

# Science Curriculum and Instruction

## Instructional Time in Science

Though many factors influence the relationship between amount of instructional time and student achievement—primarily, the quality of the instruction and the students’ readiness to learn—instructional time remains a crucial component in considering students’ opportunity to learn. Instructional time was calculated using principals’ reports on the number of school days per year and the number of instructional hours per day and teachers’ reports on the weekly number of hours of science instruction, as explained in Exhibit 13.1 (see About the Scale). Exhibits 13.2 and 13.3 present principals’ and teachers’ reports about the instructional hours overall per year and hours spent on science instruction in fourth grade and eighth grade, respectively. For countries teaching science as separate subjects in the eighth grade, the instructional time included the amount of time spent on each individual science subject. Countries are ordered by the number of hours per year for science instruction.

On average, the fourth grade students across the TIMSS 2019 countries received 895 hours per year of instruction across all subjects; 73 hours, or about 8 percent of the total, were devoted to science instruction. The number of hours devoted to science instruction ranged from a high of 158 hours in the Philippines to just 34 hours in Ireland. The amount of science instructional time relative to total instructional time also varied across countries, reflecting different approaches to organizing and addressing the science curriculum. It is notable, though, that there is much less science instructional time for fourth grade students across countries compared with mathematics. As shown in Exhibit 12.2, fourth grade students had an average of 154 hours of mathematics instruction, more than twice that for science (Exhibit 13.2). As might be anticipated, within-country of estimates instructional time can vary somewhat from the levels of instructional time established by policy.

The eighth grade students across the TIMSS 2019 countries received an average of 1,023 hours of instruction across all subjects; 137 hours, or about 13 percent of the total, were devoted to science instruction. The number of hours for science instruction ranged from 243 in Lebanon, where science is taught as separate subjects, to 70 in Italy. In nearly all of the countries that participated in TIMSS at the fourth and eighth grades, the number of hours devoted to science instruction increased between fourth and eighth grades—sometimes by three or more times the average hours in fourth grade—reflecting the increased emphasis on science in the curriculum by the eighth grade.

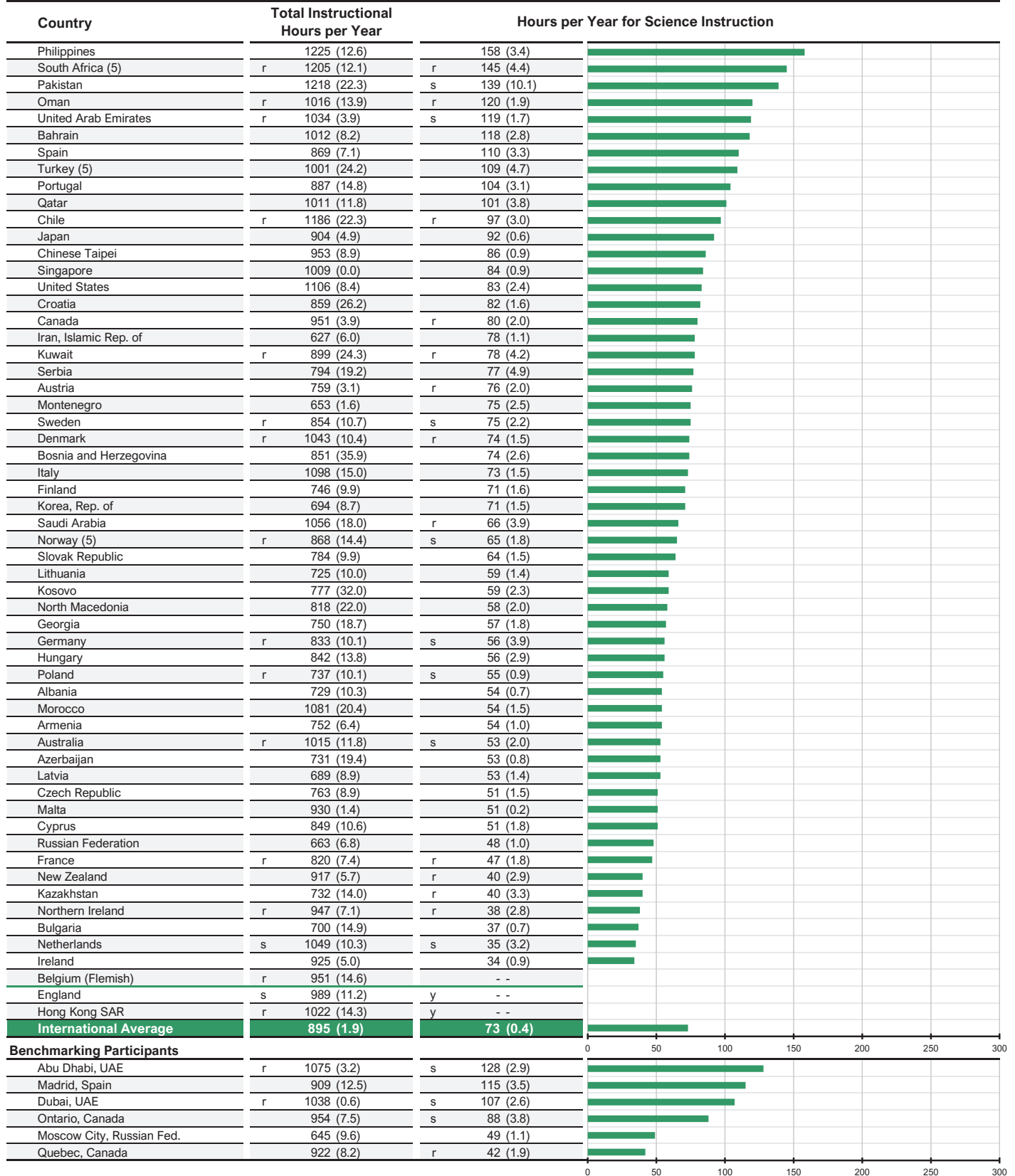
Exhibit 13.3 also includes, for countries teaching separate science subjects, the average number of hours for biology, chemistry, physics, and Earth science. In this subset of countries, students had an estimated 181 hours of science instruction. On average, the highest number of annual hours were devoted to instruction in physics (52 hours), followed by chemistry (51 hours), biology (45 hours), and Earth science (40 hours).

**Exhibit 13.1: Instructional Time Spent on Science**
*Students' Results based on Principals' and Teachers' Reports*
**About the Scale**

<b>Total Instructional Hours Per Year</b>	=	Principal Reports of School Days per Year	×	Principal Reports of Instructional Hours per Day
<b>Hours per Year for Science Instruction</b>	=	$\frac{\text{Teacher Reports of Weekly Science Instructional Hours}}{\text{Principal Reports of School Days per Week}}$	×	Principal Reports of School Days per Year

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019  
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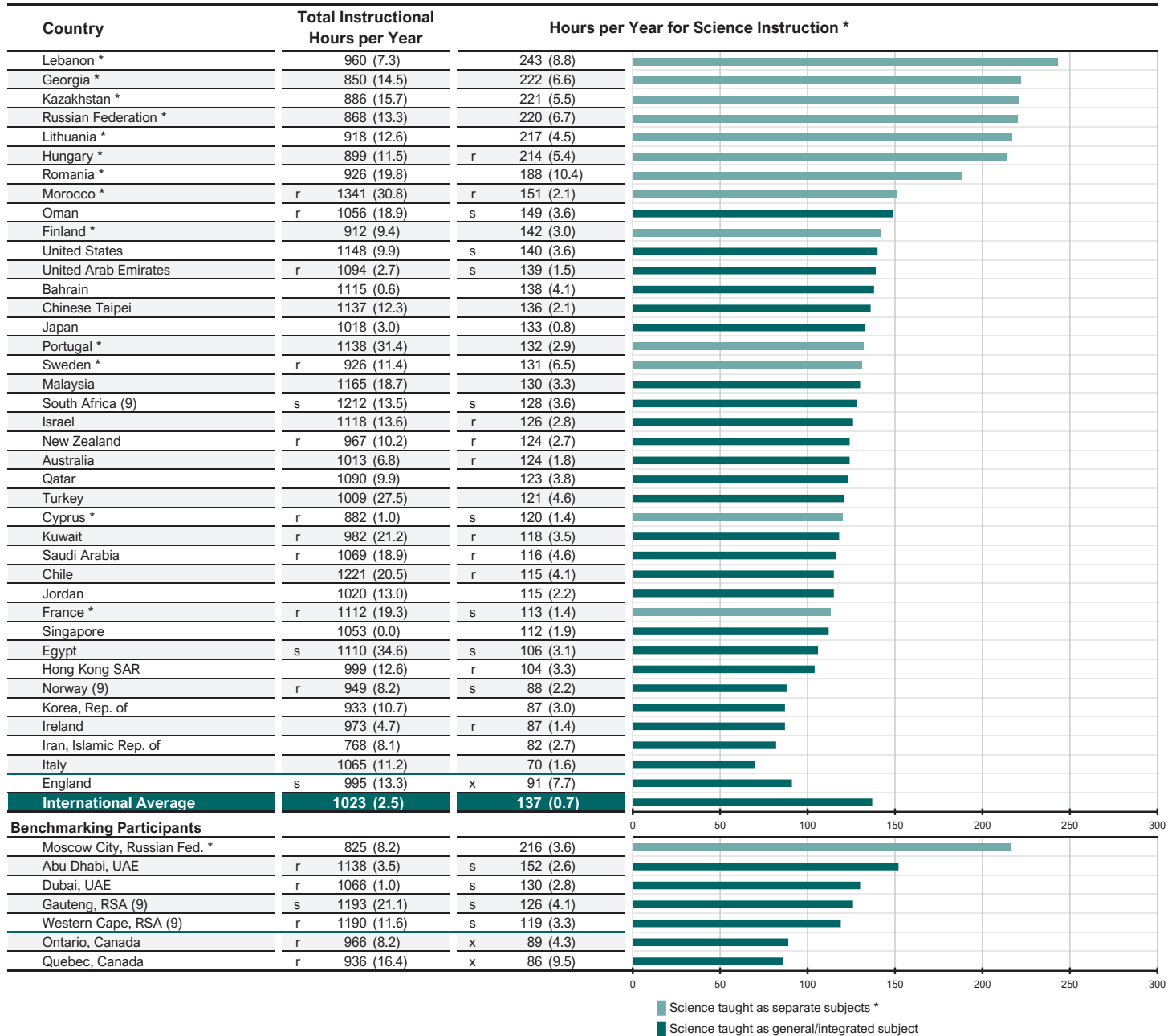
**Exhibit 13.2: Instructional Time Spent on Science**  
*Students' Results based on Principals' and Teachers' Reports*



( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 A dash (-) indicates comparable data not available.  
 An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.  
 A "y" indicates data are available for less than 40% of the students.

**Exhibit 13.3: Instructional Time Spent on Science**

Students' Results based on Principals' and Teachers' Reports



\* For countries teaching science as separate subjects, hours per year for science instruction is based on total hours across subjects.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.  
 An "x" indicates data are available for at least 40% but less than 50% of the students—interpret with caution.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019  
 Downloaded from <http://timss2019.org/download>

**Exhibit 13.3: Instructional Time Spent on Science***Students' Results based on Principals' and Teachers' Reports*

(Continued)

**Separate Science Results**

Country	Hours per Year for Instruction				
	All Science Subjects	Biology	Chemistry	Physics	Earth Science
Lebanon	243 (8.8)	83 (4.7)	78 (3.3)	r 82 (3.8)	- -
Georgia	222 (6.6)	53 (2.7)	55 (2.7)	58 (2.1)	r 55 (2.8)
Kazakhstan	221 (5.5)	56 (2.0)	57 (2.3)	55 (1.4)	53 (1.9)
Russian Federation	220 (6.7)	54 (2.4)	54 (1.7)	60 (3.0)	53 (1.4)
Lithuania	217 (4.5)	36 (1.9)	62 (1.7)	63 (1.7)	57 (1.6)
Hungary	r 214 (5.4)	r 52 (1.9)	r 60 (2.3)	r 50 (2.5)	r 54 (1.7)
Romania	188 (10.4)	41 (3.7)	r 75 (5.3)	72 (4.7)	- -
Morocco	r 151 (2.1)	r 38 (0.6)	r 38 (0.7)	r 38 (0.7)	r 38 (0.6)
Finland	142 (3.0)	33 (1.1)	38 (0.9)	38 (0.9)	33 (1.1)
Portugal	132 (2.9)	37 (0.7)	44 (1.2)	44 (1.2)	6 (0.1)
Sweden	131 (6.5)	44 (2.6)	42 (2.2)	45 (2.5)	- -
Cyprus	s 120 (1.4)	s 25 (0.3)	s 26 (0.6)	r 40 (0.5)	r 28 (0.8)
France	s 113 (1.4)	- -	- -	- -	- -
<b>International Average</b>	<b>181 (1.5)</b>	<b>45 (0.6)</b>	<b>51 (0.6)</b>	<b>52 (0.6)</b>	<b>40 (0.5)</b>
<b>Benchmarking Participants</b>					
Moscow City, Russian Fed.	216 (3.6)	52 (1.3)	54 (1.4)	57 (2.1)	53 (2.3)

France teaches the science subjects in two courses: one for biology and Earth science and one for chemistry and physics.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (-) indicates comparable data not available.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

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## Students Taught the TIMSS Science Topics

The science content domains and underlying topic areas assessed in TIMSS 2019 are documented in the TIMSS 2019 Science Framework, which was developed in collaboration with the participating countries. The science topics included in the TIMSS assessments do not represent the intersection of the topics that are universally taught but rather are a forward looking conception of science teaching and learning.

Exhibit 13.4 (see About the Scale) shows the science content domains—life science, physical science, and Earth science—and the 26 underlying topics in the TIMSS fourth grade science assessment. There were 7 topics in life science, 12 in physical science, and 7 in Earth science. Exhibit 13.6 (see About the Scale) shows the same information for the eighth grade science assessment, with its four content domains—biology, chemistry, physics, and Earth science, and the 26 underlying topics. There were 7 topics in biology, 8 in chemistry, 7 in physics, and 4 in Earth science. Teachers were asked to indicate, for each topic, whether it had been “mostly taught before this year” to students in the assessed class or “mostly taught this year,” or had been “not taught or just introduced” to students. This information serves as an indicator of the “implemented curriculum.” It can be examined together with information provided by TIMSS National Research Coordinators about whether each of the TIMSS 2019 science topics was included in their countries’ intended curriculum through the fourth or eighth grade and, if so, whether the topics were intended to be taught to “all or almost all students” or “only the more able students.” This information about the intended curriculum is reported in the *TIMSS 2019 Encyclopedia*.

Exhibit 13.5 presents fourth grade teachers’ reports about the TIMSS science topics that had been taught to students in fourth grade classrooms either prior to or during the year of the TIMSS assessment. The exhibit shows, for each country and the international average, the percentage of students whose teachers reported that the students had been taught each of the topics (before or during the school year), averaged across all topics in each science content domain, and also across all topics in all science domains. Exhibit 13.7 presents parallel information for the eighth grade, reported by teachers about the TIMSS science topics in the eighth grade assessment.

In the fourth grade, according to their teachers, 62 percent of students, on average, had been taught the TIMSS science topics overall. On average, 73 percent of students had been taught the TIMSS life science topics, and 58 percent and 60 percent had been taught the TIMSS physical science and Earth science topics, respectively. There was, however, considerable variation from content domain to content domain and from country to country, reflecting differing science curricular emphases.

In the eighth grade, on average, 72 percent of students had been taught the TIMSS science topics overall, according to their teachers. Close to three-quarters, on average, had been taught the TIMSS biology topics (74%) and chemistry topics (74%) by the eighth grade, according to their teachers, with slightly less having been taught the Earth science (71%) and physics (68%) topics. There was considerable variation across countries with respect to topic coverage by content domain.

**Exhibit 13.4: Percentages of Students Taught the TIMSS Science Topics**

Students' Results based on Teachers' Reports

**About the Scale**

Exhibit 13.5 reports the percentage of students whose teachers responded "mostly taught before this year" or "mostly taught this year," averaged across topics.

**Choose the response that best describes when students in this class have been taught each topic.**

	Mostly taught before this year	Mostly taught this year	Not yet taught or just introduced
<b>A. Life Science</b>			
1) Physical and behavioral characteristics of living things and major groups of living things (e.g., mammals, birds, insects, flowering plants) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2) Major body structures and their functions in humans, other animals, and plants -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3) Life cycles of common plants and animals (e.g., flowering plants, butterflies, frogs) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4) Characteristics of plants and animals that are inherited -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5) Interactions between organisms and their environments (e.g., physical features and behaviors that help living things survive in their environments) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6) Relationships in ecosystems (e.g., simple food chains, predator-prey relationships, competition) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7) Human health (transmission and prevention of diseases, everyday behaviors that promote good health) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>B. Physical Science</b>			
1) States of matter (solid, liquid, gas) and their properties (volume, shape) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2) Classifying materials based on physical properties (e.g., weight/mass, volume, state of matter, conductivity of heat or electricity) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3) Mixtures, including methods for separating a mixture into its components (e.g., sifting, filtering, evaporation, using a magnet) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4) Properties of magnets (e.g., like poles repel and opposite poles attract, magnets can attract some objects) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5) Physical changes in everyday life (e.g., changes of state, dissolving) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6) Chemical changes in everyday life (e.g., decaying, burning, rusting, cooking) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7) Common sources of energy (e.g., the Sun, wind, oil) and uses of energy (heating and cooling homes, providing light) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8) Light and sound in everyday life (e.g., shadows and reflections, vibrating objects make sound) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9) Heat transfer (e.g., energy flows from a hot object to a colder object) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10) Electricity and simple electrical circuits (e.g., a circuit must be complete to work correctly) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11) Forces that cause objects to move (e.g., gravity, pushing/pulling) or change their motion (e.g., friction) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12) Simple machines (e.g., levers, pulleys, wheels, ramps) that help make motion easier -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>C. Earth Science</b>			
1) Physical makeup of Earth's surface (e.g., land and water in unequal proportions, sources of fresh and salt water) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2) Earth's resources used in everyday life (e.g., water, wind, soil, forests, oil, natural gas, minerals) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3) Changes in Earth's surface over time (e.g., mountain building, weathering, erosion) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4) Fossils and what they can tell us about past conditions on Earth -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5) Weather and climate (e.g., daily, seasonal, and locational variations versus long term trends) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6) Objects in the Solar System (the Sun, the Earth, the Moon, and other planets) and their movements -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7) Earth's motion and related patterns observed on Earth (e.g., day and night, seasons) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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**Exhibit 13.5: Percentages of Students Taught the TIMSS Science Topics***Students' Results based on Teachers' Reports*

The exhibit reports the percentage of students whose teachers responded "mostly taught before this year" or "mostly taught this year," averaged across topics.

Country	All Science (26 Topics)	Life Science (7 Topics)	Physical Science (12 Topics)	Earth Science (7 Topics)
Albania	66 (1.7)	81 (1.7)	68 (1.9)	46 (3.2)
Armenia	r 60 (2.1)	r 67 (2.7)	r 46 (2.5)	77 (1.9)
Australia	65 (1.6)	70 (1.9)	63 (2.0)	r 65 (2.1)
Austria	58 (1.3)	70 (1.5)	47 (1.5)	65 (1.9)
Azerbaijan	58 (2.3)	65 (2.6)	r 42 (3.0)	77 (2.0)
Bahrain	77 (1.1)	75 (1.3)	76 (1.4)	80 (1.3)
Belgium (Flemish)	44 (1.4)	54 (2.2)	36 (1.9)	49 (1.9)
Bosnia and Herzegovina	40 (1.3)	53 (2.0)	34 (1.4)	39 (1.5)
Bulgaria	73 (1.1)	89 (0.9)	67 (1.6)	69 (1.4)
Canada	r 56 (1.2)	r 68 (1.6)	r 50 (1.3)	r 53 (1.7)
Chile	r 69 (1.6)	r 81 (2.1)	r 63 (2.4)	r 67 (2.7)
Chinese Taipei	50 (1.5)	64 (2.1)	51 (1.6)	35 (1.8)
Croatia	48 (1.3)	53 (2.2)	39 (1.3)	58 (1.9)
Cyprus	62 (1.4)	85 (1.5)	55 (2.1)	51 (2.3)
Czech Republic	50 (1.2)	71 (1.4)	30 (1.3)	66 (1.9)
Denmark	r 57 (1.7)	r 67 (2.1)	r 45 (2.0)	r 67 (2.0)
Finland	54 (1.3)	70 (1.3)	46 (1.8)	54 (1.5)
France	54 (1.0)	70 (1.3)	44 (1.2)	55 (1.7)
Georgia	63 (1.8)	70 (2.1)	60 (2.2)	60 (2.2)
Germany	57 (1.3)	63 (1.8)	53 (1.5)	59 (2.1)
Hong Kong SAR	54 (1.5)	67 (2.6)	51 (1.6)	46 (2.2)
Hungary	57 (1.1)	75 (1.3)	44 (1.5)	61 (1.7)
Iran, Islamic Rep. of	72 (1.1)	72 (1.5)	79 (1.1)	61 (1.8)
Ireland	71 (1.3)	76 (1.6)	68 (1.6)	72 (1.5)
Italy	53 (1.1)	66 (1.5)	41 (1.5)	60 (2.2)
Japan	39 (1.3)	41 (1.6)	45 (1.6)	26 (1.5)
Kazakhstan	73 (1.6)	89 (1.2)	58 (2.5)	83 (1.8)
Korea, Rep. of	48 (1.4)	55 (1.9)	46 (1.5)	46 (2.2)
Kosovo	71 (1.6)	73 (2.1)	71 (1.9)	70 (1.9)
Kuwait	86 (1.0)	93 (0.8)	84 (1.4)	83 (1.4)
Latvia	74 (1.4)	75 (2.0)	74 (1.7)	74 (1.5)
Lithuania	76 (1.6)	90 (1.2)	69 (2.1)	72 (1.8)
Malta	63 (0.2)	73 (0.2)	60 (0.2)	60 (0.3)
Montenegro	51 (0.9)	76 (1.3)	42 (1.0)	42 (0.9)
Morocco	45 (1.0)	65 (1.5)	52 (1.1)	13 (1.3)
Netherlands	r 45 (2.0)	r 53 (2.0)	r 37 (2.7)	r 51 (2.3)
New Zealand	60 (1.6)	70 (1.8)	53 (1.8)	59 (2.2)
North Macedonia	76 (2.2)	74 (2.7)	85 (1.8)	60 (3.3)
Northern Ireland	62 (2.0)	75 (2.3)	55 (2.7)	60 (2.4)
Norway (5)	s 48 (1.9)	s 57 (2.4)	s 34 (2.0)	s 61 (3.1)
Oman	65 (1.5)	77 (1.6)	70 (1.4)	44 (2.7)
Pakistan	r 77 (2.6)	r 87 (3.2)	r 80 (3.2)	r 62 (5.7)
Philippines	87 (1.2)	95 (1.0)	90 (1.2)	73 (2.4)
Poland	35 (1.2)	61 (1.5)	21 (1.4)	35 (1.9)
Portugal	85 (0.9)	97 (0.5)	77 (1.6)	88 (1.0)
Qatar	59 (1.3)	73 (2.0)	59 (1.5)	45 (1.9)
Russian Federation	66 (1.1)	89 (0.9)	40 (2.0)	87 (1.2)
Saudi Arabia	86 (1.2)	84 (1.4)	88 (1.1)	84 (1.9)
Serbia	78 (1.4)	76 (2.1)	91 (1.2)	57 (2.3)
Singapore	39 (0.4)	51 (0.8)	54 (0.5)	2 (0.4)
Slovak Republic	77 (1.3)	84 (1.2)	80 (1.4)	67 (2.0)
South Africa (5)	80 (1.4)	88 (1.1)	76 (2.0)	78 (1.6)
Spain	67 (1.0)	86 (1.2)	48 (1.6)	79 (1.3)
Sweden	r 49 (1.4)	r 60 (2.0)	39 (1.7)	r 56 (2.4)
Turkey (5)	62 (1.5)	66 (1.7)	62 (1.4)	58 (2.2)
United Arab Emirates	r 78 (0.8)	r 86 (0.7)	r 78 (0.9)	r 70 (1.3)
United States	70 (1.2)	74 (1.4)	66 (1.5)	74 (1.5)
England	y - -	y - -	y - -	y - -
<b>International Average</b>	<b>62 (0.2)</b>	<b>73 (0.2)</b>	<b>58 (0.2)</b>	<b>60 (0.3)</b>
<b>Benchmarking Participants</b>				
Ontario, Canada	r 57 (2.0)	r 70 (2.6)	r 52 (2.4)	r 52 (2.8)
Quebec, Canada	r 55 (1.8)	r 68 (2.6)	r 45 (2.0)	r 60 (2.6)
Moscow City, Russian Fed.	65 (1.3)	88 (1.0)	40 (2.0)	83 (1.4)
Madrid, Spain	66 (1.6)	82 (1.7)	48 (2.3)	81 (1.9)
Abu Dhabi, UAE	r 76 (0.9)	r 86 (0.8)	r 77 (1.1)	r 63 (1.7)
Dubai, UAE	r 83 (0.6)	r 86 (0.8)	r 84 (0.6)	r 80 (1.2)

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A dash (-) indicates comparable data not available.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

A "y" indicates data are available for less than 40% of the students.



**Exhibit 13.6: Percentages of Students Taught the TIMSS Science Topics**

Students' Results based on Teachers' Reports

**About the Scale**

Exhibit 13.7 reports the percentage of students whose teachers responded “mostly taught before this year” or “mostly taught this year,” averaged across topics.

**Choose the response that best describes when students in this class have been taught each topic.**

	Mostly taught before this year	Mostly taught this year	Not yet taught or just introduced
<b>A. Biology</b>			
1) Differences among major taxonomic groups of organisms (plants, animals, fungi, mammals, birds, reptiles, fish, amphibians, insects) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2) Major organs and organ systems in humans and other organisms (structure/function, life processes) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3) Cells, their structure and functions, including respiration and photosynthesis as cellular processes -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4) Life cycles, sexual reproduction, and heredity (inherited versus acquired/learned characteristics) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5) Role of variation and adaptation in survival/extinction of species (including fossil evidence) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6) Interdependence of populations of organisms in an ecosystem (e.g., carbon and water cycles, energy flow, food webs, competition, predation, human impacts on ecosystems) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7) Human health (e.g., causes, transmission, and prevention of common infectious diseases, immunity) and the importance of diet, exercise, and other lifestyle choices in maintaining health -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>B. Chemistry</b>			
1) Particulate structure, classification, and composition of matter (protons, neutrons, electrons, atoms, molecules, elements, compounds, mixtures) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2) The periodic table as an organizing principle for the known elements -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3) Physical and chemical properties of matter -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4) Mixtures and solutions (e.g., solvent, solute, concentration/dilution) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5) Properties of common acids and bases (e.g., acids have pH less than 7, reactions with indicators produce color changes, acids and bases neutralize each other) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6) Characteristics of chemical reactions (e.g., transformation of reactants, evidence of chemical change) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7) Matter and energy in chemical reactions (conservation of matter, familiar exothermic and endothermic reactions, factors affecting reaction rates) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8) The role of electrons in chemical bonds -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>C. Physics</b>			
1) Physical states and changes in matter (explanations of properties in terms of movement and distance between particles; phase change, changes in volume and/or pressure, physical changes) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2) Energy transformation and transfer (e.g., forms of energy, energy conservation, heat, temperature, equilibrium) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3) Basic properties/behaviors of light (reflection, refraction, color, shadows, simple ray diagrams) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4) Basic properties/behaviors of sound (vibrations that produce sound, transmission through media, loudness, pitch) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5) Electric circuits (e.g., electrical conductors/insulators and the flow of electricity in series/parallel circuits) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6) Properties and uses of permanent magnets and electromagnets -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7) Motion and forces (e.g., basic description of motion, common mechanical forces, properties of forces, effects of forces, simple machines, buoyancy, effects of density and pressure) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>D. Earth Science</b>			
1) Earth's structure and physical features (e.g., Earth's crust, mantle, and core; composition and relative distribution of water; composition of Earth's atmosphere) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2) Earth's processes, cycles, and history (e.g., rock cycle, major geological events, formation of fossils and fossil fuels, water cycle, weather versus climate) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3) Earth's resources, their use, and conservation (e.g., renewable/nonrenewable resources, human use of land and water resources) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4) Earth in the Solar System and the universe (phenomena on Earth: seasons, eclipses, tides, phases of moon; members of the Solar System; physical features of Earth) -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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**Exhibit 13.7: Percentages of Students Taught the TIMSS Science Topics***Students' Results based on Teachers' Reports*

The exhibit reports the percentage of students whose teachers responded "mostly taught before this year" or "mostly taught this year," averaged across topics.

Country	All Science (26 Topics)	Biology (7 Topics)	Chemistry (8 Topics)	Physics (7 Topics)	Earth Science (4 Topics)
Australia	r 63 (1.2)	r 61 (1.7)	r 64 (1.5)	r 56 (1.4)	r 79 (1.9)
Bahrain	81 (1.1)	92 (0.7)	74 (1.7)	72 (2.0)	93 (1.0)
Chile	71 (1.4)	77 (1.8)	60 (2.1)	69 (2.0)	85 (2.4)
Chinese Taipei	70 (0.6)	92 (2.2)	92 (0.5)	61 (1.0)	7 (1.5)
Cyprus	r 49 (0.7)	s 63 (1.1)	s 47 (1.2)	r 34 (1.5)	r 54 (1.1)
Egypt	82 (1.1)	78 (1.5)	78 (1.3)	84 (1.4)	91 (1.5)
England	s 71 (2.3)	s 71 (3.0)	s 79 (2.2)	s 72 (3.4)	x 54 (5.3)
Finland	72 (0.6)	51 (1.0)	91 (1.0)	63 (1.0)	87 (1.3)
France	r 59 (0.9)	r 70 (1.6)	r 54 (1.5)	r 46 (1.7)	r 69 (2.5)
Georgia	67 (0.8)	55 (1.4)	66 (1.6)	61 (1.3)	99 (0.5)
Hong Kong SAR	53 (1.8)	64 (2.3)	43 (2.2)	64 (2.0)	33 (3.0)
Hungary	91 (0.6)	85 (0.9)	97 (0.6)	88 (1.1)	91 (1.8)
Iran, Islamic Rep. of	70 (0.9)	61 (1.3)	78 (1.1)	70 (1.4)	71 (1.5)
Ireland	63 (0.8)	66 (1.2)	77 (1.1)	48 (1.4)	54 (2.5)
Israel	65 (1.2)	64 (1.6)	82 (1.1)	62 (1.6)	39 (3.1)
Italy	69 (1.2)	81 (1.2)	81 (2.0)	48 (2.1)	60 (2.5)
Japan	65 (0.6)	56 (1.0)	73 (0.9)	77 (1.1)	41 (1.7)
Jordan	80 (1.3)	87 (1.3)	76 (1.4)	80 (1.9)	78 (2.2)
Kazakhstan	87 (0.5)	83 (1.3)	94 (0.8)	80 (1.1)	97 (0.7)
Korea, Rep. of	57 (1.0)	50 (1.5)	49 (1.4)	68 (0.9)	67 (1.4)
Kuwait	87 (0.9)	91 (0.9)	94 (1.1)	83 (1.2)	75 (2.2)
Lebanon	76 (0.8)	76 (1.9)	80 (1.3)	71 (1.5)	- -
Lithuania	73 (1.0)	78 (1.7)	62 (2.3)	69 (1.7)	93 (1.2)
Malaysia	88 (0.8)	93 (0.9)	82 (1.3)	93 (1.2)	82 (1.9)
Morocco	57 (0.6)	69 (1.1)	45 (1.0)	48 (0.8)	74 (1.7)
New Zealand	48 (1.2)	48 (1.7)	55 (1.8)	48 (1.7)	37 (2.7)
Norway (9)	s 55 (1.2)	s 51 (2.2)	s 71 (1.5)	s 35 (2.1)	s 68 (2.9)
Oman	73 (0.9)	82 (0.8)	54 (1.5)	79 (1.4)	89 (1.5)
Portugal	63 (0.7)	63 (1.4)	73 (1.0)	40 (1.2)	80 (1.5)
Qatar	77 (1.0)	80 (1.5)	76 (1.3)	75 (1.4)	76 (1.9)
Romania	95 (0.5)	93 (1.0)	95 (0.8)	98 (0.5)	- -
Russian Federation	79 (0.6)	68 (1.6)	82 (1.4)	75 (1.0)	97 (0.8)
Saudi Arabia	84 (1.0)	89 (1.0)	82 (1.6)	77 (1.6)	95 (0.8)
Singapore	65 (0.8)	71 (1.2)	73 (1.2)	75 (1.2)	20 (1.5)
South Africa (9)	76 (1.2)	83 (1.3)	84 (1.2)	72 (1.5)	55 (3.0)
Sweden	71 (0.8)	72 (1.4)	68 (1.3)	74 (1.7)	- -
Turkey	93 (0.5)	94 (0.7)	95 (0.6)	88 (1.1)	92 (1.5)
United Arab Emirates	r 86 (0.5)	r 85 (0.6)	r 85 (0.6)	r 86 (0.8)	r 86 (0.9)
United States	r 84 (1.1)	r 89 (1.2)	r 82 (1.8)	r 76 (1.7)	r 91 (1.5)
<b>International Average</b>	<b>72 (0.2)</b>	<b>74 (0.2)</b>	<b>74 (0.2)</b>	<b>68 (0.2)</b>	<b>71 (0.3)</b>
<b>Benchmarking Participants</b>					
Ontario, Canada	s 65 (1.7)	s 81 (1.9)	s 41 (2.5)	s 69 (2.7)	s 79 (3.0)
Moscow City, Russian Fed.	74 (0.7)	62 (1.6)	76 (1.3)	70 (0.9)	98 (0.5)
Gauteng, RSA (9)	76 (1.6)	85 (1.8)	82 (1.7)	70 (2.3)	57 (3.4)
Western Cape, RSA (9)	75 (1.3)	80 (1.7)	83 (1.3)	72 (2.1)	56 (3.4)
Abu Dhabi, UAE	r 86 (0.8)	r 85 (1.0)	r 86 (1.0)	r 88 (1.2)	r 83 (1.4)
Dubai, UAE	r 85 (0.9)	r 84 (0.9)	r 84 (0.8)	r 84 (1.5)	r 89 (1.5)
Quebec, Canada	y - -	y - -	y - -	y - -	y - -

() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (-) indicates comparable data not available.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for at least 40% but less than 50% of the students—interpret with caution. A "y" indicates data are available for less than 40% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019

Downloaded from <http://timss2019.org/download>

## Instructional Clarity in Science Lessons

The clarity with which teachers convey the curriculum to students has significant implications for student learning. Students were asked about aspects of teachers' instruction during their science lessons: whether they know what their teacher expects them to do, and whether their teacher is easy to understand, has clear answers to their questions, is good at explaining science, does a variety of things to help the students learn, links new lessons to previous knowledge (eighth grade only), and explains a topic again when the students do not understand. Responses were combined into the TIMSS 2019 *Instructional Clarity in Science Lessons* scale, as described in Exhibit 13.8 (see About the Scale). Exhibits 13.9 and 13.10 present students' reports about the clarity of their science lessons, for fourth grade and eighth grade, respectively. Countries are reported by percentage of students reporting "high clarity of instruction."

On average, slightly less than three-quarters (72%) of fourth grade students reported "high clarity" of instruction in their science lessons, 22 percent reported "moderate clarity," and just 6 percent characterized their lessons as having "low clarity." There was a range in views across countries with, interestingly, lower percentages of students characterizing their lessons as having "high clarity" in some of the higher performing countries, such as Korea and Japan. On average, internationally and within most countries, however, higher clarity was associated with higher average achievement. Across countries, average achievement was 498 among students reporting "high clarity" of instruction, 480 among students reporting "moderate clarity" of instruction, and 466 among students reporting "low clarity" of instruction.

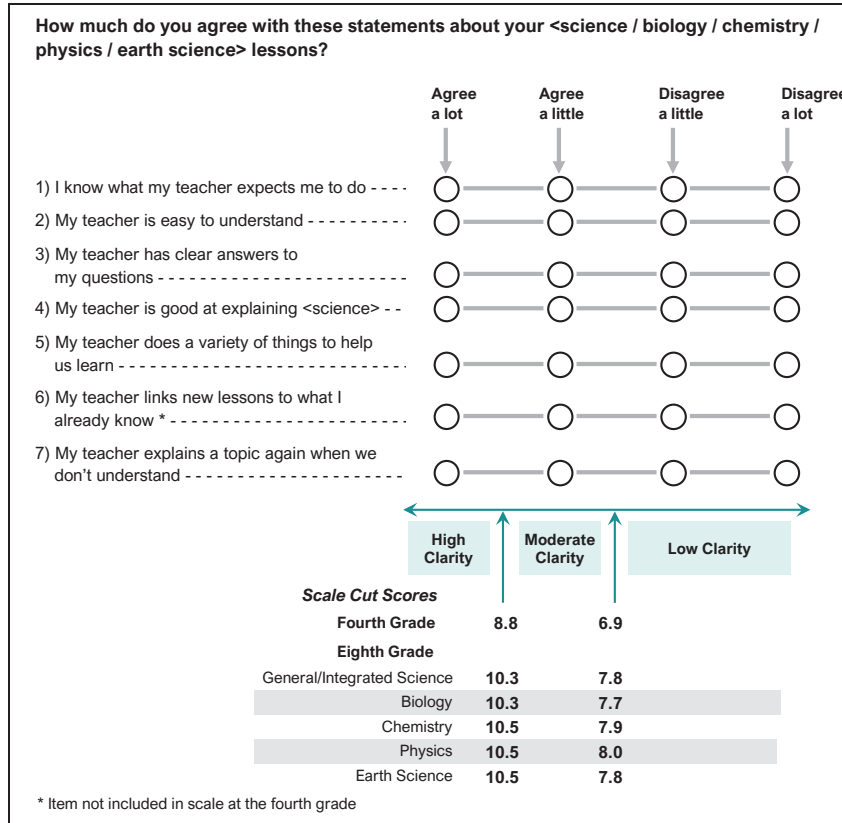
Eighth grade students' reports are presented separately for countries in which science is taught as an integrated subject in eighth grade (first panel of the exhibit) and for countries in which science is taught as separate subjects (following four panels). Eighth grade students were, on average, less positive about the clarity of their science instruction compared with fourth grade students. Similar percentages of students reported "high," "moderate," and "low clarity of instruction" for integrated science, biology, chemistry, physics, and Earth science. For all science subjects, 44 to 49 percent of eighth grade students, on average, characterized instruction as having "high clarity," 38 to 41 percent reported "moderate clarity," and 12 to 16 percent reported "low clarity." As seen in fourth grade, clarity of instruction was positively associated with science achievement. In countries teaching science as an integrated subject and for each of the separate science subjects, average achievement increased with each successively higher level of students' reports of instructional clarity.

**Exhibit 13.8: Instructional Clarity in Science Lessons – Students’ Reports**

Students’ Reports

**About the Scale**

Students were scored according to their responses to seven statements on the *Instructional Clarity in Science Lessons* scale. Cut scores divide the scale into three categories. Students who reported **High Clarity of Instruction** in their science lessons had a score at or above the cut score corresponding to “agreeing a lot” with four of the seven statements and “agreeing a little” with the other three, on average. Students who reported **Low Clarity of Instruction** in their science lessons had a score at or below the cut score corresponding to “disagreeing a little” with four of the seven statements and “agreeing a little” with the other three, on average. All other students reported **Moderate Clarity of Instruction** in their science lessons. At the eighth grade, a comparable approach was used for biology, chemistry, physics, and Earth science in countries where these were taught as separate subjects.



SOURCE: IEA’s Trends in International Mathematics and Science Study TIMSS 2019  
Downloaded from <http://timss2019.org/download>

## Exhibit 13.9: Instructional Clarity in Science Lessons – Students' Reports

Students' Reports

Country	High Clarity of Instruction		Moderate Clarity of Instruction		Low Clarity of Instruction		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Albania	97 (0.3)	493 (3.5)	2 (0.3)	~ ~	1 (0.1)	~ ~	11.6 (0.04)
Kosovo	95 (0.6)	420 (3.4)	4 (0.4)	355 (11.0)	1 (0.2)	~ ~	11.2 (0.04)
North Macedonia	92 (0.7)	436 (6.2)	6 (0.6)	372 (11.8)	1 (0.2)	~ ~	11.2 (0.05)
Montenegro	90 (0.6)	460 (2.5)	8 (0.5)	431 (6.5)	2 (0.2)	~ ~	11.1 (0.04)
Iran, Islamic Rep. of	88 (0.9)	449 (3.7)	9 (0.7)	407 (8.3)	3 (0.4)	369 (13.0)	10.9 (0.05)
Bosnia and Herzegovina	86 (0.8)	465 (3.0)	11 (0.7)	435 (6.1)	2 (0.2)	~ ~	10.8 (0.04)
Bulgaria	86 (1.1)	527 (4.3)	11 (0.9)	505 (11.2)	3 (0.4)	480 (24.3)	10.8 (0.06)
Armenia	86 (0.8)	475 (3.3)	11 (0.6)	449 (5.1)	3 (0.4)	427 (11.8)	10.8 (0.06)
Georgia	85 (1.2)	456 (4.0)	12 (1.0)	448 (9.8)	3 (0.5)	411 (18.0)	10.7 (0.06)
Azerbaijan	85 (1.0)	438 (3.0)	11 (0.8)	421 (6.3)	4 (0.4)	389 (11.7)	10.6 (0.06)
Portugal	82 (0.9)	507 (2.6)	15 (0.8)	494 (4.0)	3 (0.3)	489 (9.8)	10.4 (0.04)
Oman	80 (1.0)	451 (4.4)	15 (0.7)	397 (6.0)	4 (0.4)	356 (8.6)	10.4 (0.06)
Lithuania	80 (1.2)	539 (2.6)	18 (1.1)	537 (4.2)	2 (0.3)	~ ~	10.2 (0.06)
Morocco	80 (1.2)	386 (5.9)	16 (0.9)	346 (9.8)	4 (0.5)	292 (10.2)	10.3 (0.07)
Bahrain	79 (1.1)	504 (2.9)	17 (0.8)	468 (6.2)	5 (0.4)	438 (8.2)	10.3 (0.06)
Spain	78 (1.2)	517 (2.3)	18 (1.0)	500 (4.1)	4 (0.4)	485 (8.9)	10.1 (0.06)
United Arab Emirates	78 (0.5)	488 (2.2)	16 (0.3)	440 (3.0)	6 (0.3)	400 (5.6)	10.3 (0.03)
Serbia	77 (1.3)	521 (3.2)	20 (1.0)	510 (7.7)	3 (0.5)	502 (10.8)	10.3 (0.06)
Turkey (5)	77 (1.2)	540 (3.8)	18 (0.9)	497 (6.6)	5 (0.5)	451 (10.6)	10.2 (0.05)
Hungary	77 (1.2)	533 (2.6)	19 (0.9)	520 (4.6)	4 (0.5)	511 (8.3)	10.3 (0.06)
Kuwait	76 (1.2)	413 (6.1)	17 (0.9)	364 (9.0)	7 (0.6)	324 (9.9)	10.2 (0.07)
Russian Federation	76 (1.0)	568 (3.3)	21 (0.9)	569 (3.6)	3 (0.3)	552 (8.7)	10.0 (0.04)
Malta	76 (0.6)	498 (1.6)	19 (0.5)	491 (3.5)	5 (0.3)	486 (7.0)	10.1 (0.03)
Austria	75 (1.0)	525 (2.5)	21 (0.9)	514 (4.7)	4 (0.5)	513 (8.3)	10.1 (0.05)
United States	74 (0.8)	546 (2.6)	20 (0.7)	536 (3.9)	6 (0.4)	502 (6.2)	10.1 (0.04)
Kazakhstan	74 (1.1)	502 (3.5)	25 (1.0)	479 (4.3)	2 (0.2)	~ ~	10.0 (0.06)
Saudi Arabia	73 (1.0)	424 (4.0)	19 (0.7)	372 (5.5)	7 (0.6)	349 (11.6)	10.1 (0.06)
Belgium (Flemish)	73 (0.9)	502 (2.3)	24 (0.9)	500 (3.5)	3 (0.2)	481 (6.1)	9.9 (0.04)
Northern Ireland	73 (1.2)	519 (2.4)	22 (1.0)	521 (4.2)	5 (0.5)	511 (6.9)	9.9 (0.05)
Ireland	73 (1.3)	530 (3.3)	21 (1.0)	525 (4.4)	6 (0.5)	529 (5.7)	9.9 (0.06)
Slovak Republic	73 (1.3)	521 (3.9)	23 (1.0)	524 (4.7)	4 (0.6)	510 (12.0)	10.0 (0.06)
Canada	72 (0.9)	526 (2.0)	23 (0.8)	521 (2.5)	5 (0.3)	512 (5.0)	10.0 (0.04)
Qatar	72 (1.2)	469 (3.4)	20 (1.0)	419 (7.1)	8 (0.5)	383 (8.2)	10.0 (0.06)
Pakistan	71 (2.3)	302 (13.5)	21 (1.6)	267 (21.1)	8 (1.1)	260 (19.5)	10.0 (0.11)
Cyprus	71 (1.6)	516 (3.1)	20 (0.8)	505 (4.0)	9 (1.1)	500 (5.8)	9.8 (0.09)
Czech Republic	70 (1.3)	535 (2.9)	24 (1.0)	538 (3.1)	5 (0.6)	514 (5.9)	9.9 (0.06)
Norway (5)	70 (1.2)	540 (2.5)	25 (1.0)	543 (3.7)	5 (0.6)	544 (7.2)	9.8 (0.05)
Italy	70 (1.1)	514 (3.2)	25 (0.9)	501 (4.0)	4 (0.4)	495 (7.7)	9.7 (0.04)
Germany	70 (1.3)	526 (2.3)	24 (0.8)	517 (3.3)	6 (0.7)	501 (8.3)	9.7 (0.05)
England	70 (1.4)	539 (3.2)	25 (1.1)	538 (3.9)	6 (0.6)	540 (6.6)	9.9 (0.06)
Australia	68 (1.2)	533 (2.8)	24 (0.9)	538 (3.6)	8 (0.8)	519 (7.0)	9.8 (0.06)
Netherlands	67 (1.3)	520 (2.9)	28 (1.0)	523 (4.1)	5 (0.5)	488 (9.5)	9.7 (0.06)
Croatia	67 (1.1)	527 (2.2)	30 (1.2)	518 (3.3)	3 (0.4)	510 (11.4)	9.9 (0.04)
Chile	67 (1.2)	478 (2.8)	27 (1.0)	463 (3.7)	6 (0.5)	433 (7.0)	9.8 (0.05)
Latvia	66 (1.2)	543 (2.7)	29 (1.0)	544 (3.0)	6 (0.6)	533 (6.0)	9.6 (0.05)
South Africa (5)	65 (1.1)	355 (5.2)	23 (0.8)	288 (5.8)	12 (0.6)	258 (6.1)	9.7 (0.06)
Sweden	65 (1.5)	536 (4.0)	30 (1.2)	546 (3.7)	6 (0.6)	520 (7.6)	9.5 (0.06)
Chinese Taipei	64 (1.5)	562 (2.1)	28 (1.2)	556 (3.0)	8 (0.7)	532 (5.7)	9.7 (0.07)
New Zealand	64 (1.2)	503 (2.8)	27 (0.9)	508 (3.3)	9 (0.6)	500 (4.9)	9.5 (0.05)
Singapore	63 (1.0)	601 (3.3)	29 (0.7)	587 (4.1)	8 (0.5)	569 (6.6)	9.6 (0.04)
Finland	61 (1.2)	559 (2.7)	32 (1.1)	552 (3.3)	7 (0.6)	539 (5.5)	9.4 (0.05)
Poland	60 (1.3)	535 (2.8)	31 (0.9)	533 (3.1)	9 (0.7)	517 (6.0)	9.5 (0.06)
France	56 (1.2)	488 (3.7)	37 (0.9)	491 (3.5)	7 (0.6)	477 (6.5)	9.3 (0.05)
Hong Kong SAR	55 (1.4)	543 (3.3)	30 (1.0)	523 (3.6)	15 (1.0)	505 (7.3)	9.2 (0.07)
Denmark	49 (1.7)	526 (3.0)	37 (1.3)	520 (3.3)	13 (1.2)	517 (4.6)	8.8 (0.07)
Philippines	48 (1.9)	288 (8.9)	36 (1.2)	227 (7.1)	16 (1.0)	196 (7.2)	8.9 (0.08)
Japan	44 (1.6)	561 (2.4)	44 (1.1)	564 (2.3)	13 (1.0)	558 (3.4)	8.6 (0.06)
Korea, Rep. of	42 (1.4)	596 (2.8)	48 (1.3)	584 (2.3)	11 (1.0)	573 (5.5)	8.5 (0.05)
<b>International Average</b>	<b>72 (0.2)</b>	<b>498 (0.5)</b>	<b>22 (0.1)</b>	<b>480 (0.8)</b>	<b>6 (0.1)</b>	<b>466 (1.3)</b>	
<b>Benchmarking Participants</b>							
Dubai, UAE	82 (0.6)	548 (1.6)	14 (0.5)	532 (3.4)	4 (0.3)	510 (8.7)	10.4 (0.03)
Madrid, Spain	77 (1.1)	526 (2.3)	19 (0.9)	519 (2.5)	4 (0.4)	501 (9.2)	10.1 (0.06)
Ontario, Canada	72 (1.4)	528 (3.4)	23 (1.2)	521 (4.0)	5 (0.5)	516 (7.8)	9.9 (0.06)
Moscow City, Russian Fed.	70 (1.2)	597 (2.5)	25 (0.9)	594 (2.9)	5 (0.5)	576 (6.0)	9.7 (0.05)
Abu Dhabi, UAE	69 (0.9)	438 (3.0)	21 (0.7)	388 (4.4)	10 (0.6)	365 (7.7)	9.8 (0.05)
Quebec, Canada	68 (1.5)	523 (3.1)	26 (1.1)	521 (3.5)	6 (0.7)	508 (7.1)	9.8 (0.07)

This TIMSS context questionnaire scale was established in 2019 based on the combined response distribution of all countries that participated in TIMSS 2019. To provide a point of reference for country comparisons, the scale centerpoint of 10 was located at the mean of the combined distribution. The units of the scale were chosen so that 2 scale score points corresponded to the standard deviation of the distribution.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019  
Downloaded from <http://timss2019.org/download>

## Exhibit 13.10: Instructional Clarity in Science Lessons – Students' Reports

## Students' Reports

The general/integrated science panel summarizes responses for countries where students are enrolled in science as a single subject. The following panels for biology, chemistry, physics, and Earth science summarize responses for countries where students are taught science as separate subjects.

## Instructional Clarity in General/Integrated Science Lessons

General/Integrated Science	High Clarity of Instruction		Moderate Clarity of Instruction		Low Clarity of Instruction		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Jordan	72 (1.3)	467 (4.5)	22 (1.0)	431 (5.7)	6 (0.5)	410 (7.7)	11.0 (0.05)
Turkey	69 (1.7)	524 (3.4)	22 (1.0)	498 (6.4)	8 (0.9)	496 (8.0)	10.8 (0.08)
Egypt	68 (1.2)	413 (5.0)	26 (1.0)	359 (6.8)	6 (0.5)	340 (9.0)	10.8 (0.05)
Iran, Islamic Rep. of	67 (1.2)	458 (3.5)	27 (1.1)	433 (5.3)	6 (0.6)	436 (6.8)	10.8 (0.05)
Saudi Arabia	66 (1.4)	445 (2.9)	27 (0.9)	416 (3.5)	7 (0.7)	410 (6.1)	10.7 (0.06)
Kuwait	61 (1.5)	459 (5.5)	28 (1.0)	434 (5.8)	11 (0.8)	419 (8.1)	10.4 (0.07)
Oman	61 (1.0)	480 (2.8)	31 (0.9)	437 (4.2)	8 (0.6)	413 (8.7)	10.4 (0.04)
Bahrain	59 (1.5)	504 (2.0)	31 (1.1)	473 (3.5)	10 (0.8)	446 (7.6)	10.4 (0.07)
United Arab Emirates	57 (0.7)	497 (2.7)	32 (0.6)	454 (3.0)	11 (0.4)	420 (5.9)	10.4 (0.03)
South Africa (9)	53 (1.1)	379 (3.8)	37 (0.8)	361 (3.4)	9 (0.6)	375 (6.5)	10.2 (0.05)
United States	53 (1.3)	532 (5.2)	33 (0.8)	522 (4.7)	14 (0.8)	515 (5.2)	10.2 (0.06)
Qatar	53 (1.5)	487 (5.0)	33 (1.0)	470 (5.3)	14 (1.1)	451 (6.5)	10.1 (0.07)
Malaysia	51 (1.3)	476 (3.4)	42 (1.0)	452 (4.6)	7 (0.9)	405 (9.6)	10.1 (0.05)
Israel	48 (1.7)	522 (4.4)	33 (1.0)	511 (5.1)	19 (1.2)	509 (7.2)	9.8 (0.08)
New Zealand	43 (1.4)	511 (3.9)	42 (0.9)	499 (4.2)	15 (1.1)	476 (6.1)	9.8 (0.07)
Italy	42 (1.6)	505 (3.4)	45 (1.3)	500 (2.6)	13 (1.2)	490 (4.1)	9.7 (0.07)
England	42 (1.6)	534 (5.0)	41 (1.2)	521 (6.0)	17 (1.2)	487 (7.1)	9.7 (0.07)
Singapore	42 (1.1)	617 (4.2)	48 (0.8)	607 (3.9)	10 (0.7)	574 (7.5)	9.8 (0.04)
Ireland	41 (1.7)	537 (3.2)	38 (1.1)	525 (3.5)	21 (1.5)	515 (5.4)	9.6 (0.09)
Australia	41 (1.4)	548 (3.4)	40 (0.8)	523 (3.5)	18 (1.3)	507 (5.2)	9.7 (0.07)
Norway (9)	40 (1.6)	511 (3.7)	44 (1.1)	495 (3.4)	16 (1.0)	466 (6.2)	9.7 (0.07)
Chinese Taipei	37 (1.3)	593 (3.1)	51 (1.1)	570 (2.2)	13 (0.9)	538 (5.1)	9.7 (0.06)
Chile	34 (1.4)	468 (4.0)	50 (1.0)	462 (3.5)	17 (1.2)	457 (5.4)	9.5 (0.07)
Hong Kong SAR	32 (1.4)	516 (5.9)	51 (1.5)	502 (6.1)	17 (1.3)	489 (8.9)	9.4 (0.07)
Japan	17 (1.2)	591 (3.6)	57 (1.2)	572 (2.6)	25 (1.6)	550 (3.1)	8.7 (0.06)
Korea, Rep. of	17 (0.9)	600 (3.9)	59 (1.1)	565 (2.4)	24 (1.5)	524 (3.6)	8.7 (0.05)
<b>International Average</b>	<b>49 (0.3)</b>	<b>507 (0.8)</b>	<b>38 (0.2)</b>	<b>484 (0.9)</b>	<b>13 (0.2)</b>	<b>466 (1.3)</b>	
<b>Benchmarking Participants</b>							
Dubai, UAE	59 (1.2)	557 (2.2)	33 (1.0)	539 (3.3)	9 (0.7)	524 (6.3)	10.5 (0.05)
Western Cape, RSA (9)	53 (1.5)	438 (5.2)	36 (1.2)	445 (6.8)	10 (0.9)	448 (9.0)	10.2 (0.06)
Gauteng, RSA (9)	53 (1.2)	427 (3.9)	36 (0.8)	415 (4.7)	11 (0.9)	430 (9.1)	10.1 (0.06)
Ontario, Canada	50 (2.4)	528 (4.1)	36 (1.5)	518 (3.8)	14 (1.3)	513 (6.4)	10.1 (0.11)
Abu Dhabi, UAE	50 (1.1)	460 (4.0)	35 (1.0)	394 (5.4)	15 (0.9)	364 (8.2)	10.0 (0.06)
Quebec, Canada	42 (2.2)	546 (3.8)	43 (1.2)	535 (4.2)	15 (1.7)	520 (8.2)	9.7 (0.10)

## Separate Science Results

## Instructional Clarity in Biology Lessons

Biology	High Clarity of Instruction		Moderate Clarity of Instruction		Low Clarity of Instruction		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Georgia	70 (1.6)	454 (4.1)	25 (1.4)	438 (5.6)	5 (0.5)	438 (12.2)	11.0 (0.07)
Romania	64 (2.0)	472 (4.4)	25 (1.2)	468 (6.1)	11 (1.3)	479 (8.8)	10.6 (0.10)
Lebanon	58 (1.7)	394 (5.1)	33 (1.4)	359 (6.0)	9 (0.7)	354 (8.5)	10.5 (0.07)
Morocco	56 (1.2)	404 (3.5)	34 (0.8)	385 (3.1)	10 (0.8)	385 (6.7)	10.3 (0.06)
Portugal	51 (1.9)	525 (3.0)	40 (1.5)	518 (3.8)	9 (1.2)	505 (6.7)	10.2 (0.09)
Kazakhstan	46 (1.3)	490 (3.9)	50 (1.2)	471 (3.3)	4 (0.4)	438 (10.0)	10.1 (0.05)
Hungary	45 (1.9)	536 (3.5)	40 (1.1)	523 (3.3)	15 (1.5)	532 (7.2)	9.9 (0.10)
Cyprus	44 (1.5)	500 (3.1)	37 (1.0)	480 (3.1)	19 (1.3)	467 (4.4)	9.7 (0.08)
Russian Federation	43 (1.4)	548 (5.3)	47 (1.3)	539 (4.4)	10 (0.8)	542 (4.7)	9.9 (0.05)
Finland	40 (1.5)	563 (3.6)	48 (1.1)	538 (3.6)	12 (1.0)	520 (7.9)	9.7 (0.07)
Lithuania	37 (1.7)	538 (3.2)	48 (1.2)	531 (3.7)	15 (1.6)	537 (6.3)	9.6 (0.08)
Sweden	31 (1.5)	536 (4.8)	51 (1.2)	526 (3.5)	18 (1.3)	515 (5.8)	9.3 (0.07)
France	29 (1.3)	491 (4.0)	53 (1.3)	490 (3.4)	18 (1.8)	481 (4.1)	9.2 (0.08)
<b>International Average</b>	<b>47 (0.4)</b>	<b>496 (1.1)</b>	<b>41 (0.3)</b>	<b>482 (1.2)</b>	<b>12 (0.3)</b>	<b>476 (2.1)</b>	
<b>Benchmarking Participants</b>							
Moscow City, Russian Fed.	38 (1.8)	570 (3.4)	47 (1.2)	565 (3.4)	14 (1.2)	564 (5.5)	9.6 (0.08)

This TIMSS context questionnaire scale for general/integrated science was established in 2019 based on the combined response distribution of all countries that participated in TIMSS 2019 where science is taught as a single subject. To provide a point of reference for country comparisons, the scale centerpoint of 10 was located at the mean of the combined distribution. The units of the scale were chosen so that 2 scale score points corresponded to the standard deviation of the distribution. The separate scales for biology, chemistry, physics, and Earth science were each established in 2019 using a comparable approach.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

## Exhibit 13.10: Instructional Clarity in Science Lessons – Students' Reports

Students' Reports

(Continued)

## Separate Science Results

Instructional Clarity in Chemistry Lessons

Country	High Clarity of Instruction		Moderate Clarity of Instruction		Low Clarity of Instruction		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Georgia	60 (1.7)	459 (4.0)	30 (1.3)	437 (4.9)	10 (1.1)	428 (7.8)	10.6 (0.07)
Lebanon	60 (1.6)	396 (5.0)	30 (1.3)	356 (6.7)	10 (0.9)	355 (8.9)	10.6 (0.07)
Romania	58 (1.6)	479 (4.3)	29 (0.9)	465 (5.5)	14 (1.3)	461 (8.1)	10.4 (0.08)
Cyprus	55 (1.3)	498 (2.4)	33 (1.3)	482 (2.7)	12 (1.0)	453 (4.8)	10.4 (0.06)
Morocco	54 (1.2)	409 (3.3)	35 (0.8)	379 (3.3)	11 (0.8)	383 (5.0)	10.4 (0.06)
Russian Federation	45 (1.3)	554 (4.6)	43 (0.9)	536 (4.4)	12 (1.0)	532 (5.9)	10.1 (0.06)
Portugal	43 (2.1)	527 (3.9)	41 (1.4)	516 (3.4)	15 (1.5)	508 (5.6)	9.9 (0.09)
Lithuania	43 (1.7)	544 (3.8)	42 (1.2)	530 (3.4)	15 (1.4)	522 (4.5)	9.9 (0.08)
Kazakhstan	42 (1.2)	497 (4.0)	49 (1.0)	466 (3.3)	8 (0.9)	459 (9.1)	10.1 (0.06)
Finland	37 (1.4)	571 (2.9)	46 (1.0)	541 (3.2)	17 (1.1)	511 (5.5)	9.7 (0.06)
Sweden	32 (1.7)	540 (4.9)	48 (1.2)	522 (4.0)	19 (1.6)	514 (5.1)	9.5 (0.08)
Hungary	32 (1.5)	534 (4.7)	43 (1.1)	529 (3.1)	25 (1.6)	528 (4.3)	9.4 (0.08)
France	24 (1.4)	494 (4.3)	50 (1.5)	491 (3.0)	26 (1.8)	482 (4.5)	9.1 (0.08)
<b>International Average</b>	<b>45 (0.4)</b>	<b>500 (1.1)</b>	<b>40 (0.3)</b>	<b>481 (1.1)</b>	<b>15 (0.4)</b>	<b>472 (1.7)</b>	
<b>Benchmarking Participants</b>							
Moscow City, Russian Fed.	39 (1.6)	575 (3.0)	43 (1.1)	564 (3.6)	18 (1.3)	559 (4.5)	9.7 (0.07)

Instructional Clarity in Physics Lessons

Country	High Clarity of Instruction		Moderate Clarity of Instruction		Low Clarity of Instruction		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Georgia	61 (1.8)	457 (4.0)	30 (1.4)	439 (5.1)	9 (1.1)	432 (8.9)	10.7 (0.08)
Lebanon	58 (1.6)	395 (4.8)	32 (1.2)	357 (5.6)	10 (0.8)	364 (11.1)	10.6 (0.07)
Romania	55 (1.7)	479 (4.5)	30 (1.0)	465 (5.3)	15 (1.4)	464 (6.1)	10.4 (0.08)
Morocco	54 (1.1)	409 (3.3)	35 (0.7)	381 (3.0)	10 (0.8)	385 (4.5)	10.4 (0.06)
Cyprus	51 (1.4)	502 (2.5)	32 (1.0)	480 (3.0)	18 (1.1)	461 (4.9)	10.1 (0.07)
Russian Federation	46 (1.2)	549 (4.3)	43 (1.0)	540 (4.5)	11 (0.9)	537 (7.8)	10.2 (0.06)
Portugal	43 (2.1)	527 (3.9)	41 (1.4)	516 (3.4)	15 (1.5)	508 (5.6)	10.0 (0.09)
Kazakhstan	43 (1.2)	494 (4.1)	50 (1.1)	470 (3.6)	7 (0.6)	456 (5.9)	10.2 (0.04)
Finland	35 (1.5)	568 (3.7)	45 (1.1)	538 (3.5)	20 (1.3)	513 (6.2)	9.7 (0.07)
Hungary	34 (1.6)	543 (3.9)	42 (1.2)	526 (3.5)	24 (1.7)	520 (4.4)	9.5 (0.09)
Lithuania	33 (1.9)	539 (4.4)	44 (1.3)	533 (3.1)	22 (2.1)	532 (5.7)	9.5 (0.10)
Sweden	32 (1.4)	544 (4.5)	51 (1.1)	526 (3.8)	18 (1.1)	510 (6.1)	9.6 (0.06)
France	24 (1.4)	494 (4.3)	50 (1.5)	490 (3.0)	26 (1.8)	482 (4.5)	9.1 (0.08)
<b>International Average</b>	<b>44 (0.4)</b>	<b>500 (1.1)</b>	<b>40 (0.3)</b>	<b>482 (1.1)</b>	<b>16 (0.4)</b>	<b>474 (1.8)</b>	
<b>Benchmarking Participants</b>							
Moscow City, Russian Fed.	42 (1.6)	575 (3.6)	42 (1.0)	563 (3.2)	16 (1.3)	556 (4.1)	9.9 (0.08)

Instructional Clarity in Earth Science Lessons

Country	High Clarity of Instruction		Moderate Clarity of Instruction		Low Clarity of Instruction		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Romania	65 (1.8)	479 (5.7)	28 (1.4)	462 (6.3)	7 (0.9)	461 (13.5)	10.8 (0.07)
Georgia	62 (1.9)	456 (4.1)	30 (1.5)	436 (5.3)	7 (0.9)	455 (12.1)	10.7 (0.08)
Morocco	54 (1.1)	407 (3.5)	35 (0.7)	385 (3.0)	11 (0.8)	388 (5.8)	10.3 (0.05)
Portugal	51 (1.9)	525 (3.0)	40 (1.5)	518 (3.8)	9 (1.2)	505 (6.7)	10.3 (0.08)
Russian Federation	45 (1.1)	546 (4.5)	45 (1.0)	541 (4.2)	10 (0.8)	547 (7.8)	10.1 (0.05)
Kazakhstan	43 (1.3)	489 (4.3)	50 (1.1)	471 (3.6)	7 (0.6)	465 (8.1)	10.1 (0.05)
Lithuania	41 (1.8)	538 (3.7)	43 (1.2)	532 (3.6)	16 (1.5)	532 (5.0)	9.8 (0.09)
Cyprus	40 (1.2)	498 (3.0)	35 (1.0)	484 (2.9)	25 (1.1)	474 (3.5)	9.5 (0.07)
Finland	39 (1.4)	562 (3.2)	48 (0.9)	538 (3.4)	13 (1.0)	523 (7.1)	9.8 (0.06)
Hungary	38 (1.6)	536 (4.1)	43 (1.1)	523 (3.6)	19 (1.6)	533 (4.0)	9.6 (0.08)
France	29 (1.3)	491 (4.0)	53 (1.3)	490 (3.4)	18 (1.8)	481 (4.1)	9.3 (0.08)
Lebanon	--	--	--	--	--	--	--
Sweden	--	--	--	--	--	--	--
<b>International Average</b>	<b>46 (0.5)</b>	<b>503 (1.2)</b>	<b>41 (0.4)</b>	<b>489 (1.2)</b>	<b>13 (0.4)</b>	<b>488 (2.3)</b>	
<b>Benchmarking Participants</b>							
Moscow City, Russian Fed.	39 (1.7)	572 (3.8)	44 (1.0)	565 (3.3)	17 (1.3)	563 (4.3)	9.7 (0.08)

A dash (-) indicates comparable data not available.

An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019  
Downloaded from <http://timss2019.org/download>

## Teachers' Emphasis on Science Investigation

Science practices, and in particular scientific inquiry and investigation knowledge and skills, are important components of many science curricula. Teachers were asked the frequency with which they have their students engage in various instructional activities related to science investigations and experiments. Responses were combined into the TIMSS *Teachers' Emphasis on Science Investigation* scale, described in Exhibit 13.11 (see About the Scale), to report two categories: “about half the lessons or more” and “less than half the lessons.” Results of teachers' reports are presented in Exhibits 13.12 and 13.13 for fourth and eighth grades, respectively, together with students' average achievement. Countries are ordered by the percentage of students in “about half the lessons or more.”

On average, 31 percent of fourth grade students had teachers who reported an emphasis on science investigation in “about half the lessons or more,” and 69 percent had teachers who reported an emphasis on science investigation in “less than half the lessons.” Average achievement was similar for students in both categories of emphasis. Just 27 percent of eighth grade students were taught by teachers reporting an emphasis on science investigation in “about half the lessons or more,” and 73 percent had teachers who reported an emphasis on science investigation in “less than half the lessons.” In eighth grade, average achievement for students in the “about half the lessons or more” category was 492, and was 490 for those in the “less than half the lessons” category.

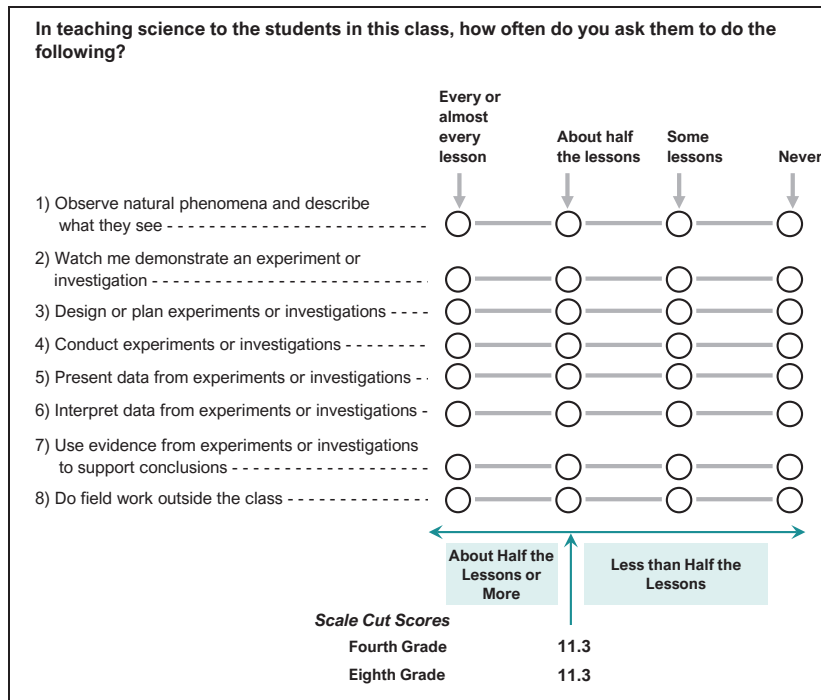


**Exhibit 13.11: Teachers' Emphasis on Science Investigation**

Students' Results Based on Teachers' Reports

**About the Scale**

Students were scored according to their teachers' reports regarding how often they asked students to do eight instructional activities on the *Emphasis on Science Investigation* scale. Cut scores divide the scale into two categories. Students with teachers reporting they emphasize science investigation in **About Half the Lessons or More** had a score at or above the cut score corresponding to their teachers reporting they do all eight activities in "about half the lessons," on average. All other students had teachers reporting they emphasize science investigation in **Less than Half the Lessons**.



SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019  
Downloaded from <http://timss2019.org/download>

## Exhibit 13.12: Teachers' Emphasis on Science Investigation

Students' Results Based on Teachers' Reports

Country	About Half the Lessons or More		Less than Half the Lessons		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Oman	82 (2.4)	431 (5.0)	18 (2.4)	457 (11.0)	12.5 (0.11)
Iran, Islamic Rep. of	78 (3.1)	444 (5.4)	22 (3.1)	428 (8.2)	12.5 (0.15)
Philippines	75 (3.8)	248 (8.8)	25 (3.8)	249 (12.4)	12.3 (0.20)
Cyprus	72 (3.9)	513 (3.8)	28 (3.9)	510 (4.2)	12.0 (0.12)
Turkey (5)	69 (3.6)	522 (6.1)	31 (3.6)	536 (5.2)	12.2 (0.22)
Pakistan	r 66 (7.0)	303 (22.1)	34 (7.0)	278 (15.8)	12.0 (0.30)
Korea, Rep. of	66 (4.1)	590 (2.9)	34 (4.1)	583 (3.0)	11.6 (0.14)
Kuwait	61 (3.5)	392 (7.7)	39 (3.5)	394 (10.0)	11.6 (0.19)
United Arab Emirates	r 58 (2.2)	486 (3.3)	42 (2.2)	458 (4.5)	11.5 (0.10)
Albania	57 (3.6)	493 (5.7)	43 (3.6)	485 (5.6)	11.5 (0.20)
Qatar	54 (2.9)	441 (7.1)	46 (2.9)	460 (4.8)	11.3 (0.13)
Japan	53 (4.4)	561 (2.0)	47 (4.4)	563 (3.0)	11.3 (0.14)
Bahrain	51 (4.0)	496 (6.6)	49 (4.0)	488 (6.3)	11.0 (0.13)
North Macedonia	48 (4.4)	429 (8.3)	52 (4.4)	424 (8.8)	11.3 (0.21)
Kosovo	46 (4.3)	419 (4.8)	54 (4.3)	408 (4.8)	11.2 (0.19)
Morocco	43 (4.1)	373 (8.4)	57 (4.1)	376 (8.2)	10.9 (0.17)
South Africa (5)	43 (4.2)	316 (8.8)	57 (4.2)	332 (7.2)	10.9 (0.22)
Kazakhstan	43 (3.8)	499 (6.7)	57 (3.8)	489 (4.3)	11.0 (0.20)
Saudi Arabia	43 (3.4)	416 (6.6)	57 (3.4)	391 (6.3)	10.9 (0.13)
Australia	35 (3.3)	531 (4.7)	65 (3.3)	535 (3.6)	10.0 (0.15)
Azerbaijan	33 (3.4)	423 (5.8)	67 (3.4)	429 (4.2)	10.3 (0.16)
Italy	32 (3.4)	511 (5.1)	68 (3.4)	509 (3.3)	10.0 (0.19)
Chile	r 31 (4.1)	473 (5.9)	69 (4.1)	466 (3.9)	10.2 (0.18)
Serbia	30 (3.9)	522 (4.8)	70 (3.9)	515 (4.4)	10.0 (0.20)
Singapore	30 (2.7)	602 (5.5)	70 (2.7)	591 (4.3)	10.4 (0.08)
Portugal	29 (3.1)	501 (4.3)	71 (3.1)	505 (2.8)	9.9 (0.16)
Croatia	28 (3.5)	524 (4.6)	72 (3.5)	523 (2.4)	9.8 (0.20)
Chinese Taipei	27 (3.2)	559 (3.0)	73 (3.2)	558 (2.1)	10.2 (0.14)
Montenegro	26 (2.2)	448 (4.8)	74 (2.2)	455 (2.8)	9.6 (0.11)
Slovak Republic	25 (3.0)	532 (6.2)	75 (3.0)	518 (4.0)	9.8 (0.17)
United States	24 (2.3)	545 (5.4)	76 (2.3)	537 (3.2)	9.7 (0.13)
Malta	24 (0.3)	498 (2.2)	76 (0.3)	495 (1.5)	9.6 (0.02)
Bosnia and Herzegovina	20 (2.3)	454 (6.8)	80 (2.3)	460 (3.0)	9.4 (0.14)
Ireland	19 (2.9)	524 (6.9)	81 (2.9)	529 (3.1)	9.4 (0.15)
Spain	19 (3.3)	504 (6.3)	81 (3.3)	512 (2.8)	9.2 (0.16)
Bulgaria	19 (3.1)	540 (11.8)	81 (3.1)	517 (5.3)	9.4 (0.15)
France	18 (2.6)	491 (6.0)	82 (2.6)	488 (3.5)	9.3 (0.15)
Canada	r 17 (1.7)	519 (3.9)	83 (1.7)	526 (2.2)	9.6 (0.09)
Georgia	16 (2.6)	450 (13.0)	84 (2.6)	456 (3.9)	9.5 (0.16)
Russian Federation	15 (2.6)	563 (6.9)	85 (2.6)	568 (3.2)	8.8 (0.16)
New Zealand	15 (2.1)	500 (7.0)	85 (2.1)	503 (2.9)	9.1 (0.13)
Armenia	15 (2.9)	470 (8.0)	85 (2.9)	467 (3.9)	9.2 (0.15)
Northern Ireland	14 (3.3)	528 (6.2)	86 (3.3)	517 (2.6)	8.5 (0.18)
Latvia	13 (2.7)	542 (5.3)	87 (2.7)	542 (2.7)	9.4 (0.16)
Lithuania	12 (2.5)	534 (10.0)	88 (2.5)	537 (2.7)	8.8 (0.14)
Denmark	r 8 (2.5)	517 (9.2)	92 (2.5)	522 (2.8)	8.6 (0.16)
Hong Kong SAR	8 (2.8)	543 (20.8)	92 (2.8)	531 (3.6)	8.7 (0.22)
Sweden	7 (2.4)	533 (12.3)	93 (2.4)	540 (3.3)	8.4 (0.18)
Germany	7 (1.9)	509 (13.1)	93 (1.9)	519 (2.3)	8.5 (0.14)
Hungary	6 (1.6)	525 (8.9)	94 (1.6)	529 (2.9)	8.4 (0.13)
Poland	6 (1.8)	527 (8.4)	94 (1.8)	532 (2.7)	8.5 (0.14)
Finland	6 (1.4)	559 (7.7)	94 (1.4)	555 (2.6)	8.2 (0.10)
Netherlands	r 6 (2.7)	528 (13.2)	94 (2.7)	517 (3.2)	7.8 (0.16)
Austria	5 (1.3)	519 (10.3)	95 (1.3)	522 (2.6)	8.2 (0.12)
Czech Republic	4 (1.1)	544 (11.1)	96 (1.1)	533 (2.6)	8.3 (0.12)
Belgium (Flemish)	3 (1.2)	509 (10.2)	97 (1.2)	502 (2.1)	7.6 (0.13)
Norway (5)	s 2 (1.0)	~ ~	98 (1.0)	540 (2.8)	7.7 (0.14)
England	x 12 (4.0)	538 (9.9)	88 (4.0)	538 (5.2)	9.8 (0.19)
<b>International Average</b>	<b>31 (0.4)</b>	<b>491 (1.1)</b>	<b>69 (0.4)</b>	<b>490 (0.7)</b>	
<b>Benchmarking Participants</b>					
Dubai, UAE	r 67 (2.2)	554 (2.5)	33 (2.2)	541 (4.8)	12.2 (0.12)
Abu Dhabi, UAE	r 46 (3.0)	430 (7.3)	54 (3.0)	405 (6.0)	11.0 (0.15)
Ontario, Canada	r 16 (3.1)	519 (8.4)	84 (3.1)	528 (3.9)	9.6 (0.14)
Madrid, Spain	16 (3.5)	530 (7.6)	84 (3.5)	521 (1.9)	9.2 (0.16)
Quebec, Canada	r 15 (3.0)	523 (4.9)	85 (3.0)	522 (2.7)	9.3 (0.17)
Moscow City, Russian Fed.	10 (3.1)	599 (8.3)	90 (3.1)	594 (2.3)	8.6 (0.17)

This TIMSS context questionnaire scale was established in 2015 based on the combined response distribution of all countries that participated in TIMSS 2015. To provide a point of reference for country comparisons, the scale centerpoint of 10 was located at the mean of the combined distribution. The units of the scale were chosen so that 2 scale score points corresponded to the standard deviation of the distribution.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for at least 40% but less than 50% of the students—interpret with caution.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019  
Downloaded from <http://timss2019.org/download>

## Exhibit 13.13: Teachers' Emphasis on Science Investigation

Students' Results Based on Teachers' Reports

Country	About Half the Lessons or More		Less than Half the Lessons		Average Scale Score	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement		
Oman	75 (2.8)	458 (3.7)	25 (2.8)	456 (7.5)	12.1 (0.11)	
Iran, Islamic Rep. of	61 (3.4)	452 (5.3)	39 (3.4)	445 (6.2)	11.6 (0.14)	
Kuwait	55 (4.8)	435 (6.2)	45 (4.8)	455 (9.6)	11.5 (0.17)	
Morocco	49 (2.8)	395 (3.3)	51 (2.8)	393 (3.7)	11.0 (0.10)	
Turkey	48 (4.2)	521 (7.6)	52 (4.2)	510 (4.2)	11.1 (0.22)	
United Arab Emirates	48 (1.7)	489 (4.4)	52 (1.7)	461 (4.5)	10.9 (0.07)	
Bahrain	46 (2.3)	481 (3.6)	54 (2.3)	490 (3.1)	10.9 (0.13)	
Qatar	45 (4.6)	477 (8.0)	55 (4.6)	473 (6.0)	10.8 (0.14)	
Saudi Arabia	44 (3.9)	438 (4.3)	56 (3.9)	426 (4.1)	10.9 (0.17)	
Egypt	43 (4.2)	401 (8.5)	57 (4.2)	382 (6.2)	10.9 (0.19)	
Jordan	43 (4.0)	455 (7.3)	57 (4.0)	449 (5.5)	10.9 (0.15)	
Malaysia	41 (3.6)	472 (7.7)	59 (3.6)	451 (5.4)	10.7 (0.15)	
Lebanon	37 (2.7)	377 (6.6)	63 (2.7)	377 (6.7)	10.6 (0.11)	
Kazakhstan	36 (2.0)	481 (4.4)	64 (2.0)	476 (3.6)	10.3 (0.12)	
Chile	27 (3.6)	456 (6.5)	73 (3.6)	465 (3.3)	9.9 (0.15)	
France	25 (3.1)	494 (5.2)	75 (3.1)	486 (2.9)	10.1 (0.12)	
South Africa (9)	25 (2.4)	360 (6.8)	75 (2.4)	374 (4.0)	9.6 (0.13)	
United States	25 (2.2)	531 (7.5)	75 (2.2)	525 (5.4)	9.8 (0.11)	
Cyprus	24 (2.2)	481 (6.2)	76 (2.2)	488 (2.9)	9.8 (0.10)	
Korea, Rep. of	23 (3.6)	563 (4.1)	77 (3.6)	560 (2.3)	9.8 (0.16)	
Finland	23 (1.5)	549 (4.1)	77 (1.5)	541 (3.2)	9.4 (0.06)	
Japan	21 (3.4)	574 (6.3)	79 (3.4)	568 (2.4)	10.1 (0.12)	
Romania	20 (2.1)	473 (7.5)	80 (2.1)	471 (4.3)	9.6 (0.10)	
Israel	20 (3.1)	506 (11.2)	80 (3.1)	515 (4.8)	9.4 (0.15)	
Hong Kong SAR	18 (3.5)	526 (16.0)	82 (3.5)	499 (6.2)	9.3 (0.16)	
Georgia	16 (1.5)	441 (6.5)	84 (1.5)	448 (3.8)	9.3 (0.08)	
Ireland	14 (1.9)	520 (7.9)	86 (1.9)	529 (2.7)	9.8 (0.10)	
Russian Federation	14 (1.2)	550 (6.6)	86 (1.2)	542 (4.2)	9.0 (0.09)	
Australia	14 (2.3)	542 (10.8)	86 (2.3)	532 (3.8)	9.5 (0.09)	
England	13 (3.9)	505 (18.9)	87 (3.9)	525 (7.6)	9.6 (0.16)	
Italy	11 (2.0)	494 (7.9)	89 (2.0)	502 (2.6)	9.0 (0.12)	
New Zealand	10 (2.2)	513 (15.2)	90 (2.2)	500 (3.9)	9.2 (0.12)	
Hungary	8 (1.3)	544 (6.3)	92 (1.3)	527 (2.8)	8.7 (0.08)	
Portugal	8 (1.2)	514 (6.2)	92 (1.2)	520 (2.9)	8.8 (0.10)	
Chinese Taipei	8 (2.0)	587 (8.8)	92 (2.0)	573 (2.0)	8.6 (0.13)	
Lithuania	7 (1.0)	529 (5.5)	93 (1.0)	533 (2.9)	8.3 (0.08)	
Sweden	6 (1.3)	530 (13.9)	94 (1.3)	521 (3.3)	8.2 (0.14)	
Singapore	3 (1.0)	597 (27.0)	97 (1.0)	607 (4.1)	8.5 (0.08)	
Norway (9)	1 (0.7)	~	99 (0.7)	498 (3.6)	7.8 (0.12)	
<b>International Average</b>	<b>27 (0.5)</b>	<b>492 (1.5)</b>	<b>73 (0.5)</b>	<b>490 (0.7)</b>		
<b>Benchmarking Participants</b>						
Dubai, UAE	r	53 (3.3)	553 (5.6)	47 (3.3)	549 (5.0)	11.3 (0.10)
Abu Dhabi, UAE	r	42 (2.3)	448 (9.4)	58 (2.3)	395 (7.2)	10.6 (0.11)
Gauteng, RSA (9)		31 (3.5)	412 (7.8)	69 (3.5)	427 (5.3)	10.0 (0.20)
Western Cape, RSA (9)		21 (3.4)	418 (11.2)	79 (3.4)	446 (6.6)	9.2 (0.18)
Moscow City, Russian Fed.		12 (1.3)	571 (4.9)	88 (1.3)	566 (3.0)	8.8 (0.08)
Ontario, Canada	s	11 (3.3)	522 (11.6)	89 (3.3)	521 (4.9)	8.7 (0.21)
Quebec, Canada	y	-	-	-	-	-

This TIMSS context questionnaire scale was established in 2015 based on the combined response distribution of all countries that participated in TIMSS 2015. To provide a point of reference for country comparisons, the scale centerpoint of 10 was located at the mean of the combined distribution. The units of the scale were chosen so that 2 scale score points corresponded to the standard deviation of the distribution.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

A "y" indicates data are available for less than 40% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019  
Downloaded from <http://timss2019.org/download>

## School Resources for Science Experiments

Undertaking hands-on science investigations is an important component of science curricula in many countries. Exhibits 13.14 (fourth grade) and 13.15 (eighth grade) present principals' reports on whether their schools have two resources for facilitating hands-on science experiments—a science laboratory and assistance for teachers when students are conducting experiments—along with student achievement. Countries are ordered by the percentage of students in schools with a science laboratory.

On average across countries, 36 percent of fourth grade students were in schools with a science laboratory, and their average achievement was higher than that of the 64 percent of students who were in schools without a laboratory (496 vs. 486). Of course, the availability of a laboratory in the school could be related to other economic factors that are related to achievement. On average, 35 percent of fourth grade students were in schools in which assistance is available to teachers when students are conducting experiments. This finding also ranged considerably across countries, and there are countries in which many schools have a science laboratory, but assistance is not available to teachers when students conduct experiments.

A much higher percentage of eighth grade students (85%) were in schools with a science laboratory. Average achievement for these students was substantially higher than for students in schools without this resource (494 compared with 457). Still, only about half (54%) of students were in schools in which assistance was available to teachers when students are conducting experiments, and this finding was likewise associated with higher average science achievement (494 compared with 483).

**Exhibit 13.14: School Resources for Conducting Science Experiments**  
*Students' Results based on Principals' Reports*

Country	Schools Have a Science Laboratory				Teachers Have Assistance Available when Students are Conducting Experiments			
	Yes		No		Yes		No	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Japan	100 (0.0)	562 (1.8)	0 (0.0)	~ ~	36 (4.3)	559 (3.0)	64 (4.3)	563 (2.0)
Korea, Rep. of	99 (0.9)	588 (2.2)	1 (0.9)	~ ~	74 (4.0)	590 (2.4)	26 (4.0)	581 (4.3)
Singapore	98 (0.0)	595 (3.4)	2 (0.0)	~ ~	67 (0.0)	597 (4.3)	33 (0.0)	590 (5.1)
Kuwait	95 (1.5)	392 (6.5)	5 (1.5)	400 (28.9)	78 (3.3)	393 (7.2)	22 (3.3)	388 (15.8)
China Taipei	93 (1.9)	557 (1.8)	7 (1.9)	567 (5.1)	90 (2.5)	558 (1.9)	10 (2.5)	558 (5.2)
United Arab Emirates	85 (1.2)	468 (2.5)	15 (1.2)	488 (6.2)	83 (1.1)	474 (2.5)	17 (1.1)	455 (3.5)
Bahrain	85 (2.0)	490 (4.0)	15 (2.0)	507 (6.4)	74 (2.7)	489 (4.0)	26 (2.7)	501 (6.2)
Denmark	r 84 (3.2)	522 (2.8)	16 (3.2)	526 (4.8)	r 7 (1.9)	532 (5.6)	93 (1.9)	522 (2.7)
Qatar	83 (3.0)	440 (4.6)	17 (3.0)	497 (11.2)	86 (2.0)	442 (4.5)	14 (2.0)	495 (9.1)
Saudi Arabia	80 (2.9)	405 (4.9)	20 (2.9)	391 (13.6)	71 (3.5)	398 (5.3)	29 (3.5)	416 (7.1)
Poland	66 (3.2)	535 (3.1)	34 (3.2)	524 (4.8)	50 (4.5)	532 (3.7)	50 (4.5)	529 (3.8)
Cyprus	66 (4.5)	514 (3.8)	34 (4.5)	504 (4.8)	20 (3.8)	519 (7.2)	80 (3.8)	508 (3.4)
Turkey (5)	62 (4.3)	534 (5.2)	38 (4.3)	514 (8.4)	13 (2.7)	536 (13.1)	87 (2.7)	525 (4.8)
Chile	57 (3.9)	478 (3.7)	43 (3.9)	458 (5.0)	39 (4.5)	473 (3.9)	61 (4.5)	467 (4.1)
Georgia	50 (3.8)	454 (5.1)	50 (3.8)	455 (5.6)	8 (2.5)	470 (10.2)	92 (2.5)	453 (4.2)
Lithuania	48 (4.8)	537 (4.2)	52 (4.8)	539 (4.8)	12 (2.8)	542 (10.9)	88 (2.8)	538 (2.9)
Armenia	45 (4.3)	464 (4.3)	55 (4.3)	468 (4.7)	89 (2.5)	465 (3.4)	11 (2.5)	476 (8.8)
Iran, Islamic Rep. of	42 (3.1)	458 (6.8)	58 (3.1)	429 (5.5)	18 (3.1)	455 (9.5)	82 (3.1)	438 (4.8)
Hong Kong SAR	42 (4.8)	543 (5.5)	58 (4.8)	523 (5.6)	62 (3.9)	534 (3.8)	38 (3.9)	528 (6.4)
Portugal	41 (3.7)	504 (3.9)	59 (3.7)	504 (3.1)	39 (4.0)	500 (3.3)	61 (4.0)	506 (3.1)
Kazakhstan	38 (3.8)	494 (6.4)	62 (3.8)	495 (4.5)	61 (3.9)	494 (4.5)	39 (3.9)	492 (6.0)
Italy	36 (3.9)	505 (4.9)	64 (3.9)	513 (3.4)	13 (2.8)	508 (7.7)	87 (2.8)	510 (3.1)
Pakistan	36 (8.2)	297 (29.4)	64 (8.2)	287 (11.8)	55 (6.4)	300 (20.4)	45 (6.4)	279 (14.1)
Latvia	36 (3.7)	542 (4.3)	64 (3.7)	542 (2.8)	71 (3.5)	541 (3.1)	29 (3.5)	543 (3.8)
Czech Republic	35 (3.9)	521 (4.2)	65 (3.9)	541 (3.0)	8 (2.3)	535 (12.6)	92 (2.3)	534 (2.6)
Russian Federation	33 (3.0)	572 (5.2)	67 (3.0)	565 (3.9)	30 (3.0)	566 (4.0)	70 (3.0)	568 (4.0)
Spain	32 (2.9)	524 (3.4)	68 (2.9)	505 (2.8)	20 (2.9)	515 (7.9)	80 (2.9)	510 (2.6)
Sweden	31 (4.1)	529 (6.7)	69 (4.1)	540 (3.7)	17 (3.7)	533 (6.9)	83 (3.7)	537 (4.1)
Oman	30 (2.3)	418 (7.2)	70 (2.3)	441 (5.4)	29 (2.7)	423 (7.7)	71 (2.7)	437 (5.3)
Norway (5)	r 28 (4.7)	545 (4.5)	72 (4.7)	538 (3.0)	r 24 (4.1)	539 (6.4)	76 (4.1)	540 (2.7)
England	s 24 (4.6)	543 (11.3)	76 (4.6)	536 (4.3)	s 37 (5.3)	537 (8.3)	63 (5.3)	538 (4.7)
Slovak Republic	22 (3.4)	531 (5.4)	78 (3.4)	518 (4.8)	13 (2.4)	516 (9.6)	87 (2.4)	522 (4.3)
United States	21 (2.5)	547 (6.1)	79 (2.5)	537 (3.5)	19 (2.4)	539 (7.8)	81 (2.4)	538 (3.5)
Australia	21 (2.9)	537 (6.3)	79 (2.9)	531 (3.5)	15 (2.7)	537 (6.6)	85 (2.7)	531 (3.2)
Montenegro	21 (0.3)	453 (5.9)	79 (0.3)	453 (2.6)	27 (0.6)	456 (3.8)	73 (0.6)	452 (2.6)
Kosovo	20 (3.9)	419 (8.5)	80 (3.9)	412 (4.4)	12 (3.1)	410 (8.6)	88 (3.1)	413 (3.9)
Albania	18 (2.3)	525 (5.5)	82 (2.3)	482 (3.9)	15 (2.8)	519 (8.7)	85 (2.8)	485 (3.9)
Malta	16 (0.3)	518 (2.7)	84 (0.3)	492 (1.5)	47 (0.4)	496 (1.7)	53 (0.4)	496 (1.8)
Philippines	16 (2.8)	294 (18.7)	84 (2.8)	241 (8.7)	65 (4.2)	240 (8.3)	35 (4.2)	266 (11.8)
Bosnia and Herzegovina	14 (2.8)	462 (7.6)	86 (2.8)	458 (3.0)	25 (3.4)	457 (6.1)	75 (3.4)	459 (3.0)
Azerbaijan	13 (2.7)	425 (9.9)	87 (2.7)	427 (3.4)	48 (3.8)	425 (4.9)	52 (3.8)	429 (5.0)
Finland	13 (3.0)	556 (6.9)	87 (3.0)	554 (2.7)	32 (3.4)	556 (4.8)	68 (3.4)	554 (2.7)
Germany	13 (2.1)	512 (7.1)	87 (2.1)	519 (2.6)	6 (1.6)	526 (9.3)	94 (1.6)	518 (2.4)
South Africa (5)	13 (2.4)	401 (21.9)	87 (2.4)	314 (5.0)	20 (3.3)	302 (11.5)	80 (3.3)	332 (5.9)
Serbia	11 (2.4)	506 (8.1)	89 (2.4)	518 (3.7)	33 (4.3)	522 (5.1)	67 (4.3)	514 (4.2)
Canada	11 (1.1)	537 (7.1)	89 (1.1)	522 (1.9)	20 (2.4)	528 (5.7)	80 (2.4)	522 (2.2)
Morocco	10 (2.5)	450 (24.1)	90 (2.5)	365 (6.6)	50 (3.1)	392 (7.9)	50 (3.1)	359 (8.1)
Hungary	9 (2.5)	546 (9.9)	91 (2.5)	527 (3.0)	17 (3.3)	537 (9.1)	83 (3.3)	527 (3.3)
Croatia	6 (2.2)	530 (10.5)	94 (2.2)	524 (2.2)	15 (3.0)	532 (6.5)	85 (3.0)	523 (2.0)
North Macedonia	6 (2.0)	400 (17.4)	94 (2.0)	428 (6.4)	34 (4.1)	437 (9.3)	66 (4.1)	420 (8.5)
New Zealand	6 (1.5)	539 (13.4)	94 (1.5)	500 (2.5)	18 (3.1)	484 (9.0)	82 (3.1)	507 (3.0)
Bulgaria	5 (1.8)	554 (14.9)	95 (1.8)	519 (5.3)	1 (1.0)	~ ~	99 (1.0)	521 (5.1)
Netherlands	s 3 (1.9)	525 (16.8)	97 (1.9)	518 (3.3)	s 21 (4.6)	517 (6.9)	79 (4.6)	519 (3.6)
Austria	2 (1.1)	~ ~	98 (1.1)	522 (2.6)	5 (1.6)	505 (15.3)	95 (1.6)	523 (2.7)
Ireland	2 (1.0)	~ ~	98 (1.0)	528 (3.2)	9 (2.5)	519 (24.0)	91 (2.5)	529 (2.6)
France	2 (1.1)	~ ~	98 (1.1)	488 (3.0)	5 (1.8)	494 (16.5)	95 (1.8)	488 (3.0)
Belgium (Flemish)	1 (0.8)	~ ~	99 (0.8)	501 (2.2)	61 (4.1)	497 (3.0)	39 (4.1)	508 (3.0)
Northern Ireland	r 0 (0.0)	~ ~	100 (0.0)	520 (2.7)	r 19 (3.7)	517 (7.4)	81 (3.7)	521 (2.7)
<b>International Average</b>	<b>36 (0.4)</b>	<b>496 (1.3)</b>	<b>64 (0.4)</b>	<b>486 (0.9)</b>	<b>35 (0.4)</b>	<b>491 (1.1)</b>	<b>65 (0.4)</b>	<b>491 (0.7)</b>
<b>Benchmarking Participants</b>								
Abu Dhabi, UAE	r 87 (1.0)	407 (3.6)	13 (1.0)	447 (7.3)	r 79 (0.7)	414 (3.4)	21 (0.7)	405 (4.7)
Dubai, UAE	r 77 (0.3)	541 (2.3)	23 (0.3)	560 (2.9)	r 81 (0.2)	543 (2.2)	19 (0.2)	556 (3.1)
Moscow City, Russian Fed.	64 (4.2)	595 (2.8)	36 (4.2)	595 (3.5)	17 (3.2)	600 (5.2)	83 (3.2)	594 (2.4)
Madrid, Spain	44 (3.5)	529 (2.6)	56 (3.5)	518 (3.1)	16 (2.7)	526 (4.8)	84 (2.7)	523 (2.3)
Ontario, Canada	8 (1.4)	562 (14.7)	92 (1.4)	521 (3.0)	9 (4.0)	534 (28.5)	91 (4.0)	523 (3.2)
Quebec, Canada	7 (2.1)	510 (9.1)	93 (2.1)	523 (2.7)	33 (4.2)	524 (4.1)	67 (4.2)	521 (3.0)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 A tilde (~) indicates insufficient data to report achievement.  
 An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 13.15: School Resources for Conducting Science Experiments**  
*Students' Results based on Principals' Reports*

Country	Schools Have a Science Laboratory				Teachers Have Assistance Available when Students are Conducting Experiments			
	Yes		No		Yes		No	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	100 (0.0)	530 (3.3)	0 (0.0)	~ ~	66 (3.4)	532 (3.5)	34 (3.4)	526 (7.6)
Ireland	100 (0.0)	525 (2.8)	0 (0.0)	~ ~	14 (2.9)	535 (8.2)	86 (2.9)	523 (3.1)
Korea, Rep. of	100 (0.0)	561 (2.1)	0 (0.0)	~ ~	46 (3.6)	565 (3.7)	54 (3.6)	557 (2.9)
Singapore	100 (0.0)	608 (3.9)	0 (0.0)	~ ~	99 (0.0)	609 (4.0)	1 (0.0)	~ ~
Sweden	100 (0.0)	522 (3.2)	0 (0.0)	~ ~	15 (3.2)	501 (12.3)	85 (3.2)	526 (3.6)
Oman	100 (0.3)	457 (3.0)	0 (0.3)	~ ~	82 (3.0)	459 (3.4)	18 (3.0)	452 (7.3)
Bahrain	100 (0.1)	486 (1.9)	0 (0.1)	~ ~	92 (0.1)	487 (2.0)	8 (0.1)	476 (5.6)
Hong Kong SAR	99 (0.7)	504 (5.3)	1 (0.7)	~ ~	98 (1.3)	504 (5.4)	2 (1.3)	~ ~
Japan	99 (0.9)	570 (2.2)	1 (0.9)	~ ~	35 (4.0)	570 (4.2)	65 (4.0)	569 (2.9)
Kuwait	99 (0.6)	443 (5.4)	1 (0.6)	~ ~	83 (3.3)	443 (6.2)	17 (3.3)	445 (13.1)
New Zealand	99 (0.9)	505 (3.6)	1 (0.9)	~ ~	53 (5.1)	500 (5.1)	47 (5.1)	507 (5.7)
England	s 99 (1.0)	521 (5.7)	1 (1.0)	~ ~	s 71 (4.6)	518 (7.2)	29 (4.6)	526 (12.8)
Malaysia	99 (0.3)	460 (3.6)	1 (0.3)	~ ~	91 (2.1)	461 (4.0)	9 (2.1)	449 (10.1)
Cyprus	r 99 (0.0)	483 (2.2)	1 (0.0)	~ ~	r 36 (0.4)	494 (3.6)	64 (0.4)	477 (2.6)
Chinese Taipei	99 (0.8)	575 (2.0)	1 (0.8)	~ ~	92 (1.6)	577 (2.0)	8 (1.6)	544 (8.4)
Qatar	99 (1.0)	475 (4.3)	1 (1.0)	~ ~	94 (1.7)	473 (4.5)	6 (1.7)	502 (21.0)
Portugal	98 (1.3)	519 (2.9)	2 (1.3)	~ ~	46 (4.8)	524 (4.7)	54 (4.8)	514 (4.2)
United Arab Emirates	97 (0.7)	472 (2.4)	3 (0.7)	430 (6.1)	91 (1.0)	471 (2.4)	9 (1.0)	462 (5.6)
Egypt	95 (1.8)	390 (5.6)	5 (1.8)	374 (22.8)	94 (1.8)	391 (6.0)	6 (1.8)	373 (24.7)
Norway (9)	r 93 (2.4)	497 (3.6)	7 (2.4)	490 (12.6)	r 34 (4.6)	494 (5.8)	66 (4.6)	498 (4.3)
Saudi Arabia	92 (1.8)	433 (2.8)	8 (1.8)	420 (14.3)	82 (3.4)	433 (3.2)	18 (3.4)	434 (8.4)
Jordan	92 (1.9)	458 (4.5)	8 (1.9)	390 (13.1)	89 (2.0)	456 (5.2)	11 (2.0)	420 (8.9)
Israel	90 (2.7)	514 (4.7)	10 (2.7)	509 (15.8)	85 (2.8)	513 (4.6)	15 (2.8)	516 (10.9)
Lebanon	89 (2.5)	378 (5.2)	11 (2.5)	368 (12.8)	65 (3.2)	388 (6.4)	35 (3.2)	355 (9.9)
Finland	87 (3.2)	544 (3.3)	13 (3.2)	535 (9.5)	19 (3.2)	542 (6.0)	81 (3.2)	543 (3.7)
Morocco	83 (2.4)	395 (3.3)	17 (2.4)	393 (7.5)	43 (3.7)	400 (4.7)	57 (3.7)	390 (4.3)
Kazakhstan	81 (2.8)	480 (3.7)	19 (2.8)	467 (7.0)	92 (1.5)	478 (3.4)	8 (1.5)	476 (8.8)
United States	80 (2.8)	531 (3.9)	20 (2.8)	510 (15.1)	34 (3.4)	519 (7.2)	66 (3.4)	530 (6.1)
Russian Federation	79 (3.1)	545 (4.0)	21 (3.1)	535 (9.0)	46 (3.6)	540 (6.3)	54 (3.6)	545 (4.0)
France	r 75 (4.1)	493 (3.6)	25 (4.1)	482 (6.6)	r 13 (2.8)	510 (10.5)	87 (2.8)	488 (3.4)
Italy	75 (3.7)	501 (2.9)	25 (3.7)	504 (5.7)	13 (2.9)	492 (11.3)	87 (2.9)	503 (2.5)
Georgia	70 (3.7)	446 (4.6)	30 (3.7)	450 (5.8)	6 (2.2)	488 (24.7)	94 (2.2)	444 (3.8)
Chile	68 (3.1)	473 (3.8)	32 (3.1)	439 (6.1)	32 (3.5)	474 (6.5)	68 (3.5)	457 (4.1)
Iran, Islamic Rep. of	67 (3.5)	461 (4.9)	33 (3.5)	424 (6.0)	27 (3.1)	465 (8.0)	73 (3.1)	444 (4.4)
Turkey	63 (3.7)	525 (5.1)	37 (3.7)	500 (5.7)	14 (2.6)	542 (13.5)	86 (2.6)	511 (4.2)
Romania	62 (3.3)	485 (6.3)	38 (3.3)	447 (4.9)	38 (3.3)	491 (7.2)	62 (3.3)	458 (4.7)
South Africa (9)	46 (2.5)	406 (5.6)	54 (2.5)	339 (3.6)	35 (2.7)	371 (6.7)	65 (2.7)	370 (3.8)
Lithuania	27 (3.8)	547 (5.2)	73 (3.8)	526 (3.9)	7 (2.3)	519 (6.7)	93 (2.3)	533 (3.0)
Hungary	26 (3.8)	553 (8.0)	74 (3.8)	522 (3.3)	17 (3.1)	560 (10.6)	83 (3.1)	524 (3.7)
<b>International Average</b>	<b>85 (0.4)</b>	<b>494 (0.7)</b>	<b>15 (0.4)</b>	<b>457 (2.2)</b>	<b>54 (0.5)</b>	<b>494 (1.2)</b>	<b>46 (0.5)</b>	<b>483 (1.4)</b>
<b>Benchmarking Participants</b>								
Quebec, Canada	100 (0.0)	540 (3.5)	0 (0.0)	~ ~	98 (1.3)	540 (3.6)	2 (1.3)	~ ~
Dubai, UAE	r 98 (0.0)	546 (2.3)	2 (0.0)	~ ~	r 92 (0.2)	546 (2.4)	8 (0.2)	555 (6.0)
Abu Dhabi, UAE	r 98 (0.1)	418 (4.3)	2 (0.1)	~ ~	r 91 (0.9)	416 (4.6)	9 (0.9)	430 (8.5)
Moscow City, Russian Fed.	97 (1.3)	567 (3.0)	3 (1.3)	567 (16.1)	28 (3.6)	573 (6.0)	72 (3.6)	564 (3.3)
Western Cape, RSA (9)	73 (3.8)	452 (7.3)	27 (3.8)	408 (9.1)	22 (3.9)	476 (20.3)	78 (3.9)	431 (6.7)
Gauteng, RSA (9)	65 (3.9)	434 (5.3)	35 (3.9)	400 (8.7)	42 (4.5)	429 (8.0)	58 (4.5)	416 (6.2)
Ontario, Canada	r 44 (4.7)	532 (4.3)	56 (4.7)	512 (4.3)	r 18 (4.6)	530 (12.7)	82 (4.6)	519 (3.4)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019  
 Downloaded from <http://timss2019.org/download>

## Experiments in Science Lessons

Students were asked about the frequency with which they conduct science experiments in their science lessons. Their reports are presented in Exhibits 13.16 (fourth grade) and 13.17 (eighth grade).

In fourth grade, 31 percent of students, on average, reported that they conducted experiments “at least once a week,” 26 percent “once or twice a month,” 24 percent “a few times a year,” and 18 percent “never.” Across countries, students reporting that they do experiments “once or twice a month” or “a few times a year” had higher average achievement than students who said they do them “at least once a week” or “never.”

In the eighth grade, the frequency with which students conduct science experiments varied by science subject. In countries teaching science as an integrated subject, 28 percent of students reported that they do them “at least once a week,” 37 percent said “once or twice a month,” 24 percent said “a few times a year,” and 11 percent said they “never” do them, on average. In countries teaching science as separate subjects, frequencies were similar to those for integrated science in chemistry and physics lessons, but much less frequent in biology and Earth science lessons. As in fourth grade, across countries, students reporting that they do experiments “once or twice a month” or “a few times a year” had higher average achievement than students doing them “at least once a week” or “never.”

## Exhibit 13.16: Frequency Students Conduct Experiments in Science Lessons

Students' Reports

Country	At Least Once a Week		Once or Twice a Month		A Few Times a Year		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Albania	54 (2.2)	490 (4.4)	26 (2.3)	498 (4.7)	13 (2.0)	502 (11.0)	7 (0.8)	472 (9.0)
Armenia	40 (1.3)	462 (3.6)	24 (1.4)	481 (4.7)	16 (1.2)	473 (6.0)	21 (1.3)	465 (4.5)
Australia	26 (1.4)	516 (4.5)	30 (1.4)	542 (3.2)	31 (1.6)	547 (3.8)	13 (1.0)	515 (4.2)
Austria	16 (0.8)	480 (4.8)	19 (0.8)	516 (4.1)	26 (1.0)	543 (3.6)	39 (1.3)	530 (2.8)
Azerbaijan	48 (1.9)	433 (3.9)	18 (1.3)	432 (5.0)	16 (1.5)	431 (5.2)	17 (1.2)	439 (5.6)
Bahrain	45 (1.2)	490 (3.4)	26 (1.1)	504 (4.4)	17 (0.8)	507 (5.5)	12 (0.9)	480 (6.1)
Belgium (Flemish)	17 (1.1)	482 (4.3)	40 (1.7)	507 (2.8)	32 (1.6)	510 (3.1)	10 (0.8)	483 (4.7)
Bosnia and Herzegovina	24 (1.1)	438 (4.2)	16 (0.9)	459 (4.7)	29 (1.3)	485 (3.6)	31 (1.7)	458 (3.0)
Bulgaria	21 (1.5)	502 (7.1)	21 (1.7)	521 (7.1)	32 (2.1)	538 (7.8)	27 (1.5)	527 (7.3)
Canada	20 (0.8)	495 (3.2)	35 (1.1)	530 (2.4)	30 (1.1)	538 (3.3)	14 (0.8)	520 (3.4)
Chile	27 (1.3)	448 (4.1)	25 (1.1)	483 (3.8)	27 (1.3)	493 (3.5)	20 (1.4)	459 (4.0)
Chinese Taipei	58 (1.8)	562 (2.0)	31 (1.5)	558 (2.8)	6 (0.5)	546 (5.8)	5 (0.4)	529 (5.9)
Croatia	18 (1.3)	496 (4.3)	23 (1.2)	526 (3.1)	45 (1.7)	538 (2.3)	15 (1.4)	515 (4.0)
Cyprus	43 (2.6)	512 (3.9)	32 (1.5)	523 (3.8)	16 (1.2)	512 (4.6)	10 (1.3)	479 (5.8)
Czech Republic	13 (0.7)	487 (6.0)	18 (0.9)	525 (4.2)	23 (1.3)	555 (4.3)	46 (1.5)	539 (2.5)
Denmark	24 (1.9)	500 (4.3)	38 (1.4)	528 (3.0)	28 (1.5)	537 (3.6)	10 (1.2)	521 (5.9)
England	26 (1.3)	526 (5.7)	41 (1.2)	550 (3.4)	24 (1.3)	539 (4.7)	9 (0.8)	520 (5.7)
Finland	7 (0.6)	505 (7.8)	30 (1.1)	554 (2.8)	43 (1.1)	567 (3.0)	20 (0.9)	553 (3.9)
France	16 (1.0)	462 (5.4)	16 (1.0)	495 (4.6)	40 (1.4)	500 (3.8)	28 (1.8)	483 (4.0)
Georgia	38 (1.7)	446 (5.0)	30 (1.7)	461 (5.3)	15 (1.1)	474 (7.8)	16 (1.4)	448 (7.0)
Germany	27 (1.2)	493 (3.5)	31 (1.2)	532 (3.2)	31 (1.3)	547 (3.4)	11 (1.0)	514 (6.0)
Hong Kong SAR	13 (1.1)	512 (6.2)	28 (1.3)	535 (4.3)	36 (1.7)	546 (3.2)	22 (1.6)	515 (5.7)
Hungary	14 (0.8)	478 (4.3)	16 (0.8)	539 (3.9)	26 (1.1)	547 (3.3)	43 (1.3)	534 (3.2)
Iran, Islamic Rep. of	54 (1.8)	439 (4.6)	26 (1.3)	451 (6.7)	13 (0.8)	453 (6.4)	8 (1.0)	414 (10.6)
Ireland	13 (1.0)	494 (4.7)	32 (1.4)	533 (4.1)	42 (1.3)	538 (3.7)	13 (1.0)	523 (5.2)
Italy	24 (0.9)	488 (4.0)	23 (0.9)	519 (3.7)	32 (1.0)	524 (3.8)	21 (0.9)	504 (3.6)
Japan	64 (1.5)	561 (2.0)	32 (1.5)	572 (2.6)	3 (0.3)	505 (9.6)	1 (0.1)	~ ~
Kazakhstan	42 (1.3)	485 (4.2)	22 (1.0)	504 (4.0)	14 (0.8)	514 (4.9)	22 (1.1)	491 (4.7)
Korea, Rep. of	72 (1.8)	587 (2.2)	25 (1.5)	591 (3.6)	3 (0.5)	585 (8.2)	1 (0.1)	~ ~
Kosovo	45 (1.4)	414 (4.0)	16 (1.1)	421 (4.5)	17 (1.5)	428 (5.3)	22 (1.3)	414 (6.1)
Kuwait	52 (1.5)	402 (6.4)	20 (1.1)	398 (8.7)	13 (0.8)	396 (10.3)	16 (1.1)	379 (8.9)
Latvia	23 (1.5)	523 (4.4)	36 (1.2)	549 (2.9)	29 (1.3)	553 (2.6)	11 (0.9)	535 (6.3)
Lithuania	16 (1.2)	507 (5.2)	30 (1.6)	541 (3.7)	36 (1.5)	553 (3.7)	18 (1.3)	533 (4.7)
Malta	29 (0.8)	474 (2.7)	32 (0.7)	512 (2.6)	27 (0.6)	507 (2.4)	12 (0.5)	486 (5.6)
Montenegro	28 (1.1)	440 (4.1)	18 (1.0)	469 (3.8)	17 (1.2)	470 (4.0)	37 (1.6)	461 (3.4)
Morocco	45 (1.8)	376 (7.1)	24 (1.5)	378 (8.4)	16 (1.4)	382 (8.1)	15 (1.6)	371 (18.4)
Netherlands	11 (0.8)	494 (7.1)	22 (1.1)	517 (3.2)	38 (1.2)	533 (3.7)	30 (1.3)	514 (3.9)
New Zealand	16 (1.0)	471 (4.7)	21 (1.0)	508 (4.2)	36 (1.4)	520 (3.5)	27 (1.5)	499 (3.6)
North Macedonia	40 (2.0)	409 (6.8)	31 (1.5)	454 (7.5)	22 (2.4)	447 (12.5)	7 (0.7)	406 (8.9)
Northern Ireland	10 (0.9)	488 (5.5)	24 (1.5)	521 (3.3)	41 (1.7)	533 (3.1)	24 (1.8)	507 (4.1)
Norway (5)	26 (1.8)	523 (4.1)	35 (1.5)	547 (3.0)	33 (1.8)	553 (3.2)	6 (0.8)	516 (6.5)
Oman	47 (1.6)	437 (5.3)	22 (1.1)	441 (5.1)	22 (1.2)	448 (6.6)	9 (0.7)	423 (7.1)
Pakistan	43 (2.9)	305 (15.5)	22 (2.5)	291 (21.2)	13 (2.0)	297 (20.1)	22 (3.0)	261 (20.0)
Philippines	43 (1.4)	263 (7.8)	27 (0.9)	256 (9.5)	16 (0.7)	252 (8.2)	14 (1.0)	221 (8.0)
Poland	12 (0.8)	492 (4.8)	18 (0.7)	535 (3.3)	32 (1.2)	548 (3.3)	38 (1.1)	531 (3.0)
Portugal	36 (1.2)	490 (3.5)	25 (1.2)	515 (2.8)	26 (1.2)	521 (3.1)	13 (0.9)	491 (5.5)
Qatar	45 (1.2)	437 (4.4)	24 (1.1)	475 (5.8)	18 (1.0)	480 (6.1)	13 (0.7)	428 (7.7)
Russian Federation	14 (1.1)	535 (4.8)	22 (1.5)	572 (5.7)	33 (1.6)	575 (2.8)	32 (1.4)	570 (3.1)
Saudi Arabia	47 (1.5)	407 (4.4)	18 (0.7)	413 (6.6)	12 (0.7)	425 (6.0)	23 (1.4)	390 (7.2)
Serbia	31 (1.6)	507 (4.2)	24 (1.5)	532 (4.8)	28 (1.7)	529 (4.7)	17 (1.4)	504 (7.3)
Singapore	39 (0.7)	588 (4.0)	40 (0.7)	605 (3.7)	17 (0.6)	595 (4.3)	4 (0.3)	558 (7.0)
Slovak Republic	17 (1.1)	477 (6.8)	23 (1.2)	522 (4.9)	34 (1.4)	544 (3.4)	27 (1.3)	519 (6.2)
South Africa (5)	38 (0.9)	327 (5.0)	22 (0.8)	320 (6.1)	22 (0.9)	347 (8.2)	19 (1.0)	310 (6.5)
Spain	16 (0.8)	472 (4.6)	17 (0.9)	515 (3.3)	28 (1.0)	528 (2.2)	39 (1.5)	518 (2.5)
Sweden	24 (1.9)	526 (5.7)	36 (1.7)	548 (3.7)	26 (1.8)	548 (4.0)	15 (1.6)	517 (6.4)
Turkey (5)	38 (1.7)	515 (5.0)	38 (1.4)	552 (4.2)	11 (0.7)	538 (6.9)	13 (0.9)	489 (7.9)
United Arab Emirates	43 (0.7)	467 (2.3)	29 (0.7)	494 (3.0)	18 (0.7)	484 (3.0)	10 (0.3)	444 (4.3)
United States	22 (1.0)	510 (4.7)	27 (0.9)	554 (2.9)	31 (0.8)	557 (3.3)	20 (0.9)	532 (3.7)
<b>International Average</b>	<b>31 (0.2)</b>	<b>475 (0.7)</b>	<b>26 (0.2)</b>	<b>499 (0.7)</b>	<b>24 (0.2)</b>	<b>503 (0.8)</b>	<b>18 (0.2)</b>	<b>478 (0.9)</b>
<b>Benchmarking Participants</b>								
Ontario, Canada	21 (1.3)	491 (5.2)	32 (1.8)	533 (4.2)	31 (2.0)	541 (5.7)	16 (0.9)	525 (4.7)
Quebec, Canada	16 (1.3)	493 (5.0)	39 (2.0)	524 (2.9)	33 (1.8)	536 (3.2)	12 (2.2)	514 (5.9)
Moscow City, Russian Fed.	11 (0.6)	562 (4.8)	14 (0.8)	596 (5.1)	27 (0.9)	607 (3.1)	48 (1.6)	596 (2.6)
Madrid, Spain	14 (1.2)	485 (4.7)	19 (1.3)	526 (3.4)	29 (1.6)	540 (2.2)	38 (1.8)	524 (2.6)
Abu Dhabi, UAE	41 (1.1)	406 (3.7)	27 (0.9)	437 (4.8)	20 (0.8)	441 (4.3)	13 (0.7)	406 (7.1)
Dubai, UAE	40 (0.9)	535 (2.6)	35 (0.8)	555 (2.2)	18 (0.7)	551 (3.0)	6 (0.3)	527 (5.1)

() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study TIMSS 2019

Downloaded from <http://timss2019.org/download>



**Exhibit 13.17: Frequency Students Conduct Experiments in Science Lessons**

Students' Reports

The general/integrated science panel summarizes responses for countries where students are enrolled in science as a single subject. The following panels for biology, chemistry, physics, and Earth science summarize responses for countries where students are taught science as separate subjects.

*Frequency Students Conduct Experiments in General/Integrated Science Lessons*

Country	At Least Once a Week		Once or Twice a Month		A Few Times a Year		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	39 (1.6)	534 (4.1)	42 (1.2)	541 (3.6)	14 (1.0)	516 (3.8)	5 (0.7)	443 (10.1)
Bahrain	20 (0.7)	465 (4.6)	29 (0.9)	493 (3.4)	34 (0.8)	508 (2.7)	17 (0.8)	470 (4.8)
Chile	11 (0.9)	407 (6.5)	33 (1.7)	468 (3.5)	44 (1.5)	477 (3.2)	12 (1.4)	452 (5.9)
Chinese Taipei	13 (1.5)	558 (5.5)	53 (2.1)	579 (2.3)	25 (1.9)	586 (3.8)	9 (1.5)	542 (6.1)
Egypt	49 (1.5)	395 (5.7)	24 (1.2)	406 (6.0)	13 (1.1)	404 (8.6)	15 (1.1)	363 (8.1)
England	32 (2.0)	512 (7.2)	49 (1.6)	537 (5.2)	14 (1.1)	505 (6.8)	4 (0.6)	453 (12.6)
Hong Kong SAR	57 (2.2)	510 (5.8)	37 (2.1)	504 (7.0)	4 (0.7)	460 (10.8)	2 (0.3)	~ ~
Iran, Islamic Rep. of	32 (1.3)	433 (4.1)	36 (1.0)	458 (4.0)	21 (0.9)	471 (6.1)	11 (0.7)	432 (6.0)
Ireland	35 (2.1)	521 (4.2)	45 (1.7)	538 (3.0)	15 (1.2)	528 (5.1)	5 (0.8)	460 (16.0)
Israel	16 (1.1)	490 (6.0)	35 (1.1)	519 (5.0)	33 (1.2)	535 (5.1)	16 (1.0)	496 (6.5)
Italy	3 (0.5)	430 (8.0)	18 (1.2)	494 (5.0)	45 (1.3)	512 (2.8)	33 (1.7)	497 (3.3)
Japan	35 (2.3)	575 (3.5)	60 (2.2)	569 (2.5)	5 (0.9)	546 (5.5)	0 (0.2)	~ ~
Jordan	41 (1.1)	439 (4.8)	29 (0.9)	475 (4.9)	15 (0.8)	482 (5.3)	16 (1.0)	434 (7.0)
Korea, Rep. of	6 (0.7)	547 (8.6)	49 (1.9)	559 (2.7)	39 (1.9)	571 (2.8)	6 (1.1)	522 (7.2)
Kuwait	45 (1.5)	444 (6.2)	27 (0.8)	448 (6.9)	17 (1.4)	466 (6.0)	11 (0.8)	425 (9.5)
Malaysia	29 (1.3)	450 (5.5)	41 (1.2)	474 (3.4)	26 (0.8)	461 (3.9)	5 (0.6)	411 (11.7)
New Zealand	37 (2.2)	507 (5.5)	42 (1.3)	509 (3.5)	14 (1.3)	488 (6.2)	6 (0.9)	437 (9.1)
Norway (9)	14 (1.9)	491 (7.2)	42 (1.9)	503 (3.3)	39 (2.1)	500 (3.9)	4 (0.7)	429 (13.0)
Oman	47 (1.1)	462 (3.1)	31 (0.8)	466 (3.6)	17 (0.6)	467 (4.8)	6 (0.5)	409 (7.2)
Qatar	33 (1.7)	460 (6.6)	37 (1.3)	493 (4.9)	20 (1.2)	493 (7.5)	10 (0.8)	430 (9.3)
Saudi Arabia	27 (1.0)	407 (4.2)	25 (0.7)	448 (3.6)	26 (0.9)	459 (3.3)	21 (1.1)	418 (5.0)
Singapore	12 (0.6)	612 (8.2)	42 (0.8)	617 (3.7)	43 (0.8)	602 (4.6)	3 (0.3)	541 (11.1)
South Africa (9)	42 (0.8)	335 (3.9)	22 (0.6)	401 (3.9)	22 (0.6)	409 (4.0)	15 (1.1)	370 (5.4)
Turkey	15 (1.1)	475 (8.4)	40 (1.7)	523 (4.5)	26 (1.4)	541 (4.9)	19 (1.2)	498 (6.8)
United Arab Emirates	28 (0.7)	452 (4.5)	37 (0.5)	492 (2.3)	24 (0.6)	498 (3.4)	11 (0.4)	436 (6.2)
United States	20 (1.1)	526 (6.2)	45 (1.2)	535 (6.4)	26 (0.9)	530 (4.1)	10 (0.8)	466 (5.1)
<b>International Average</b>	<b>28 (0.3)</b>	<b>478 (1.2)</b>	<b>37 (0.3)</b>	<b>502 (0.9)</b>	<b>24 (0.2)</b>	<b>501 (1.0)</b>	<b>11 (0.2)</b>	<b>451 (1.8)</b>
<b>Benchmarking Participants</b>								
Ontario, Canada	12 (1.2)	519 (4.9)	49 (2.0)	530 (3.5)	32 (1.8)	520 (4.0)	8 (1.2)	491 (8.9)
Quebec, Canada	14 (1.7)	530 (5.4)	58 (1.9)	541 (4.1)	24 (2.0)	539 (4.6)	3 (0.6)	474 (13.6)
Gauteng, RSA (9)	32 (1.0)	367 (4.2)	27 (0.9)	441 (4.0)	26 (0.9)	465 (5.7)	15 (0.9)	431 (5.2)
Western Cape, RSA (9)	30 (1.2)	375 (4.6)	26 (0.9)	465 (6.3)	28 (1.2)	491 (7.9)	16 (1.1)	437 (6.7)
Abu Dhabi, UAE	27 (0.8)	387 (6.7)	34 (0.8)	441 (3.8)	25 (0.7)	458 (4.7)	14 (0.8)	394 (9.1)
Dubai, UAE	25 (1.4)	535 (5.5)	44 (1.1)	556 (2.8)	25 (1.3)	555 (6.0)	6 (0.7)	518 (10.3)

**Separate Science Results***Frequency Students Conduct Experiments in Biology Lessons*

Country	At Least Once a Week		Once or Twice a Month		A Few Times a Year		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Cyprus	6 (0.5)	434 (7.8)	28 (1.0)	480 (3.5)	45 (1.1)	498 (2.2)	21 (1.1)	481 (4.2)
Finland	4 (0.4)	493 (10.8)	32 (1.2)	534 (3.6)	50 (1.1)	559 (3.2)	13 (1.1)	549 (6.9)
France	15 (1.2)	463 (5.4)	38 (1.5)	492 (3.9)	36 (1.7)	500 (3.7)	11 (1.4)	478 (6.1)
Georgia	20 (1.4)	432 (7.8)	29 (1.7)	454 (4.8)	21 (1.4)	462 (5.2)	30 (1.9)	447 (6.0)
Hungary	4 (0.4)	458 (11.0)	11 (1.0)	525 (7.4)	30 (1.1)	543 (3.7)	55 (1.8)	530 (3.0)
Kazakhstan	37 (1.4)	460 (4.4)	33 (0.9)	490 (3.6)	20 (1.0)	499 (4.6)	11 (0.8)	469 (6.5)
Lebanon	29 (1.6)	364 (5.7)	23 (1.5)	377 (8.1)	25 (1.2)	405 (6.8)	22 (2.2)	367 (8.7)
Lithuania	3 (0.5)	465 (11.3)	23 (1.4)	522 (4.6)	56 (1.7)	543 (3.4)	18 (1.6)	533 (5.4)
Morocco	38 (0.9)	376 (3.4)	23 (0.7)	400 (3.6)	22 (0.7)	424 (4.5)	18 (0.8)	395 (3.4)
Portugal	10 (1.4)	497 (6.5)	35 (1.8)	518 (3.6)	40 (1.7)	528 (3.3)	15 (1.9)	523 (6.1)
Romania	10 (1.1)	429 (8.3)	15 (1.0)	466 (5.6)	37 (1.4)	487 (4.6)	38 (2.1)	471 (5.7)
Russian Federation	6 (0.6)	503 (8.8)	29 (1.5)	547 (5.2)	39 (1.1)	552 (4.1)	26 (1.5)	535 (5.3)
Sweden	19 (1.4)	508 (7.0)	39 (1.4)	532 (3.9)	32 (1.4)	543 (3.7)	10 (1.0)	501 (7.6)
<b>International Average</b>	<b>16 (0.3)</b>	<b>452 (2.2)</b>	<b>28 (0.4)</b>	<b>488 (1.4)</b>	<b>35 (0.4)</b>	<b>503 (1.2)</b>	<b>22 (0.4)</b>	<b>483 (1.7)</b>
<b>Benchmarking Participants</b>								
Moscow City, Russian Fed.	3 (0.4)	535 (9.1)	23 (1.6)	569 (4.5)	46 (1.6)	573 (3.2)	28 (1.9)	559 (4.2)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent. A tilde (~) indicates insufficient data to report achievement.

## Exhibit 13.17: Frequency Students Conduct Experiments in Science Lessons

Students' Reports

(Continued)

## Separate Science Results

Frequency Students Conduct Experiments in Chemistry Lessons

Chemistry	At Least Once a Week		Once or Twice a Month		A Few Times a Year		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Cyprus	23 (0.9)	460 (4.0)	54 (1.2)	494 (2.4)	19 (1.0)	502 (3.7)	4 (0.7)	473 (10.8)
Finland	47 (1.7)	562 (3.5)	39 (1.3)	544 (3.4)	13 (0.8)	515 (5.3)	1 (0.2)	~ ~
France	32 (1.7)	469 (3.8)	45 (1.4)	503 (3.3)	18 (1.2)	494 (4.6)	6 (1.1)	474 (10.5)
Georgia	26 (1.7)	436 (6.6)	35 (1.6)	455 (4.7)	19 (1.3)	464 (6.3)	20 (1.9)	442 (6.4)
Hungary	18 (1.3)	518 (6.9)	34 (1.3)	540 (3.3)	26 (1.2)	542 (4.2)	22 (1.3)	511 (4.6)
Kazakhstan	43 (1.6)	467 (4.1)	35 (1.2)	490 (4.5)	15 (1.0)	499 (5.2)	8 (0.7)	453 (8.2)
Lebanon	33 (1.7)	363 (6.3)	27 (1.5)	386 (7.6)	24 (1.2)	412 (7.5)	16 (1.50)	353 (9.4)
Lithuania	6 (0.8)	481 (10.2)	40 (1.8)	533 (4.1)	45 (1.7)	547 (3.4)	9 (1.10)	516 (5.9)
Morocco	44 (1.0)	383 (3.2)	24 (0.8)	403 (4.3)	18 (0.8)	414 (4.4)	14 (0.90)	398 (4.4)
Portugal	18 (1.9)	505 (5.8)	48 (1.8)	519 (2.9)	30 (1.9)	529 (3.6)	4 (0.80)	526 (13.9)
Romania	17 (1.5)	443 (7.0)	28 (1.5)	478 (5.5)	36 (1.9)	487 (5.3)	19 (2.00)	462 (6.6)
Russian Federation	20 (1.6)	531 (6.1)	52 (1.6)	547 (4.3)	21 (1.4)	551 (4.6)	7 (0.80)	530 (9.2)
Sweden	37 (1.6)	527 (4.9)	40 (1.0)	533 (3.7)	19 (1.5)	524 (5.9)	4 (0.60)	482 (14.3)
<b>International Average</b>	<b>28 (0.4)</b>	<b>473 (1.6)</b>	<b>38 (0.4)</b>	<b>494 (1.2)</b>	<b>23 (0.4)</b>	<b>499 (1.4)</b>	<b>10 (0.3)</b>	<b>468 (2.7)</b>
<b>Benchmarking Participants</b>								
Moscow City, Russian Fed.	13 (1.1)	551 (5.8)	54 (1.9)	570 (3.2)	25 (1.5)	574 (3.7)	8 (1.30)	553 (7.3)

Frequency Students Conduct Experiments in Physics Lessons

Physics	At Least Once a Week		Once or Twice a Month		A Few Times a Year		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Cyprus	33 (1.0)	478 (3.2)	40 (1.0)	492 (2.9)	20 (0.9)	505 (4.4)	7 (0.6)	462 (7.4)
Finland	36 (1.8)	557 (4.2)	42 (1.4)	546 (3.9)	20 (1.0)	525 (4.6)	3 (0.3)	497 (12.0)
France	32 (1.7)	469 (3.8)	45 (1.4)	503 (3.3)	18 (1.2)	494 (4.6)	6 (1.1)	474 (10.5)
Georgia	28 (1.9)	440 (6.3)	33 (1.7)	456 (5.5)	19 (1.3)	463 (6.8)	20 (2.1)	436 (5.5)
Hungary	17 (1.1)	519 (6.7)	33 (1.2)	538 (3.8)	26 (1.0)	542 (3.8)	24 (1.5)	513 (4.3)
Kazakhstan	46 (1.6)	467 (3.7)	35 (1.1)	496 (4.4)	12 (0.8)	492 (6.4)	7 (0.6)	450 (7.7)
Lebanon	32 (1.5)	365 (5.7)	24 (1.2)	382 (7.1)	22 (1.0)	411 (7.0)	22 (1.8)	366 (9.0)
Lithuania	8 (0.7)	495 (6.6)	40 (1.7)	533 (3.8)	43 (1.8)	546 (4.2)	10 (1.1)	520 (6.0)
Morocco	46 (1.0)	384 (3.2)	24 (0.8)	404 (3.9)	17 (0.7)	417 (5.3)	13 (0.8)	397 (4.2)
Portugal	18 (1.9)	505 (5.8)	48 (1.8)	519 (2.9)	30 (1.9)	529 (3.6)	4 (0.8)	526 (13.9)
Romania	15 (1.2)	434 (8.9)	27 (1.6)	477 (5.2)	36 (1.8)	491 (4.9)	21 (1.9)	461 (6.1)
Russian Federation	26 (1.4)	534 (5.0)	52 (1.2)	552 (3.9)	17 (1.2)	543 (6.7)	6 (0.7)	519 (9.1)
Sweden	30 (1.5)	524 (5.3)	39 (1.1)	535 (3.8)	25 (1.5)	536 (5.0)	6 (0.6)	495 (11.2)
<b>International Average</b>	<b>28 (0.4)</b>	<b>475 (1.5)</b>	<b>37 (0.4)</b>	<b>495 (1.2)</b>	<b>24 (0.4)</b>	<b>500 (1.5)</b>	<b>11 (0.3)</b>	<b>470 (2.4)</b>
<b>Benchmarking Participants</b>								
Moscow City, Russian Fed.	17 (1.2)	554 (5.2)	59 (1.5)	571 (3.0)	19 (1.4)	574 (4.9)	5 (0.9)	545 (7.3)

Frequency Students Conduct Experiments in Earth Science Lessons

Earth Science	At Least Once a Week		Once or Twice a Month		A Few Times a Year		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Cyprus	5 (0.5)	435 (9.5)	7 (0.6)	459 (6.0)	17 (0.7)	483 (4.7)	70 (1.1)	495 (2.3)
Finland	5 (0.4)	477 (9.0)	27 (1.0)	528 (3.5)	44 (0.9)	552 (3.1)	24 (1.0)	570 (4.1)
France	15 (1.2)	463 (5.4)	38 (1.5)	492 (3.9)	36 (1.7)	500 (3.7)	11 (1.4)	478 (6.1)
Georgia	15 (1.0)	420 (9.1)	22 (1.6)	443 (6.2)	19 (1.3)	459 (5.5)	45 (1.9)	460 (4.9)
Hungary	7 (0.6)	479 (8.7)	12 (0.8)	510 (5.4)	22 (0.8)	542 (4.3)	59 (1.4)	536 (2.8)
Kazakhstan	33 (1.5)	456 (4.3)	28 (1.0)	484 (4.5)	19 (1.1)	504 (4.9)	21 (1.1)	483 (5.0)
Lebanon	- -	- -	- -	- -	- -	- -	- -	- -
Lithuania	2 (0.4)	~ ~	11 (0.9)	514 (5.5)	32 (1.6)	533 (3.5)	54 (2.1)	544 (3.7)
Morocco	38 (0.8)	378 (3.3)	23 (0.6)	399 (3.4)	21 (0.7)	425 (4.9)	18 (0.9)	401 (3.6)
Portugal	10 (1.4)	497 (6.5)	35 (1.8)	518 (3.6)	40 (1.7)	528 (3.3)	15 (1.9)	523 (6.1)
Romania	12 (1.6)	427 (9.0)	14 (1.1)	470 (7.8)	32 (2.1)	488 (6.4)	42 (2.3)	476 (8.1)
Russian Federation	6 (0.5)	519 (8.2)	15 (1.0)	538 (7.1)	27 (1.2)	548 (4.5)	53 (1.6)	546 (4.3)
Sweden	- -	- -	- -	- -	- -	- -	- -	- -
<b>International Average</b>	<b>13 (0.3)</b>	<b>455 (2.4)</b>	<b>21 (0.3)</b>	<b>487 (1.6)</b>	<b>28 (0.4)</b>	<b>506 (1.4)</b>	<b>37 (0.5)</b>	<b>501 (1.5)</b>
<b>Benchmarking Participants</b>								
Moscow City, Russian Fed.	4 (0.8)	533 (7.8)	9 (0.7)	558 (5.3)	20 (1.1)	567 (3.5)	66 (1.7)	570 (3.1)

A dash (-) indicates comparable data not available. A tilde (~) indicates insufficient data to report achievement. An "r" indicates data are available for at least 70% but less than 85% of the students.