly agree that reading is a favorite hobby, by country: 2000



NOTE: Each bar above represents the difference in percentages of males and females in each country who agree or strongly agree that reading is a favorite hobby. These differences are statistically significant in every country and indicated by darker bars. For instance, in the United States, 15 percent more females than males agree or strongly agree that reading is a favorite hobby, a difference that is statistically significant. Average percentage difference is calculated by subtracting percentage of males who agree from percentage of females who agree. Detail may not sum to totals due to rounding. Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 27 OECD countries. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

schooling cannot provide all of the knowledge and skills that people will need throughout their lives, and that people need to continue to learn (both formally and informally) for their own individual social and economic well-being and for the well-being of their societies. Acknowledging that students cannot learn everything they need for success in life in school, PISA recognizes that students must at least develop the prerequisites for successful learning. Research shows that these prerequisites are cognitive and motivational in nature and that several dimensions (i.e., beliefs, attitudes) are related to self-regulated learning (Baumert et al., 1998). The PISA instrument on self-regulated learning focused on three of these dimensions—learning strategies, motivation, and self-concept. The previous section touched upon motivation; this section focuses on learning strategies.

PISA 2000 provides initial information on the different strategies for learning that students report using. This information can provide some insight into how schools and societies have shaped young people's approaches to learning and how students see themselves as learners. Young people may take these approaches to learning with them into adulthood, and awareness of what learning strategies they use may help them to be successful learners in the future.

To collect this information, PISA 2000 offered participating countries a series of optional questions for students on their learning strategies. Questions related to learning strategies focused on several areas: control of learning, use of memorization and elaboration strategies, and the use of competitive or cooperative strategies for success. Only information related to the use of memorization and elaboration strategies is discussed here.[28]

To gauge students' use of memorization strategies when studying, PISA 2000 asked students to reply to the question "I memorize as much as possible" by choosing one of four possible responses: never, sometimes, often, or always.[29]

About half (49 percent) of U.S. 15-year-olds report trying to memorize as much as possible often or always when studying (figure 23, page 56). The U.S. percentage in this case is higher than the OECD average, suggesting that a greater proportion of U.S. students often use memorization as a learning strategy than the average proportion of OECD country students.

In the United States, about the same percentages of males and females (50 percent of females and 48 percent of males) say they often or always try to memorize as much as possible when studying (figure 24, page 57; table A3.32). Fourteen other countries (of the 25 countries reporting data) also have similar percentages of males and females reporting this strategy, but the remaining 10 other countries that report information on the use of memorization all have more males than females who say they use this strategy.

As a contrast to memorizing while studying, PISA 2000 also asked students to reply to the question "I try to relate new material to things I have already learned in other subjects," using the same response categories noted above for memorization: never, sometimes, often, and always. PISA 2000 considers this type of question as an indication of use of "elaboration" strategies.

Percentages of students who respond that they often or always try to relate new material to things they have already learned range from 15 percent in Italy to 90 percent in Hungary. Fifty-nine percent of U.S. students (figure 25, page 58)

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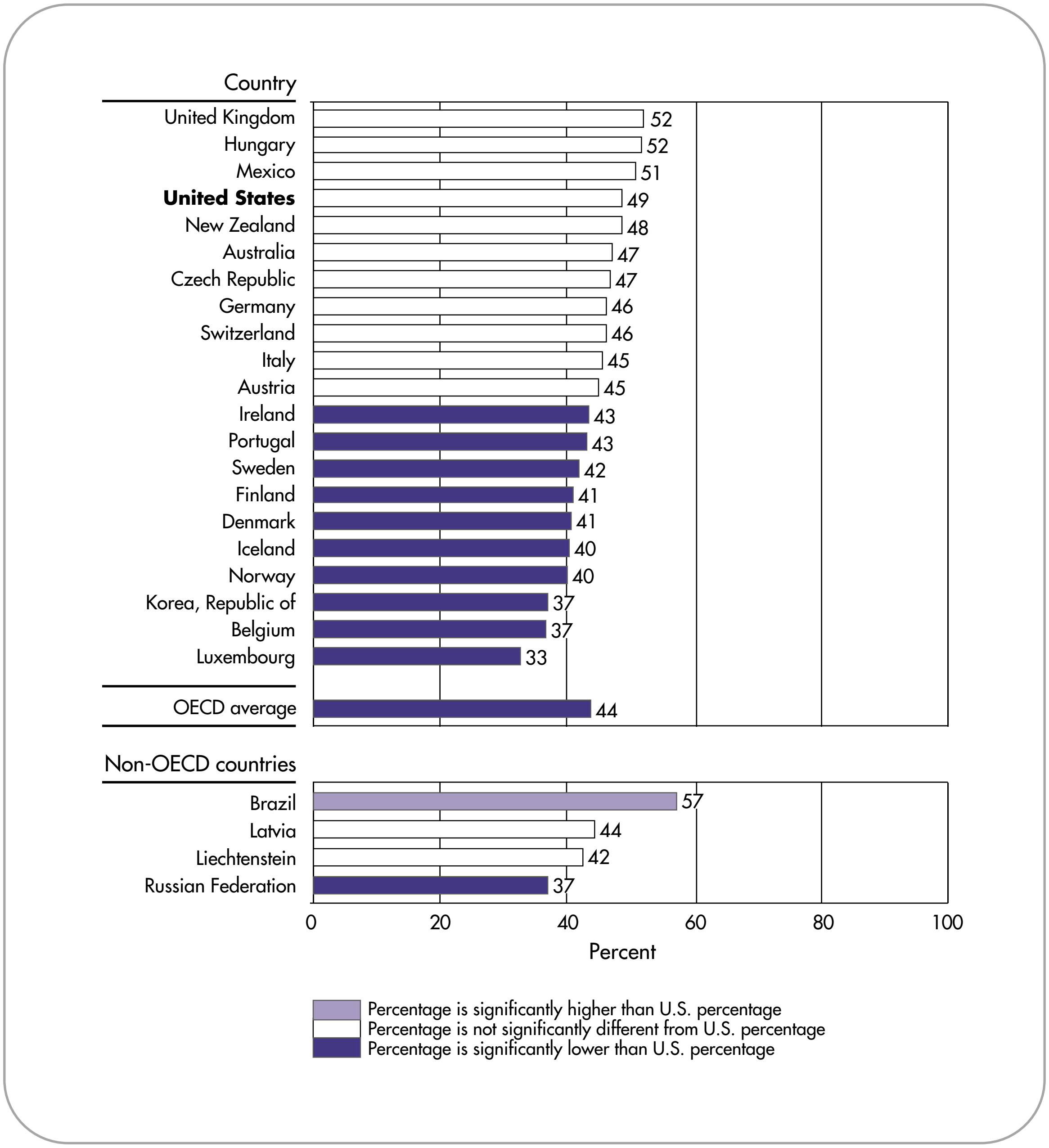
[28] Elaboration strategies refer to students' relating information they are trying to learn to things they already know or have learned, or trying to relate new things to real world situations. PISA 2000 created indices for memorization and elaboration from a series of student questions. Only responses to two illustrative questions are discussed here. For further information on learning strategies or other cross-curricular competencies, see the PISA international report *Knowledge and Skills for Life—First Results from the OECD Programme for International Student Assessment* (OECD 2001). An in-depth report on these topics is planned to be published in 2002.

[29] Questions on learning strategies were optional, and not all countries report data for this question. Canada, France, Greece, Japan, Poland, and Spain do not report results.

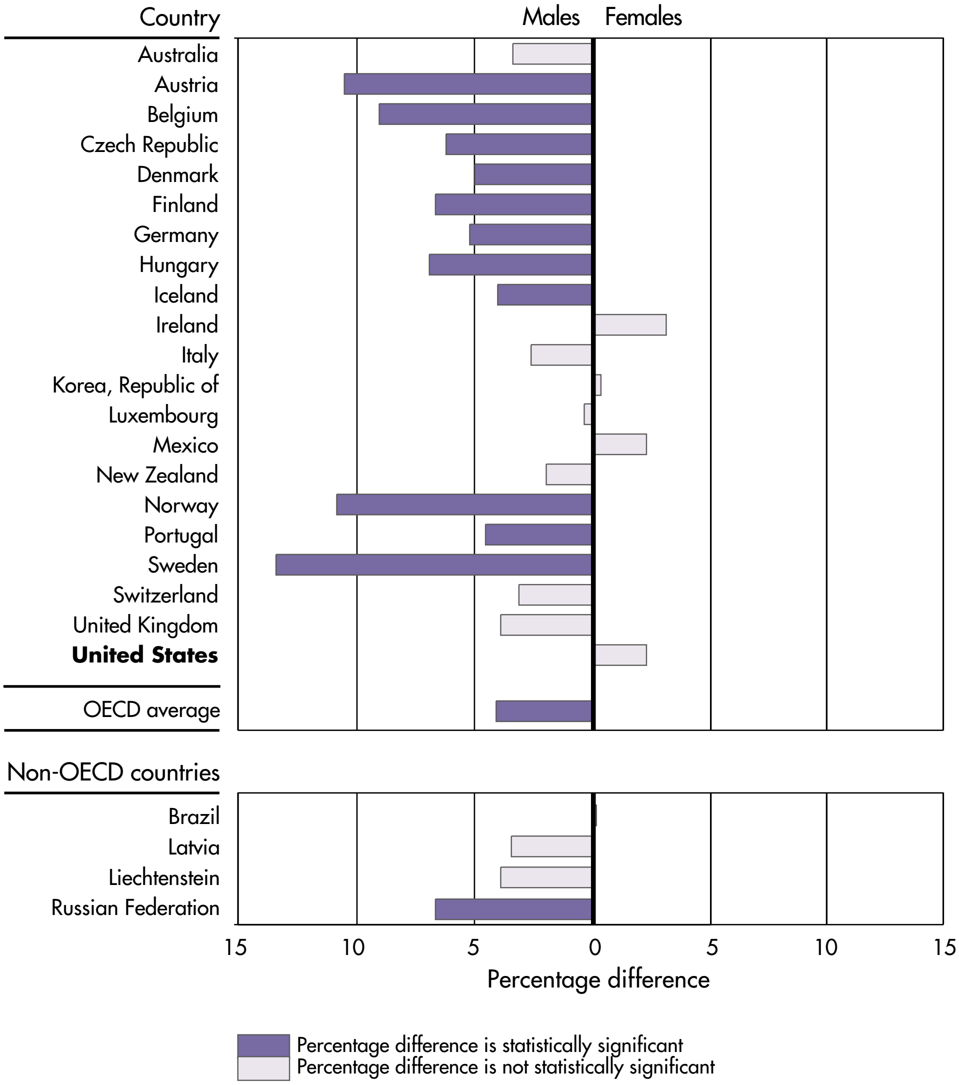
Figure 23.—Percentage of 15-year-olds who report memorizing often or always when studying, by country: 2000



NOTE: Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 21 OECD countries. The other participating OECD countries did not collect data for this question. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

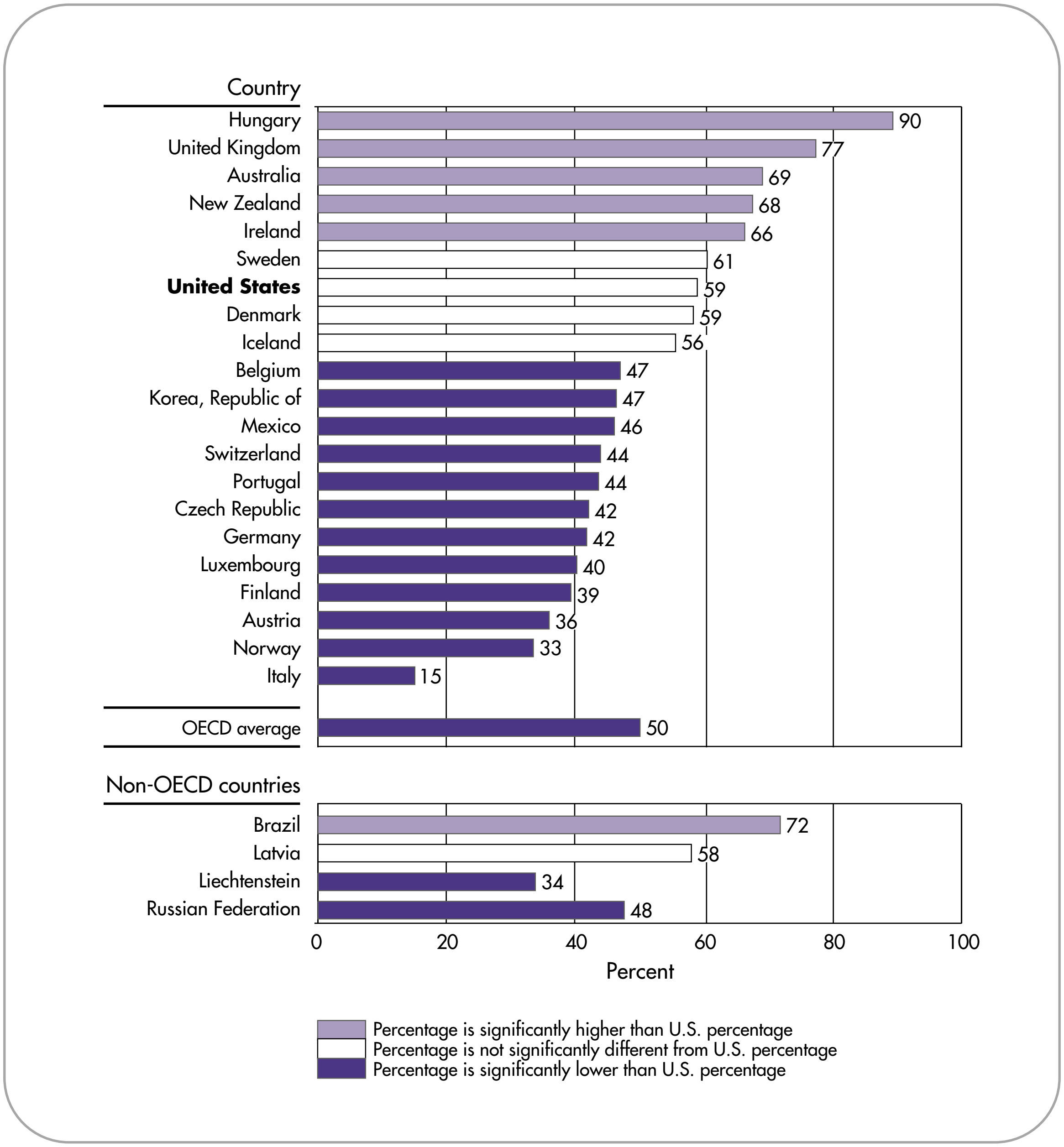
Figure 24.—Percentage differences by gender of 15-year-olds who report memorizing often or always when studying, by country: 2000



NOTE: Each bar above represents the difference in percentages of males and females in each country who say the use memorization often or always. Some of these differences are statistically significant and indicated by darker bars. In the United States, 2 percent more females than males state they use memorization often or always, a difference that is not statistically significant and indicated by a lighter bar. Average percentage difference is calculated by subtracting percentage of males who agree from percentage of females who agree. Detail may not sum to totals due to rounding. Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 21 OECD countries. The other participating OECD countries did not collect data for this question. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

Figure 25.—Percentage of 15-year-olds who report using an elaboration strategy often or always when studying, by country: 2000



NOTE: Elaboration refers to students' relating information they are attempting to learn to things they already know or have learned. Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 21 OECD countries. The other participating OECD countries did not collect data for this question. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

report using this strategy frequently, a higher percentage than the OECD average.

Within the United States, a higher proportion of females (61 percent) than males (57 percent) say they frequently try to relate new material to things they have already learned. This difference between females and males is also evident in eight other countries (figure 26, page 60; table A3.33). Six countries show the opposite pattern, in which greater percentages of males than females report frequently trying to relate new material to things they have already learned, and the remaining countries show no differences between males and females.

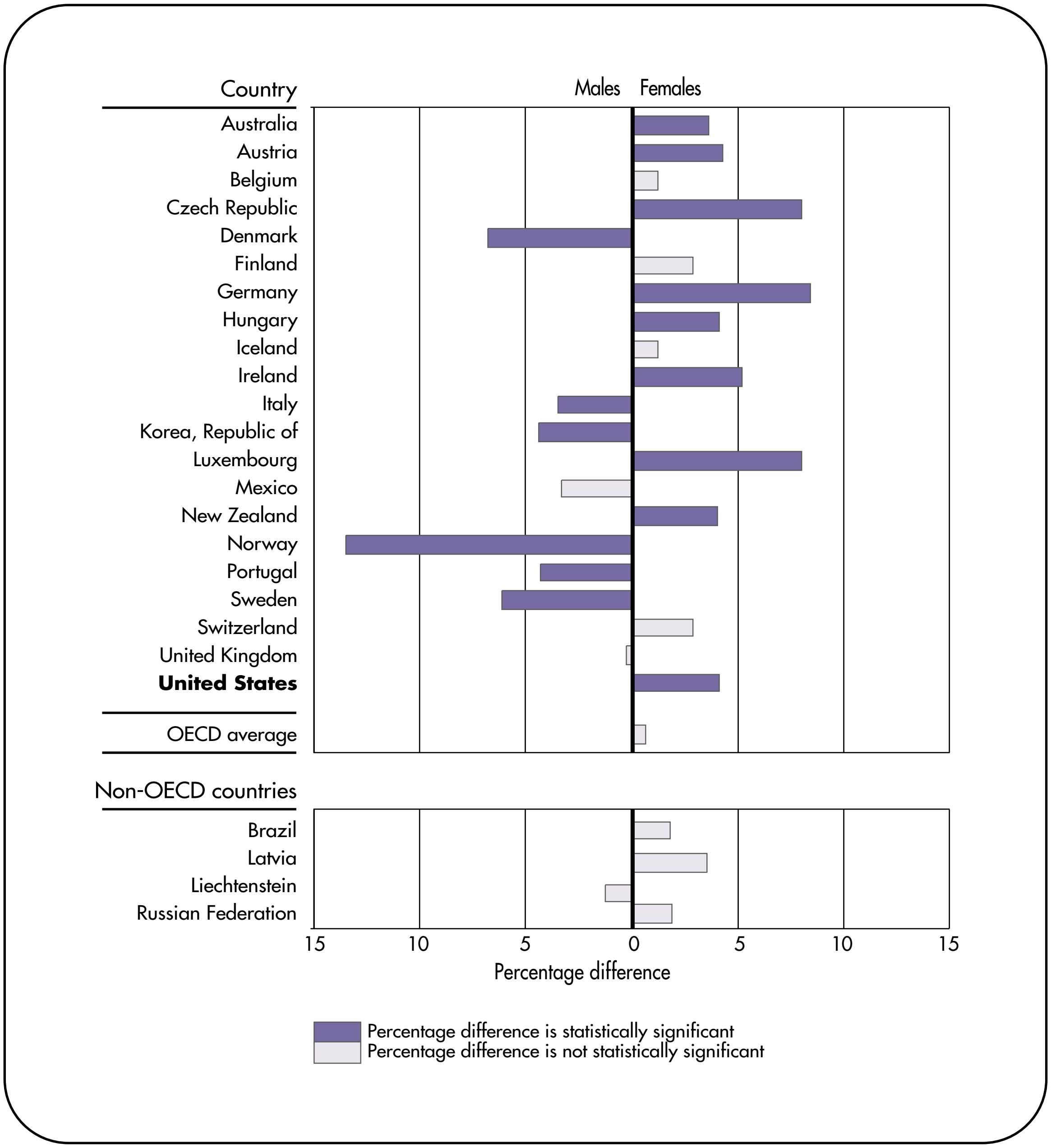
Memorization and elaboration strategies are, of course, not mutually exclusive learning approaches, and about half of U.S. 15-year-olds report using each of these strategies frequently. In both cases, the U.S. percentage is higher than the OECD average percentage. For the U.S., greater percentages of females than males report using each strategy frequently. Again, this preliminary information from PISA 2000 raises more questions than it can answer. Why do greater proportions of females in the United States report using elaboration as a strategy? Why do higher percentages of U.S. students report trying to memorize as much as possible than in other OECD countries? What can this tell us about how 15-year-olds think about learning? How might these learning strategies affect students as they continue on in their lives?

THE FUTURE OF PISA

As noted above, as PISA develops over time, it is planned that general outcomes of learning or cross-curricular competencies will come to play a greater role and that the measures of reading literacy, mathematics literacy, and science literacy will be continually refined and improved.

This report provides an initial look at results from PISA 2000 from a U.S. perspective. As mentioned, the Organization for Economic Cooperation and Development (OECD) has also published a report describing results from PISA 2000. Additionally, over the next 2 years, the OECD will publish a series of additional reports addressing specific themes or questions from PISA 2000 in greater detail. These reports will include an in-depth look at reading literacy, and will also deal in greater depth with issues such as gender and socioeconomic status. Data from PISA 2000 will also be made available to the public and to researchers. As with any international study, PISA's value is largely determined by the countries participating in it. Hopefully, the information contained in this report will be interesting and useful for U.S. policymakers, researchers, and the public.

Figure 26.—Percentage differences by gender of 15-year-olds who report using an elaboration strategy often or always when studying, by country: 2000



NOTE: Elaboration refers to students' relating information they are attempting to learn to things they already know or have learned. Each bar above represents the difference in percentages of males and females in each country who say they use an elaboration strategy often or always. Some of these differences are statistically significant and indicated by darker bars. For instance, in the United States, 4 percent more females than males state they use an elaboration strategy often or always, a difference that is statistically significant. Average percentage difference is calculated by subtracting percentage of males who agree from percentage of females who agree. Detail may not sum to totals due to rounding. Although the Netherlands participated in the Program for International Student Assessment (PISA) in 2000, technical problems with its sample prevent its results from being discussed here. For information on the results for the Netherlands, see OECD (2001). The OECD average is the average of the national averages of 21 OECD countries. The other participating OECD countries did not collect data for this question. Because PISA is principally an OECD study, the results for non-OECD countries are displayed separately from those of the OECD countries and not included in the OECD average.

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

REFERENCES

Adult Literacy and Lifeskills survey. (2001a). *Numeracy Framework*. Retrieved November 14, 2001 from: ftp://etsis1.ets.org/pub/corp/Numeracy%20Framework.pdf

—(2001b). *Prose and Document Literacy Framework*. Retrieved November 14, 2001 from: ftp://etsis1.ets.org/pub/corp/Prose-final.pdf

Berktold, J., Geis, S., and Kaufman, P. (1998). *Subsequent Educational Attainment of High School Dropouts* (NCES 98–085). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Braswell, J.S., Lutkus, A.D., Grigg, W.S., Santpau, S.L., Tay-Lim, B., and Johnson, M. (2001). *The Nation's Report Card: Mathematics 2000* (NCES 2001–517). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Baumert, J., Fend, H., O'Neil, H.F., and Peschar, J.L. (1998). *Prepared for Lifelong Learning: Frame of Reference for the Measurement of Self-Regulated Learning as a Cross-Curricular Competence (CCC) in the PISA Project*. Paper presented at the 19th meeting of Network A, October 27-29, 1999, Echternach, Luxembourg.

Peschar, J.L., Veenstra, R., and Molenaar, I.W. (1999, October). *Self-Regulated Learning as a Cross Curricular Competency: The Construction of Instruments in 22 Countries for the PISA Main Study 2000 Synthesis Report*. Paper presented at the 19th meeting of Network A, Echternach, Luxembourg.

Binkley, M. (1994). *Reading Literacy in the United States: Technical Report* (NCES 94–259). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Binkley, M., and Williams, T. (1996). *Reading Literacy in the United States: Findings from the IEA Reading Literacy Study* (NCES 96–258). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Campbell, J., Reese, C., O'Sullivan, C., and Dossey, J. (1996). *NAEP 1994: Trends in Academic Progress* (NCES 97–095). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Campbell, J.R., Kelly, D.L., Mullis, I.V.S., Martin, M.O., and Sainsbury, M. (2001). *Framework and Specifications for PIRLS Assessment 2001*. Chestnut Hill, MA: Boston College.

Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartland, J., Mood, A.M., Weinfeld, F.D., and York, R.L. (1966). *Equality of Educational Opportunity*. U.S. Department of Health, Education, and Welfare. Washington, DC: U.S. Government Printing Office.

Donahoe, P.L., Finnegan, R.J., Lutkus, A.D., Allen, N.I., and Campbell, J.R. (2001). *The Nation's Report Card: Fourth Grade Reading, 2000* (NCES 2001–499). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Elley, W. (1992). *How in the World Do Students Read?* Amsterdam: International Association for the Evaluation of Educational Achievement.

Federal Interagency Forum on Child and Family Statistics. (2001). *America's Children: Key National Indicators of Well-Being, 2001*. Federal Interagency Forum on Child and Family Statistics. Washington, DC: U.S. Government Printing Office.

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

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

Gibson, C. and Lennon, E. (1999). *Historical Census Statistics on the Foreign-born Population of the United States: 1850–1990* (working paper 29). U.S. Department of Commerce. Washington, DC: U.S. Census Bureau.

Gonzales, P., Calsyn, C., Jocelyn, L., Mak, K., Kastberg, D., Arafeh, S., Williams, T., and Tsen, W. (2001). *Pursuing Excellence: Comparisons Of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999* (NCES 2001–028). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Hedges, L.V. and Nowell, A. (1999). Closing the Black-White Gap In Achievement Test Scores. *Sociology of Education*, *72* (2): 111–135.

Hernandez, D.J. (1993). *America's Children: Resources from Family, Government, and the Economy*. New York: Russell Sage Foundation.

Lippman, L., Burns, S., and McArthur, E. (1996). *Urban Schools: Challenge of Location and Poverty* (NCES 96–184). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Lollock, L. (2001). *The Foreign Born Population in the United States: March 2000*, (Current Population Reports, P20–534). U.S. Department of Commerce. Washington, DC: U.S. Census Bureau.

Martin, M.O., Gregory, K.D., and Stemler, S.E. (Eds.). (2000). *TIMSS 1999 Technical Report*. Chestnut Hill, MA: Boston College.

Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Gregory, K.D., Smith, T.A., Chrostowski, S.J., Garden, R.A., and O'Connor, K.M. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Chestnut Hill, MA: Boston College.

McArthur, E. (1993). *Language Characteristics and Schooling in the United States, A Changing Picture: 1979 to 1989* (NCES 93–699). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Mullis, I., Martin, M., Fierros, E., Goldberg, A., and Stemler, S. (2000). *Gender Differences in Achievement*. Chestnut Hill, MA: Boston College.

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

Organization for Economic Cooperation and Development. (1998). *Education at a Glance*. Paris: Author.

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

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

Organization for Economic Cooperation and Development. (2001, April 18–20). *Described Proficiency Scales for PISA 2000*. Discussion document presented at the PISA Board of Participating Countries meeting, Paris, France.

Robitaille, D.F., Schmidt, W.H., Raizen, S., McKnight, C., Britton, E., and Nicol, C. (1993). *Curriculum Frameworks for Mathematics and Science*. TIMSS monograph no. 1. Vancouver, BC: Pacific Education Press.

Snyder, T.D. (1991). *Youth Indicators, 1991* (PIP 91-863). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Snyder, T.D., and Shafer, L. (1996). *Youth Indicators 1996* (NCES 96–027). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Snyder, T.D., and Hoffman, C.M. (2001). *Digest of Education Statistics 2000* (NCES 2001–034). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Treiman, D. (1977). *Occupational Prestige in Comparative Perspective*. New York: Academic Press.

West, J., Denton, K., and Reaney, L. (2000). *The Kindergarten Year* (NCES 2001–023). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

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

Williams, T., Levine, D., Jocelyn, L., Butler, P., and Haynes, J. (2000). *Mathematics and Science in the Eighth Grade: Findings from the Third International Mathematics and Science Study* (NCES 2000–014). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Wilson, W.J. (1996). *When Work Disappears: The World of the New Urban Poor*. New York: Knopf.

Wirt, J.G. (2001). *The Condition of Education 2000* (NCES 2000–062). U.S. Department of Education. Washington, DC: National Center for Education Statistics.