Chapter 8

Classroom Instruction

Overall, students with positive attitudes toward science have higher achievement, but these attitudes deteriorate over time. Internationally, by the eighth grade, fewer students like learning science and feel confident in their abilities (compared to the fourth grade). In countries teaching science as separate subjects, students like learning chemistry and physics less than biology and earth science, and are less confident in their abilities in them.

Engaging instruction, good nutrition, and enough sleep were related to higher achievement. However, by the eighth grade, only one-quarter of the students reported being engaged in their science lessons, and nearly as many reported being not engaged. Also, in the majority of eighth grade classrooms, instruction was limited because students were suffering from lack of sleep.

This chapter considers the learning environment of the classroom itself, because classroom instruction is at the core of student learning. Previous chapters of this report have described how teaching effectiveness can be greatly influenced by students' home and school environments as well as by teachers' preparation. However, even though the curricular policies and school resources often set the tone for accomplishment, students' day-to-day classroom activities are likely to have a considerable direct impact on their science learning.

TIMSS routinely presents very powerful evidence showing that within countries students with more positive attitudes toward science have substantially higher achievement, and the results from TIMSS 2011 are consistent with previous assessments. In addition to being motivated to learn, students need the opportunity to learn. Thus, this chapter also provides information about the instructional time devoted to science and the approaches teachers use to engage students in learning. It is difficult, however, for teachers to engage students in learning if students do not have the prerequisite skills or are too sleep deprived or disruptive to pay attention. Finally, an effective classroom environment for science learning involves using a variety of instructional approaches, capitalizing on technology, and at the eighth grade, extending instruction with homework and regularly assessing student progress.

Students' Attitudes Toward Science

Each successive TIMSS assessment has shown a strong positive relationship within countries between student attitudes toward science and their science achievement. Additionally, there is extensive research showing that students with more positive attitudes toward mathematics and science have higher average achievement in mathematics and science. For example, a recent meta-analysis of student attitudes toward school found that attitudes toward mathematics or science were related to mathematics and science achievement across 288 studies (Hattie, 2009). While positive attitudes and high achievement in science go hand in hand, it should be understood that the relationship is bidirectional, with attitudes and achievement mutually influencing each other. Students who are good at science also are more likely to enjoy learning science.

Much research about students' attitudes toward learning has studied the complex phenomenon of motivation. For example, students' motivation to learn can be affected by whether they find the subject enjoyable and place value on the subject. In addition, students' motivation can be affected by their self-confidence in learning the subject. TIMSS 2011 included scales about three

motivational constructs: intrinsic value (interest), utility value, and ability beliefs. Essentially, intrinsic motivation refers to doing an activity because it is interesting or enjoyable, and the Students Like Learning Science scale was developed to measure students' interest in and liking of learning science. In contrast, extrinsic motivation refers to doing something because it leads to a desirable outcome. There are many types of external motivation from teacher praise, to good grades, to being accepted to a good university, to having a successful career and daily life. In particular, the TIMSS 2011 Students Value Science scale addresses students' attitudes about the importance of the subject and usefulness of the subject, sometimes called attainment value and utility value (Wigfield & Eccles, 2000). Finally, motivation to learn includes having the feeling that you can succeed. The Student Confidence with Science scale assesses students' self-confidence or self-concept in their ability to learn science. A strong self-concept encourages students to engage with the instruction and show persistence, effort, and attentiveness.

Students Like Learning Science

Exhibit 8.1 presents the fourth grade results for the TIMSS 2011 Students Like Learning Science scale. Students were scored according to the degree of their agreement with five statements such as "I enjoy learning science," "Science is boring" (reverse coded), and "I learn many interesting things in science" (see second page of the exhibit for details). Students in the **Like Learning Science** category "agreed a lot" with three of the five statements and "agreed a little" with the other two, on average. In contrast, students who **Do Not Like Learning Science** "disagreed a little" with three of the statements and "agreed a little" with the other two, on average.

For each TIMSS 2011 participant, the percentage of students in each category is shown together with the students' average science achievement. The first page of the exhibit presents the results for countries participating at the fourth grade, and the average results across those countries. The second page of the exhibit presents the results for the sixth grade and benchmarking participants.

On average, more than half of the fourth grade students internationally **Like Learning Science**, substantially more than **Do Not Like Learning Science** (53% vs. 12%). The remaining fourth grade students (35%, on average) **Somewhat Like Learning Science**. Most important, however, on average, internationally, and in almost all TIMSS 2011 countries, including the sixth

Exhibit 8.1: Students Like Learning Science

TIMSS 2011 4th Grade Science

Reported by Students

Students were scored according to their degree of agreement with five statements on the *Students Like Learning Science* scale. Students who **Like Learning Science** had a score on the scale of at least 9.7, which corresponds to their "agreeing a lot" with three of the five statements and "agreeing a little" with the other two, on average. Students who **Do Not Like Learning Science** had a score no higher than 7.6, which corresponds to their "disagreeing a little" with three of the five statements and "agreeing a little" with the other two, on average. All other students **Somewhat Like Learning Science**.

Country	Like Learning Science		Somewhat Like Learning Science		Do Not Like Learning Science		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Turkey	73 (0.9)	486 (3.3)	24 (0.8)	410 (7.0)	3 (0.3)	393 (8.6)	10.9 (0.04)
Tunisia	72 (1.5)	376 (5.3)	24 (1.3)	278 (6.3)	4 (0.5)	262 (11.3)	11.0 (0.06)
Iran, Islamic Rep. of	68 (1.1)	473 (3.5)	27 (1.0)	412 (5.1)	5 (0.5)	415 (9.0)	10.7 (0.04)
Georgia	68 (1.1)	479 (3.1)	27 (0.9)	423 (5.6)	5 (0.5)	422 (10.6)	10.7 (0.04)
Portugal	66 (1.8)	533 (3.9)	31 (1.7)	502 (4.8)	4 (0.5)	489 (7.5)	10.5 (0.06)
Lithuania	63 (1.2)	524 (2.2)	29 (1.0)	502 (4.0)	8 (0.5)	498 (7.0)	10.4 (0.05)
Russian Federation	62 (1.2)	561 (3.6)	30 (0.9)	540 (4.1)	7 (0.5)	542 (5.6)	10.4 (0.05)
Kazakhstan	62 (1.3)	509 (5.1)	34 (1.3)	474 (6.1)	4 (0.4)	488 (13.4)	10.4 (0.06)
Armenia	61 (1.4)	433 (4.1)	30 (1.1)	396 (5.4)	9 (0.6)	380 (6.8)	10.5 (0.05)
Saudi Arabia	61 (1.5)	461 (4.9)	30 (1.1)	392 (7.9)	8 (0.8)	380 (10.5)	10.4 (0.06)
Romania	61 (1.4)	530 (5.6)	32 (1.2)	477 (7.5)	8 (0.6)	459 (16.1)	10.3 (0.06)
United Arab Emirates	60 (0.8)	462 (2.7)	31 (0.7)	383 (3.4)	8 (0.4)	377 (5.0)	10.4 (0.03)
Ireland	59 (1.5)	529 (3.2)	29 (1.0)	506 (4.4)	12 (1.0)	490 (9.1)	10.2 (0.07)
Chinese Taipei	58 (1.4)	564 (2.2)	30 (0.9)	537 (3.5)	11 (0.8)	533 (5.3)	10.1 (0.06)
Germany	58 (1.5)	538 (3.1)	30 (1.0)	524 (3.3)	12 (0.9)	517 (5.8)	10.1 (0.07)
Singapore	57 (0.7)	600 (3.4)	31 (0.6)	567 (4.3)	12 (0.5)	555 (5.4)	10.1 (0.03)
Poland	57 (0.9)	516 (2.9)	33 (0.9)	494 (3.1)	10 (0.5)	487 (6.0)	10.1 (0.04)
Kuwait	57 (1.4)	384 (5.1)	32 (1.1)	308 (5.2)	11 (0.9)	330 (10.7)	10.2 (0.06)
Norway	56 (1.7)	503 (2.5)	31 (1.4)	486 (3.7)	12 (0.9)	482 (4.9)	10.1 (0.07)
Thailand	56 (1.5)	498 (5.6)	38 (1.3)	444 (6.8)	6 (0.5)	420 (9.8)	10.1 (0.05)
United States	56 (0.8)	555 (2.3)	29 (0.5)	535 (3.3)	15 (0.6)	530 (3.3)	10.0 (0.04)
Oman	55 (1.1)	419 (4.1)	38 (0.9)	334 (6.1)	7 (0.4)	304 (9.5)	10.3 (0.04)
Australia	55 (1.0)	529 (2.8)	31 (0.7)	506 (3.9)	14 (0.7)	496 (5.2)	10.0 (0.05)
Malta	55 (0.8)	469 (2.8)	29 (0.8)	424 (3.9)	16 (0.6)	411 (3.7)	9.9 (0.04)
Croatia	55 (1.2)	522 (2.2)	30 (0.8)	507 (3.0)	15 (0.9)	514 (3.5)	10.0 (0.06)
Bahrain	55 (1.6)	484 (3.3)	33 (1.0)	422 (4.6)	12 (1.1)	412 (7.2)	10.1 (0.08)
New Zealand	55 (1.1)	512 (2.5)	32 (0.8)	486 (3.7)	13 (0.8)	468 (5.5)	10.0 (0.05)
Austria	53 (1.1)	540 (3.0)	33 (0.9)	524 (3.4)	14 (0.8)	521 (4.8)	9.9 (0.05)
Hong Kong SAR	52 (1.3)	551 (3.5)	35 (0.9)	523 (4.9)	14 (0.8)	507 (6.6)	9.9 (0.05)
Japan	52 (1.2)	566 (2.0)	40 (0.9)	554 (2.3)	9 (0.8)	538 (5.7)	9.9 (0.05)
Italy	51 (1.2)	532 (3.0)	36 (0.9)	519 (3.8)	12 (0.7)	515 (4.4)	9.9 (0.05)
Northern Ireland	51 (1.4)	533 (2.5)	36 (1.1)	509 (3.9)	13 (0.8)	483 (5.4)	9.8 (0.06)
Qatar	50 (1.8)	453 (5.2)	40 (1.5)	354 (5.5)	11 (0.8)	347 (12.6)	10.0 (0.07)
Slovak Republic	49 (1.2)	543 (3.5)	37 (0.9)	523 (4.6)	14 (0.8)	524 (5.5)	9.8 (0.05)
Serbia	48 (1.3)	525 (3.3)	41 (0.9)	507 (3.8)	11 (0.8)	511 (7.2)	9.8 (0.06)
Chile	48 (1.2)	501 (2.7)	39 (0.8)	462 (3.4)	13 (0.7)	471 (4.6)	9.8 (0.05)
Spain	48 (1.3)	519 (2.8)	36 (1.0)	491 (4.1)	16 (0.9)	502 (4.4)	9.7 (0.06)
Sweden	48 (1.5)	537 (3.1)	38 (1.1)	536 (3.3)	13 (0.8)	523 (4.7)	9.8 (0.06)
Hungary	48 (1.1)	554 (4.0)	36 (0.8)	519 (4.3)	16 (0.9)	519 (5.4)	9.7 (0.06)
Netherlands	45 (1.7)	536 (2.8)	36 (1.1)	529 (2.8)	19 (1.2)	524 (3.7)	9.6 (0.08)
Czech Republic	45 (1.3)	544 (2.8)	37 (1.0)	530 (3.5)	18 (0.9)	532 (4.0)	9.6 (0.06)
Denmark	44 (1.3)	533 (3.4)	36 (0.7)	526 (3.7)	19 (1.3)	527 (3.1)	9.5 (0.07)
Morocco	44 (1.8)	308 (5.9)	46 (1.4)	236 (5.2)	11 (0.9)	212 (9.0)	9.8 (0.07)
England	44 (1.5)	535 (4.1)	35 (1.1)	528 (4.1)	21 (1.1)	518 (3.9)	9.4 (0.07)
Belgium (Flemish)	42 (1.2)	516 (2.0)	35 (0.9)	508 (2.6)	23 (1.0)	498 (3.0)	9.3 (0.05)
Slovenia	41 (1.1)	529 (3.2)	38 (0.8)	515 (3.4)	21 (1.0)	516 (5.1)	9.3 (0.05)
Yemen	39 (2.1)	257 (8.2)	49 (1.9)	193 (6.7)	12 (1.4)	153 (12.3)	9.6 (0.08)
Korea, Rep. of	39 (0.9)	604 (3.1)	45 (0.9)	583 (2.0)	16 (0.7)	559 (3.6)	9.4 (0.04)
Finland	36 (1.2)	578 (3.2)	39 (1.0)	571 (3.2)	25 (1.1)	561 (3.4)	9.1 (0.06)
Azerbaijan r	33 (1.5)	477 (6.2)	62 (1.3)	441 (5.6)	5 (0.6)	415 (14.3)	9.6 (0.06)
International Avg.	53 (0.2)	504 (0.5)	35 (0.1)	469 (0.7)	12 (0.1)	461 (1.1)	

Centerpoint of scale set at 10.

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

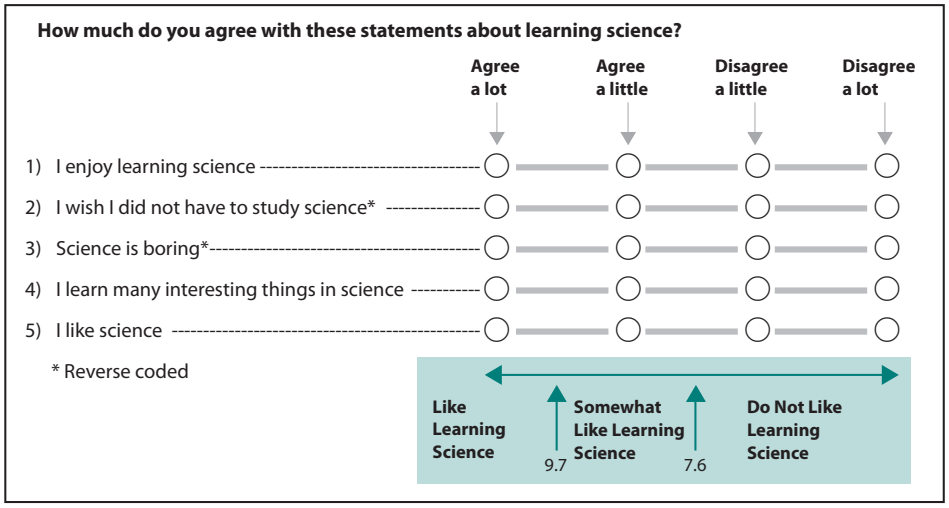
An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.1: Students Like Learning Science (Continued)

Country	Like Learning Science		Somewhat Like Learning Science		Do Not Like Learning Science		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Sixth Grade Participants							
Botswana	53 (1.4)	436 (5.0)	37 (1.2)	306 (4.9)	10 (0.6)	249 (8.8)	10.0 (0.06)
Yemen	48 (1.7)	388 (6.7)	44 (1.5)	314 (7.1)	8 (0.7)	295 (13.8)	9.9 (0.07)
Honduras	41 (1.8)	464 (6.2)	54 (1.9)	412 (5.8)	5 (0.4)	412 (12.9)	9.8 (0.06)
Benchmarking Participants							
Dubai, UAE	66 (1.0)	492 (3.0)	27 (0.8)	420 (4.3)	7 (0.5)	400 (8.3)	10.6 (0.04)
North Carolina, US	64 (1.9)	547 (4.0)	26 (1.4)	527 (6.7)	10 (0.9)	520 (8.2)	10.4 (0.08)
Alberta, Canada	59 (1.6)	550 (2.5)	31 (1.2)	533 (4.1)	10 (0.7)	524 (6.5)	10.2 (0.07)
Abu Dhabi, UAE	58 (1.8)	448 (4.9)	33 (1.5)	364 (5.4)	9 (0.8)	373 (9.0)	10.3 (0.08)
Quebec, Canada	52 (1.4)	524 (3.0)	34 (1.0)	511 (3.7)	14 (1.0)	502 (4.8)	9.9 (0.06)
Florida, US	51 (1.7)	556 (4.2)	30 (1.2)	540 (4.1)	18 (1.0)	529 (5.4)	9.8 (0.07)
Ontario, Canada	48 (1.1)	537 (3.4)	35 (0.8)	525 (3.3)	16 (0.9)	510 (4.4)	9.7 (0.06)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



grade and benchmarking participants, students who liked learning science had higher average science achievement than those who only somewhat or did not like learning science.

Exhibit 8.2 presents the corresponding results for the eighth grade on the Students Like Learning Science scale. Because 16 of the TIMSS countries teach science subjects separately (i.e., biology, chemistry, physics, and earth science) at the eighth grade rather than as a general or integrated subject, TIMSS asked students in these countries about their liking for the individual science subjects and the results were scaled separately for each subject. The first page of Exhibit 8.2 presents the results for general or integrated science for the eighth grade countries, and also for the ninth grade and benchmarking participants, as all of these teach science as a general or integrated subject. The second and third pages of the exhibit present the results for biology (second page) and chemistry, physics, and earth science (third page) in separate panels.

Looking first at general or integrated science and comparing to the fourth grade, substantially fewer eighth grade students reported positive attitudes toward learning science. At the eighth grade, about one-third (35%) of the students, internationally, on average, **Like Learning Science** (compared to 53% at the fourth grade), and about one-fifth (21%) **Do Not Like Learning Science**. Accompanying the decrease from the fourth to eighth grades in liking learning science is a widening achievement gap between students who like learning science (515, on average) and those who do not (450).

It is noticeable that some of the highest performing countries have the smallest percentages of students reporting positive attitudes toward learning science, such as Chinese Taipei, Japan, and Korea. The tendency of smaller percentages of students in some East Asian countries to report positive attitudes is consistent with previous TIMSS assessments. The relatively low percentages of students liking learning science may partially result from the high level of difficulty of the science being studied, and also these countries have a cultural tradition of serious attitudes toward learning.

Across countries teaching the sciences as separate subjects, the average percentages of students liking learning biology and earth science (36% and 33%, respectively) were similar to the percentage liking general or integrated science, but fewer students reported liking learning chemistry (25%) and physics (26%). In all four science subjects, the students who liked learning the subject had higher average achievement than those who only somewhat liked or did not like learning it.

Exhibit 8.2: Students Like Learning Science

Reported by Students

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

For general/integrated science, students were scored according to their degree of agreement with five statements on the *Students Like Learning Science* scale. Students who **Like Learning Science** had a score on the scale of at least 10.8, which corresponds to their "agreeing a lot" with three of the five statements and "agreeing a little" with the other two, on average. Students who **Do Not Like Learning Science** had a score on the scale no higher than 8.4, which corresponds to their "disagreeing a little" with three of the five statements and "agreeing a little" with the other two, on average. All other students **Somewhat Like Learning Science**. For biology, chemistry, physics, and earth science, a comparable procedure was used.

Students Like Learning General/Integrated Science

General/Integrated Science	Like Learning Science		Somewhat Like Learning Science		Do Not Like Learning Science		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Tunisia	56 (1.2)	450 (2.6)	37 (1.0)	426 (2.8)	8 (0.5)	422 (5.7)	11.0 (0.04)
Iran, Islamic Rep. of	54 (1.2)	489 (4.2)	36 (0.9)	456 (4.1)	10 (0.7)	466 (6.4)	10.8 (0.05)
Turkey	49 (1.1)	509 (3.5)	40 (0.9)	462 (3.8)	11 (0.6)	453 (5.5)	10.6 (0.04)
Jordan	47 (1.2)	485 (3.4)	42 (0.9)	430 (4.2)	11 (0.6)	420 (6.5)	10.7 (0.05)
Oman	45 (0.9)	474 (2.5)	45 (0.8)	387 (3.9)	10 (0.4)	361 (5.2)	10.7 (0.03)
Saudi Arabia	45 (1.5)	460 (3.7)	37 (1.0)	421 (4.2)	18 (1.1)	413 (5.7)	10.4 (0.07)
Ghana	45 (1.5)	357 (4.9)	48 (1.2)	277 (5.6)	7 (0.5)	223 (10.9)	10.7 (0.05)
United Arab Emirates	43 (0.9)	496 (2.4)	40 (0.7)	447 (3.1)	17 (0.7)	433 (3.0)	10.3 (0.04)
Malaysia	42 (1.4)	457 (5.8)	44 (0.9)	418 (6.3)	13 (1.0)	364 (9.4)	10.4 (0.06)
Chile	40 (1.2)	475 (2.6)	43 (0.8)	455 (2.9)	17 (0.9)	451 (4.2)	10.2 (0.05)
Singapore	38 (0.8)	617 (5.2)	46 (0.7)	584 (4.2)	16 (0.5)	542 (5.4)	10.2 (0.03)
Palestinian Nat'l Auth.	38 (1.4)	459 (3.5)	46 (1.1)	405 (4.3)	16 (1.0)	385 (6.1)	10.3 (0.06)
Qatar	36 (1.4)	479 (5.0)	44 (1.2)	393 (3.9)	19 (0.9)	373 (6.7)	10.1 (0.06)
Thailand	34 (1.2)	473 (4.4)	56 (1.0)	443 (3.9)	10 (0.8)	431 (6.7)	10.1 (0.05)
Norway	33 (1.5)	519 (3.5)	44 (1.0)	492 (3.1)	23 (1.2)	466 (3.8)	9.9 (0.07)
England	32 (1.3)	562 (5.4)	45 (0.9)	532 (5.0)	23 (1.1)	500 (4.9)	9.9 (0.06)
Bahrain	32 (1.1)	493 (3.9)	45 (1.0)	445 (2.8)	23 (1.0)	422 (4.8)	9.9 (0.05)
Israel	29 (1.1)	547 (4.7)	37 (1.0)	507 (4.9)	34 (1.5)	501 (4.5)	9.4 (0.07)
United States	29 (0.7)	555 (3.1)	43 (0.7)	523 (2.6)	28 (0.7)	500 (3.0)	9.6 (0.04)
Hong Kong SAR	28 (1.2)	561 (4.1)	51 (0.9)	534 (3.3)	21 (1.1)	506 (4.9)	9.8 (0.06)
Italy	26 (1.0)	521 (3.1)	50 (1.0)	500 (3.2)	24 (0.9)	484 (4.1)	9.6 (0.05)
Australia	25 (1.3)	559 (6.1)	42 (1.0)	521 (4.8)	33 (1.3)	490 (4.9)	9.3 (0.07)
New Zealand	24 (1.0)	549 (5.2)	46 (0.7)	510 (4.7)	30 (1.3)	494 (5.3)	9.4 (0.06)
Chinese Taipei	17 (0.8)	618 (3.4)	43 (0.7)	571 (2.7)	40 (1.1)	534 (2.6)	9.0 (0.05)
Japan	15 (0.8)	595 (3.7)	47 (1.1)	566 (2.2)	38 (1.5)	531 (3.1)	9.0 (0.06)
Korea, Rep. of	11 (0.5)	623 (3.8)	43 (0.9)	576 (2.1)	46 (1.1)	531 (2.2)	8.7 (0.04)
International Avg.	35 (0.2)	515 (0.8)	44 (0.2)	472 (0.8)	21 (0.2)	450 (1.1)	
Ninth Grade Participants							
Botswana	57 (1.2)	443 (3.1)	34 (0.8)	369 (3.8)	9 (0.5)	330 (8.6)	11.0 (0.05)
South Africa	41 (1.1)	376 (3.0)	45 (0.8)	311 (4.5)	14 (0.6)	313 (6.4)	10.4 (0.04)
Honduras	39 (1.3)	385 (4.4)	49 (1.0)	359 (4.5)	11 (0.9)	370 (6.5)	10.4 (0.06)
Benchmarking Participants							
Dubai, UAE	49 (1.1)	511 (2.9)	37 (0.9)	468 (3.7)	14 (0.7)	446 (4.7)	10.6 (0.05)
Abu Dhabi, UAE	40 (1.3)	494 (4.6)	41 (1.0)	443 (4.7)	19 (1.3)	436 (5.3)	10.2 (0.07)
Massachusetts, US	37 (1.9)	589 (5.6)	41 (1.3)	565 (5.3)	22 (2.0)	536 (5.4)	10.0 (0.10)
Colorado, US	33 (1.7)	566 (5.7)	42 (1.4)	537 (4.6)	25 (1.4)	521 (5.6)	9.8 (0.07)
Alberta, Canada	30 (1.4)	566 (3.3)	44 (1.1)	543 (2.8)	25 (1.2)	528 (2.9)	9.7 (0.07)
Connecticut, US	30 (1.9)	563 (6.5)	41 (1.4)	527 (5.2)	29 (1.7)	516 (6.3)	9.6 (0.10)
Ontario, Canada	29 (1.1)	543 (3.8)	45 (0.8)	519 (3.0)	26 (1.1)	499 (3.1)	9.7 (0.05)
California, US	29 (1.3)	530 (5.2)	43 (1.3)	496 (4.8)	28 (1.5)	475 (5.9)	9.6 (0.07)
North Carolina, US	29 (1.3)	564 (7.1)	44 (1.1)	529 (7.4)	27 (1.7)	503 (6.9)	9.6 (0.09)
Minnesota, US	29 (2.0)	582 (5.0)	44 (1.3)	549 (4.4)	28 (1.8)	532 (5.7)	9.6 (0.10)
Alabama, US	28 (1.4)	508 (7.7)	44 (1.1)	485 (6.6)	28 (1.1)	470 (6.2)	9.6 (0.06)
Florida, US	28 (1.8)	567 (7.9)	42 (1.4)	532 (6.8)	30 (2.1)	502 (8.6)	9.5 (0.10)
Indiana, US	27 (1.8)	558 (6.3)	40 (1.3)	532 (5.6)	32 (1.8)	514 (4.9)	9.4 (0.10)
Quebec, Canada	24 (1.1)	547 (3.6)	48 (0.9)	522 (2.7)	29 (1.2)	496 (3.6)	9.5 (0.06)

Centerpoint of scale set at 10.

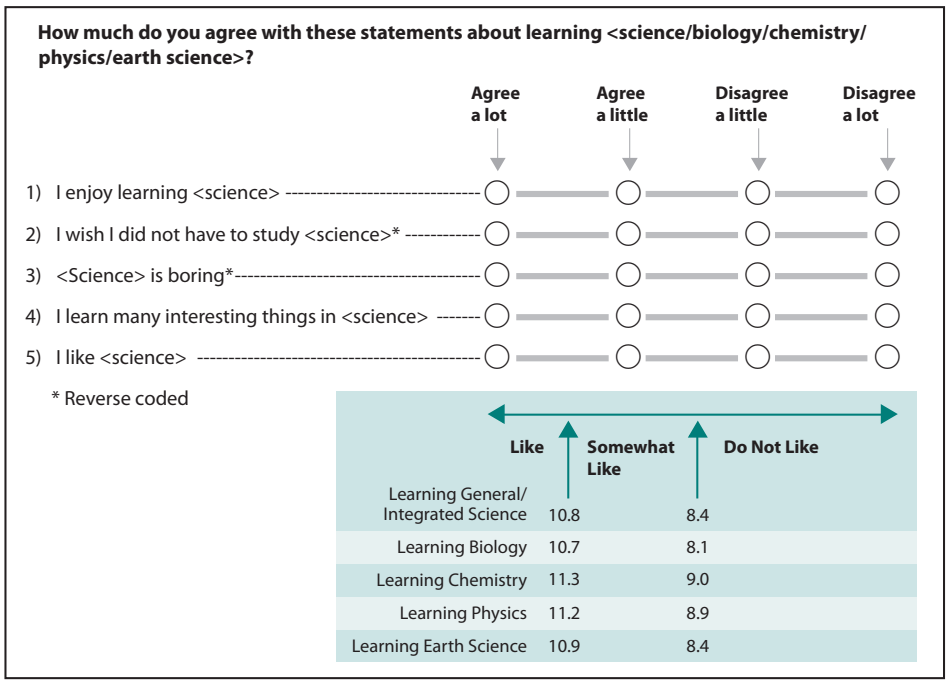
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (–) indicates comparable data are 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 2011

Exhibit 8.2: Students Like Learning Science (Continued)



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Separate Science Panels

Students Like Learning Biology

Biology	Like Learning Biology		Somewhat Like Learning Biology		Do Not Like Learning Biology		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Ukraine	56 (1.4)	507 (4.1)	37 (1.2)	495 (4.2)	8 (0.7)	501 (7.6)	10.9 (0.06)
Georgia	56 (1.3)	441 (2.9)	34 (1.1)	409 (3.5)	10 (0.8)	406 (7.0)	10.8 (0.06)
Armenia	53 (1.4)	451 (3.3)	35 (1.0)	426 (4.4)	12 (0.8)	434 (5.3)	10.7 (0.07)
Syrian Arab Republic	51 (1.3)	446 (3.8)	42 (1.2)	413 (4.0)	7 (0.5)	400 (7.2)	10.8 (0.05)
Morocco	51 (0.9)	400 (2.0)	41 (0.7)	357 (2.7)	8 (0.4)	354 (6.4)	10.8 (0.04)
Kazakhstan	46 (1.4)	505 (4.1)	50 (1.4)	480 (4.7)	4 (0.4)	496 (8.5)	10.6 (0.05)
Romania	36 (1.5)	484 (3.9)	45 (1.0)	459 (4.0)	19 (1.0)	454 (5.6)	10.0 (0.07)
Russian Federation	36 (0.9)	546 (4.5)	50 (0.8)	540 (3.4)	14 (0.9)	546 (5.0)	10.1 (0.05)
Lithuania	34 (1.3)	525 (3.1)	45 (1.1)	511 (3.2)	21 (1.1)	508 (3.9)	9.8 (0.06)
Lebanon	32 (1.3)	445 (5.7)	50 (1.0)	391 (5.6)	18 (1.0)	379 (6.1)	9.9 (0.06)
Macedonia, Rep. of	30 (1.2)	458 (5.3)	55 (1.1)	387 (5.4)	15 (1.1)	423 (10.2)	9.9 (0.06)
Hungary	28 (1.2)	536 (3.0)	43 (0.9)	514 (4.3)	29 (1.4)	525 (3.6)	9.5 (0.07)
Indonesia	24 (1.2)	414 (6.5)	71 (1.1)	405 (4.3)	5 (0.5)	385 (11.9)	9.8 (0.04)
Sweden	19 (0.9)	538 (4.0)	54 (0.9)	515 (2.8)	27 (1.1)	493 (3.6)	9.2 (0.05)
Finland	15 (0.7)	574 (4.5)	47 (1.0)	557 (2.7)	38 (1.3)	543 (2.7)	8.8 (0.05)
Slovenia	13 (0.8)	543 (4.4)	43 (1.2)	544 (2.9)	44 (1.5)	543 (3.7)	8.6 (0.06)
International Avg.	36 (0.3)	488 (1.1)	46 (0.3)	463 (1.0)	17 (0.2)	462 (1.7)	

Exhibit 8.2: Students Like Learning Science (Continued)

Students Like Learning Chemistry

Chemistry	Like Learning Chemistry		Somewhat Like Learning Chemistry		Do Not Like Learning Chemistry		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Kazakhstan	40 (1.5)	514 (4.6)	52 (1.4)	478 (4.7)	8 (0.6)	473 (6.7)	11.0 (0.05)
Morocco	39 (0.8)	403 (2.3)	47 (0.6)	361 (3.1)	13 (0.5)	365 (4.3)	10.9 (0.03)
Ukraine	35 (1.5)	521 (4.5)	40 (1.1)	495 (3.7)	25 (1.2)	489 (5.3)	10.4 (0.07)
Russian Federation	31 (0.9)	561 (4.1)	44 (0.8)	538 (4.0)	25 (1.0)	530 (3.4)	10.4 (0.05)
Lebanon	31 (1.3)	447 (5.1)	52 (1.1)	390 (5.2)	18 (1.0)	386 (7.2)	10.5 (0.06)
Armenia	28 (1.3)	464 (4.2)	39 (0.8)	430 (3.7)	32 (1.4)	435 (4.0)	10.0 (0.08)
Syrian Arab Republic	28 (1.2)	451 (4.7)	54 (1.0)	421 (4.2)	18 (0.9)	418 (4.7)	10.4 (0.05)
Lithuania	25 (1.1)	539 (3.2)	41 (0.8)	510 (3.2)	34 (1.3)	503 (3.3)	9.9 (0.06)
Macedonia, Rep. of	23 (1.2)	451 (6.0)	46 (1.2)	395 (5.8)	31 (1.6)	415 (6.2)	9.9 (0.07)
Romania	20 (1.2)	503 (4.7)	42 (1.1)	459 (3.6)	37 (1.8)	457 (4.1)	9.7 (0.08)
Slovenia	16 (0.8)	579 (4.2)	39 (1.2)	547 (3.2)	45 (1.6)	529 (3.2)	9.3 (0.06)
Hungary	16 (0.8)	548 (4.8)	35 (1.0)	515 (3.7)	49 (1.4)	521 (3.4)	9.2 (0.06)
Sweden	15 (0.9)	546 (5.2)	47 (0.9)	517 (3.1)	38 (1.2)	496 (2.8)	9.5 (0.05)
Finland	13 (0.9)	594 (4.4)	35 (1.2)	562 (2.9)	52 (1.7)	540 (2.7)	9.1 (0.07)
Indonesia r	9 (0.7)	390 (8.6)	72 (1.2)	399 (4.7)	19 (1.4)	405 (7.0)	9.9 (0.04)
Georgia	– –	– –	– –	– –	– –	– –	– –
International Avg.	25 (0.3)	501 (1.3)	46 (0.3)	468 (1.0)	30 (0.3)	464 (1.2)	

Students Like Learning Physics

Physics	Like Learning Physics		Somewhat Like Learning Physics		Do Not Like Learning Physics		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	44 (1.6)	465 (3.5)	40 (1.2)	424 (4.2)	16 (0.9)	419 (5.9)	10.9 (0.07)
Morocco	42 (0.8)	404 (2.4)	47 (0.7)	362 (2.9)	11 (0.4)	370 (3.3)	11.0 (0.03)
Georgia	42 (1.4)	447 (4.2)	40 (1.2)	418 (3.3)	18 (1.1)	402 (6.4)	10.7 (0.06)
Ukraine	40 (1.6)	523 (4.2)	42 (1.2)	491 (3.9)	19 (1.2)	484 (4.8)	10.6 (0.07)
Kazakhstan	39 (1.7)	512 (5.2)	52 (1.4)	478 (4.3)	9 (0.8)	486 (8.6)	10.8 (0.06)
Russian Federation	34 (1.0)	562 (4.0)	48 (0.7)	536 (3.2)	18 (0.9)	523 (4.3)	10.5 (0.05)
Syrian Arab Republic	29 (1.0)	453 (4.4)	55 (0.9)	421 (4.0)	16 (0.7)	419 (4.8)	10.4 (0.04)
Lebanon	27 (1.3)	446 (5.9)	52 (1.2)	391 (5.3)	22 (1.1)	399 (6.1)	10.2 (0.06)
Macedonia, Rep. of	25 (1.2)	456 (5.5)	49 (1.1)	393 (5.5)	26 (1.3)	413 (7.0)	10.0 (0.06)
Hungary	20 (0.8)	555 (3.9)	39 (0.8)	519 (4.2)	41 (1.2)	514 (3.2)	9.4 (0.05)
Lithuania	19 (1.0)	536 (4.6)	41 (0.9)	512 (3.0)	40 (1.3)	508 (3.0)	9.4 (0.06)
Romania	17 (1.1)	499 (5.1)	45 (1.1)	461 (4.5)	38 (1.5)	461 (3.7)	9.5 (0.06)
Sweden	13 (0.7)	559 (5.0)	46 (0.9)	518 (3.1)	41 (1.1)	499 (2.8)	9.3 (0.04)
Indonesia	12 (0.9)	409 (8.3)	75 (0.8)	408 (4.9)	13 (1.0)	415 (5.2)	9.9 (0.04)
Finland	9 (0.7)	602 (5.0)	32 (1.0)	559 (3.2)	58 (1.3)	544 (2.7)	8.7 (0.06)
Slovenia	7 (0.6)	586 (6.6)	28 (1.0)	550 (4.1)	65 (1.1)	536 (2.8)	8.4 (0.04)
International Avg.	26 (0.3)	501 (1.3)	46 (0.3)	465 (1.0)	28 (0.3)	462 (1.2)	

Students Like Learning Earth Science

Earth Science	Like Learning Earth Science		Somewhat Like Learning Earth Science		Do Not Like Learning Earth Science		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Georgia	50 (1.2)	446 (3.3)	40 (1.0)	411 (3.8)	10 (0.7)	397 (6.1)	10.8 (0.05)
Armenia	50 (1.5)	456 (3.3)	37 (1.0)	424 (4.0)	13 (0.8)	429 (6.5)	10.7 (0.07)
Morocco	47 (0.8)	395 (2.1)	44 (0.7)	362 (3.2)	9 (0.4)	374 (3.5)	10.8 (0.03)
Kazakhstan	43 (1.6)	505 (4.6)	50 (1.3)	481 (4.5)	6 (0.7)	493 (10.0)	10.6 (0.06)
Ukraine	42 (1.6)	511 (4.4)	44 (1.2)	497 (4.2)	14 (1.1)	493 (5.5)	10.4 (0.07)
Macedonia, Rep. of	38 (1.4)	445 (4.9)	47 (1.1)	387 (5.6)	15 (1.0)	418 (9.8)	10.3 (0.06)
Romania	36 (1.4)	489 (3.7)	44 (1.0)	459 (4.9)	20 (1.3)	446 (5.5)	10.1 (0.07)
Syrian Arab Republic	35 (1.5)	450 (4.7)	52 (1.2)	418 (4.0)	12 (0.9)	401 (6.7)	10.3 (0.05)
Lithuania	35 (1.3)	531 (3.1)	45 (0.9)	507 (2.8)	21 (1.1)	506 (4.3)	10.0 (0.07)
Russian Federation	29 (1.1)	550 (3.9)	50 (0.8)	540 (3.6)	20 (1.1)	542 (4.3)	9.9 (0.06)
Sweden	21 (0.8)	529 (3.9)	54 (0.8)	513 (3.0)	25 (1.0)	500 (3.9)	9.5 (0.04)
Hungary	20 (1.2)	527 (5.4)	39 (0.9)	516 (3.9)	41 (1.7)	529 (3.0)	9.0 (0.08)
Finland	18 (0.9)	576 (4.3)	47 (0.8)	558 (2.6)	35 (1.2)	535 (2.6)	9.2 (0.05)
Slovenia	14 (0.8)	557 (4.5)	45 (1.2)	545 (3.0)	41 (1.5)	537 (3.4)	8.8 (0.07)
Indonesia	12 (1.0)	395 (8.7)	76 (0.9)	406 (4.2)	12 (0.8)	405 (6.4)	9.5 (0.04)
Lebanon	– –	– –	– –	– –	– –	– –	– –
International Avg.	33 (0.3)	491 (1.2)	48 (0.3)	468 (1.0)	20 (0.3)	467 (1.5)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Students Value Science

Exhibit 8.3 presents the results for the TIMSS 2011 Students Value Science scale, which only was given at the eighth grade. The scale itself addresses six different aspects of valuing science:

- I think learning science will help me in my daily life;
- I need science to learn other school subjects;
- I need to do well in science to get into the university of my choice;
- I need to do well in science to get the job I want;
- I would like a job that involves using science; and
- It is important to do well in science.

Students in countries teaching the sciences as separate subjects were asked about each of the four science subjects and the results were scaled separately. On each scale, students with a score corresponding to "agreeing a lot" with three of the statements and "agreeing a little" with the other three, on average, were considered to **Value** science. In comparison, students in the **Do Not Value** science category "disagreed a little" with three of the statements and "agreed a little" with the other three, on average. The first page of Exhibit 8.3 presents the results for general or integrated science for the eighth grade countries, and also for the ninth grade and benchmarking participants. The second and third pages of the exhibit present the results for biology (second page) and chemistry, physics, and earth science (third page) in separate panels.

Internationally, on average, eighth grade students in general or integrated science countries placed a high value on science. Forty-one percent were in the **Value** category and another 33 percent were in the **Somewhat Value** category, on average. However, about one-fourth (26%) were in the **Do Not Value** category. Across the eighth grade, ninth grade, and benchmarking participants, students who said they valued science typically had higher achievement than students who only valued it somewhat, and those students, in turn, had higher achievement than students who did not value science.

Students in countries teaching the sciences as separate subjects do not seem to value the individual science subjects in the same way as students in general science countries value science. Across the four subjects, only about one-fourth (25–29%) of the students reported that they value the science subjects, about one-third (33–36%) reported that they somewhat value the subjects, and about two-fifths (36–42%) reported that they did not value them. This

Exhibit 8.3: Students Value Science

Reported by Students

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

For general/integrated science, students were scored according to their degree of agreement with six statements on the *Students Value Science* scale. Students who **Value** science had a score on the scale of at least 10.5, which corresponds to their "agreeing a lot" with three of the six statements and "agreeing a little" with the other three, on average. Students who **Do Not Value** science had a score no higher than 8.6, which corresponds to their "disagreeing a little" with three of the six statements and "agreeing a little" with the other three, on average. All other students **Somewhat Value** science. For biology, chemistry, physics, and earth science, a comparable procedure was used.

Students Value General/Integrated Science

General/Integrated Science	Value		Somewhat Value		Do Not Value		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Ghana	80 (1.0)	323 (5.1)	16 (0.8)	266 (7.2)	4 (0.4)	224 (10.5)	11.6 (0.04)
Oman	69 (0.7)	441 (3.0)	24 (0.6)	393 (5.0)	7 (0.4)	361 (6.2)	11.2 (0.03)
Jordan	66 (1.0)	468 (3.1)	25 (0.8)	437 (5.6)	8 (0.5)	403 (7.9)	11.1 (0.04)
Tunisia	62 (0.9)	441 (2.7)	27 (0.7)	436 (2.9)	12 (0.6)	438 (5.0)	10.9 (0.04)
Palestinian Nat'l Auth.	62 (1.3)	437 (3.1)	27 (0.9)	406 (4.4)	11 (0.7)	379 (7.3)	10.9 (0.05)
Saudi Arabia	53 (1.2)	446 (3.9)	32 (0.8)	433 (4.4)	15 (0.8)	419 (6.2)	10.5 (0.05)
United Arab Emirates	51 (0.7)	474 (2.8)	30 (0.5)	459 (3.1)	18 (0.5)	453 (2.8)	10.4 (0.03)
Qatar	51 (1.3)	447 (4.0)	30 (0.9)	403 (4.7)	19 (1.0)	381 (8.2)	10.4 (0.06)
Iran, Islamic Rep. of	51 (1.0)	478 (4.7)	33 (0.8)	469 (4.2)	16 (0.7)	476 (5.1)	10.5 (0.04)
Thailand	49 (1.3)	466 (4.1)	43 (1.0)	441 (4.0)	8 (0.5)	424 (5.8)	10.5 (0.04)
Malaysia	49 (1.6)	453 (5.7)	34 (0.9)	419 (6.4)	17 (1.1)	370 (9.2)	10.3 (0.07)
Bahrain	49 (1.0)	473 (2.6)	31 (0.8)	447 (3.2)	21 (0.8)	430 (5.0)	10.3 (0.05)
England	41 (1.3)	547 (5.9)	37 (0.9)	530 (4.7)	22 (0.9)	516 (5.9)	10.1 (0.05)
Singapore	41 (0.8)	616 (4.6)	43 (0.7)	583 (4.3)	17 (0.6)	546 (5.9)	10.2 (0.03)
Turkey	40 (0.8)	500 (4.2)	36 (0.6)	476 (3.8)	23 (0.8)	469 (4.7)	10.0 (0.04)
Chile	39 (0.8)	466 (2.8)	36 (0.7)	458 (2.8)	25 (0.8)	462 (3.5)	9.9 (0.03)
Israel	37 (1.2)	531 (4.9)	30 (0.8)	516 (4.7)	32 (1.0)	503 (4.2)	9.7 (0.06)
United States	36 (0.7)	544 (3.0)	34 (0.5)	525 (2.7)	29 (0.6)	506 (2.9)	9.7 (0.03)
New Zealand	26 (0.8)	531 (5.3)	33 (0.8)	515 (5.2)	41 (1.2)	504 (4.4)	9.2 (0.05)
Hong Kong SAR	26 (1.0)	559 (4.1)	43 (0.8)	535 (3.8)	32 (1.1)	518 (4.0)	9.5 (0.04)
Australia	25 (1.3)	557 (6.4)	31 (0.8)	525 (5.5)	44 (1.3)	496 (3.8)	9.1 (0.07)
Norway	24 (0.9)	506 (4.1)	38 (1.0)	499 (3.7)	38 (1.1)	484 (2.6)	9.3 (0.04)
Korea, Rep. of	14 (0.6)	607 (4.1)	40 (0.9)	574 (2.3)	46 (1.0)	535 (2.2)	8.8 (0.03)
Italy	13 (0.6)	532 (5.7)	36 (0.9)	505 (2.8)	50 (0.8)	490 (3.1)	8.9 (0.03)
Chinese Taipei	12 (0.7)	612 (4.2)	30 (0.7)	586 (2.8)	58 (1.1)	543 (2.2)	8.5 (0.05)
Japan	10 (0.7)	595 (4.9)	34 (1.0)	574 (2.7)	56 (1.1)	540 (2.7)	8.5 (0.04)
International Avg.	41 (0.2)	502 (0.8)	33 (0.2)	477 (0.8)	26 (0.2)	457 (1.1)	
Ninth Grade Participants							
Botswana	75 (0.8)	429 (3.0)	19 (0.6)	356 (4.8)	7 (0.4)	306 (9.0)	11.4 (0.03)
South Africa	57 (1.0)	344 (3.5)	26 (0.6)	319 (4.7)	16 (0.7)	346 (6.8)	10.7 (0.05)
Honduras	– –	– –	– –	– –	– –	– –	– –
Benchmarking Participants							
Dubai, UAE	52 (1.0)	494 (3.3)	29 (0.8)	479 (3.7)	19 (0.7)	476 (3.3)	10.4 (0.04)
Abu Dhabi, UAE	50 (1.1)	472 (4.6)	31 (0.8)	453 (5.1)	18 (0.9)	450 (5.2)	10.4 (0.05)
North Carolina, US	40 (1.5)	554 (6.5)	33 (1.2)	525 (7.8)	27 (1.1)	511 (6.2)	9.9 (0.06)
Alabama, US	39 (1.3)	490 (7.2)	34 (0.9)	491 (8.0)	27 (1.3)	476 (4.5)	9.9 (0.06)
Alberta, Canada	38 (1.0)	562 (3.2)	36 (0.9)	542 (2.6)	26 (1.0)	531 (3.1)	9.9 (0.05)
Minnesota, US	38 (1.7)	575 (4.7)	36 (1.1)	550 (5.0)	25 (1.5)	530 (5.3)	9.9 (0.07)
Indiana, US	37 (1.3)	552 (5.2)	35 (1.0)	533 (5.5)	28 (1.3)	510 (5.1)	9.8 (0.07)
Colorado, US	37 (1.4)	557 (5.6)	36 (1.0)	539 (6.0)	27 (1.2)	528 (5.0)	9.8 (0.06)
Florida, US	35 (1.8)	554 (7.7)	38 (1.4)	531 (8.3)	28 (1.7)	509 (7.7)	9.8 (0.08)
Massachusetts, US	34 (1.4)	587 (5.9)	36 (1.1)	567 (5.3)	30 (1.5)	546 (6.4)	9.7 (0.07)
Ontario, Canada	34 (1.1)	540 (3.3)	35 (0.9)	518 (3.4)	30 (0.9)	503 (3.4)	9.7 (0.05)
Connecticut, US	34 (1.3)	551 (6.1)	36 (0.8)	536 (4.6)	30 (1.2)	518 (5.6)	9.7 (0.07)
California, US	32 (1.3)	512 (5.5)	37 (1.2)	503 (5.7)	31 (1.1)	486 (4.8)	9.6 (0.05)
Quebec, Canada	27 (1.1)	539 (3.1)	39 (0.8)	525 (3.1)	34 (1.1)	502 (2.8)	9.5 (0.05)

Centerpoint of scale set at 10.

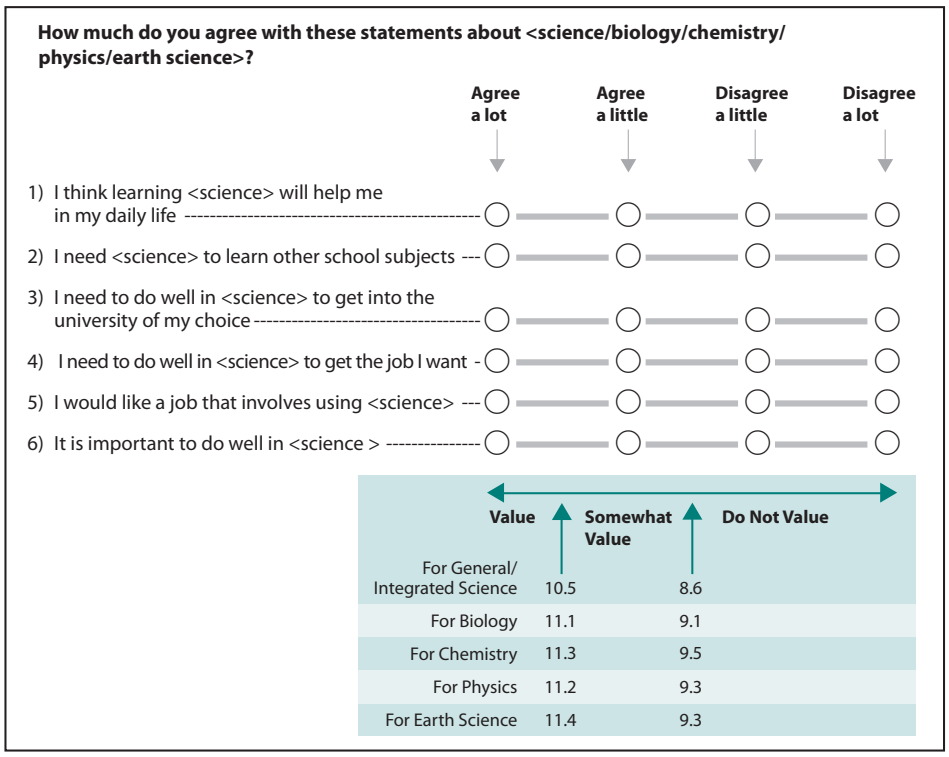
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (–) indicates comparable data are 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 2011

Exhibit 8.3: Students Value Science (Continued)



	Value	Somewhat Value	Do Not Value
For General/ Integrated Science	10.5	8.6	
For Biology	11.1	9.1	
For Chemistry	11.3	9.5	
For Physics	11.2	9.3	
For Earth Science	11.4	9.3	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Separate Science Panels

Students Value Biology

Biology	Value		Somewhat Value		Do Not Value		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Morocco	60 (0.8)	376 (2.4)	29 (0.6)	378 (3.6)	11 (0.5)	393 (4.3)	11.4 (0.03)
Syrian Arab Republic	55 (1.1)	431 (4.1)	33 (0.9)	427 (4.7)	13 (0.7)	420 (7.1)	11.3 (0.04)
Lebanon	40 (1.3)	415 (5.2)	37 (1.0)	400 (6.3)	23 (1.1)	402 (6.7)	10.6 (0.06)
Macedonia, Rep. of	39 (1.4)	384 (5.5)	33 (0.9)	418 (5.5)	28 (1.3)	448 (7.1)	10.5 (0.07)
Kazakhstan	38 (1.5)	482 (4.2)	40 (1.1)	488 (4.9)	22 (1.5)	516 (4.9)	10.6 (0.07)
Georgia	32 (1.4)	412 (4.6)	34 (0.9)	432 (3.3)	34 (1.2)	437 (3.5)	10.1 (0.06)
Ukraine	32 (1.3)	495 (5.0)	36 (1.0)	499 (4.7)	32 (1.3)	512 (3.9)	10.1 (0.06)
Armenia	26 (0.9)	425 (4.8)	32 (0.9)	433 (3.7)	42 (1.0)	454 (3.4)	9.8 (0.05)
Lithuania	25 (1.0)	514 (3.6)	37 (0.9)	511 (3.6)	37 (1.2)	520 (3.0)	9.9 (0.05)
Indonesia	24 (1.3)	405 (7.8)	62 (1.0)	404 (4.3)	14 (0.9)	418 (5.2)	10.3 (0.05)
Russian Federation	23 (0.8)	534 (5.2)	30 (0.8)	535 (3.9)	47 (1.2)	553 (3.4)	9.6 (0.05)
Romania	20 (0.8)	459 (5.0)	31 (0.9)	463 (4.6)	49 (1.1)	473 (4.1)	9.4 (0.05)
Hungary	17 (0.7)	520 (6.0)	29 (0.9)	515 (3.9)	54 (1.2)	529 (2.8)	9.2 (0.05)
Slovenia	13 (0.7)	549 (5.1)	38 (0.8)	544 (3.5)	49 (1.1)	542 (2.8)	9.3 (0.04)
Sweden	13 (0.5)	526 (5.0)	38 (0.9)	518 (3.1)	49 (0.9)	507 (2.6)	9.4 (0.03)
Finland	6 (0.4)	577 (7.2)	26 (0.9)	564 (3.5)	68 (1.0)	549 (2.5)	8.6 (0.04)
International Avg.	29 (0.3)	469 (1.3)	35 (0.2)	471 (1.1)	36 (0.3)	480 (1.1)	

Exhibit 8.3: Students Value Science (Continued)

Students Value Chemistry

Chemistry	Value		Somewhat Value		Do Not Value		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Morocco	56 (0.7)	378 (2.6)	29 (0.5)	375 (3.4)	15 (0.6)	390 (3.5)	11.4 (0.03)
Syrian Arab Republic	48 (1.3)	430 (4.1)	33 (0.9)	426 (4.5)	19 (0.9)	433 (5.7)	11.1 (0.05)
Kazakhstan	39 (1.4)	487 (4.6)	40 (1.2)	489 (5.1)	20 (1.2)	507 (5.1)	10.9 (0.05)
Lebanon	36 (1.1)	411 (5.3)	37 (1.0)	400 (6.0)	27 (1.2)	412 (6.5)	10.7 (0.05)
Macedonia, Rep. of	33 (1.2)	386 (5.9)	29 (1.0)	409 (6.2)	38 (1.4)	442 (6.0)	10.2 (0.07)
Ukraine	26 (1.1)	498 (4.6)	34 (0.8)	501 (4.9)	40 (1.4)	506 (3.3)	10.0 (0.06)
Lithuania	25 (0.9)	519 (3.8)	34 (0.8)	513 (3.5)	41 (1.1)	513 (2.8)	10.0 (0.05)
Russian Federation	22 (1.0)	544 (4.1)	29 (0.6)	539 (4.3)	49 (0.9)	545 (3.4)	9.9 (0.05)
Armenia	20 (0.7)	428 (5.2)	23 (0.8)	427 (5.0)	57 (1.1)	449 (3.0)	9.4 (0.05)
Indonesia r	17 (1.0)	392 (6.6)	55 (1.3)	397 (5.0)	28 (1.3)	411 (6.2)	10.2 (0.04)
Romania	16 (0.7)	462 (5.5)	26 (0.9)	464 (4.7)	57 (1.2)	471 (3.6)	9.3 (0.06)
Slovenia	15 (0.8)	566 (3.6)	37 (1.0)	549 (3.9)	48 (1.1)	533 (2.8)	9.7 (0.04)
Hungary	14 (0.6)	518 (6.9)	24 (0.7)	517 (5.1)	62 (0.9)	528 (2.6)	9.1 (0.04)
Sweden	11 (0.6)	518 (6.4)	33 (0.9)	520 (3.8)	56 (1.0)	510 (2.6)	9.5 (0.03)
Finland	7 (0.5)	584 (5.9)	26 (1.0)	570 (3.2)	67 (1.1)	545 (2.4)	8.9 (0.04)
Georgia	– –	– –	– –	– –	– –	– –	– –
International Avg.	26 (0.2)	475 (1.3)	33 (0.2)	473 (1.2)	42 (0.3)	479 (1.1)	

Students Value Physics

Physics	Value		Somewhat Value		Do Not Value		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Morocco	60 (0.7)	379 (2.3)	26 (0.5)	378 (3.3)	14 (0.5)	393 (3.8)	11.4 (0.03)
Syrian Arab Republic	47 (1.2)	429 (4.3)	33 (1.0)	425 (4.2)	20 (0.9)	437 (5.1)	11.0 (0.05)
Kazakhstan	42 (1.4)	491 (5.0)	40 (1.0)	486 (5.2)	18 (1.1)	506 (4.9)	10.9 (0.06)
Lebanon	37 (1.4)	415 (5.4)	36 (1.2)	400 (6.3)	27 (1.3)	408 (6.7)	10.5 (0.06)
Macedonia, Rep. of	36 (1.3)	390 (6.1)	29 (0.8)	415 (5.7)	35 (1.4)	436 (6.5)	10.2 (0.07)
Georgia	34 (1.2)	422 (4.4)	32 (0.9)	426 (3.7)	33 (1.0)	436 (3.3)	10.2 (0.05)
Ukraine	29 (1.2)	508 (4.8)	35 (1.1)	503 (4.4)	36 (1.5)	498 (3.2)	10.0 (0.06)
Russian Federation	27 (1.2)	553 (4.5)	32 (0.8)	544 (3.6)	41 (1.2)	535 (3.3)	10.0 (0.05)
Armenia	27 (1.0)	440 (4.7)	28 (0.9)	434 (4.2)	45 (1.2)	447 (3.6)	9.9 (0.05)
Lithuania	23 (0.9)	521 (4.2)	35 (1.0)	513 (3.3)	41 (1.1)	513 (2.6)	9.8 (0.05)
Indonesia	20 (1.4)	397 (9.1)	58 (1.0)	409 (4.5)	22 (1.3)	424 (4.6)	10.2 (0.05)
Hungary	17 (0.5)	539 (4.9)	27 (0.8)	521 (5.1)	56 (0.9)	521 (2.5)	9.2 (0.04)
Romania	16 (0.9)	460 (5.4)	26 (1.0)	472 (6.1)	58 (1.4)	468 (3.4)	9.1 (0.06)
Slovenia	13 (0.6)	564 (4.5)	36 (0.9)	551 (3.4)	51 (0.9)	533 (2.9)	9.3 (0.04)
Sweden	13 (0.5)	528 (5.5)	35 (0.9)	522 (3.5)	52 (0.9)	508 (2.6)	9.4 (0.03)
Finland	7 (0.6)	581 (6.2)	24 (0.9)	570 (3.4)	69 (1.0)	546 (2.5)	8.6 (0.05)
International Avg.	28 (0.3)	476 (1.3)	33 (0.2)	473 (1.1)	39 (0.3)	476 (1.0)	

Students Value Earth Science

Earth Science	Value		Somewhat Value		Do Not Value		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Morocco	58 (0.7)	373 (2.3)	28 (0.5)	378 (2.9)	14 (0.5)	404 (3.4)	11.6 (0.03)
Syrian Arab Republic	48 (1.3)	425 (4.3)	32 (0.9)	427 (4.8)	20 (1.2)	436 (6.4)	11.1 (0.06)
Kazakhstan	35 (1.2)	482 (4.5)	43 (0.9)	487 (4.7)	22 (1.3)	516 (5.6)	10.7 (0.06)
Macedonia, Rep. of	35 (1.4)	379 (5.5)	35 (1.0)	417 (5.3)	30 (1.4)	449 (6.4)	10.5 (0.07)
Georgia	32 (1.2)	414 (4.8)	35 (0.9)	426 (4.0)	33 (1.3)	443 (3.6)	10.3 (0.06)
Lithuania	26 (0.8)	509 (3.7)	39 (0.9)	516 (2.9)	35 (1.0)	517 (3.3)	10.1 (0.05)
Ukraine	24 (1.2)	492 (5.5)	39 (1.0)	505 (4.4)	38 (1.5)	506 (3.9)	10.0 (0.06)
Armenia	20 (0.9)	423 (5.0)	32 (0.9)	432 (4.1)	48 (1.2)	453 (3.3)	9.7 (0.05)
Romania	19 (1.0)	448 (4.6)	33 (1.0)	468 (4.7)	48 (1.4)	474 (4.1)	9.6 (0.06)
Indonesia	17 (1.2)	390 (8.1)	58 (1.2)	402 (4.5)	25 (1.4)	422 (4.3)	10.2 (0.05)
Sweden	15 (0.6)	508 (4.8)	43 (0.9)	519 (3.1)	42 (1.0)	509 (3.1)	9.8 (0.03)
Russian Federation	14 (0.7)	525 (5.0)	29 (0.9)	542 (4.0)	57 (1.3)	548 (3.4)	9.3 (0.06)
Slovenia	13 (0.7)	545 (5.1)	40 (0.9)	549 (3.8)	47 (1.0)	539 (2.9)	9.5 (0.04)
Hungary	11 (0.6)	506 (7.2)	26 (0.8)	514 (4.4)	62 (1.2)	531 (2.5)	9.0 (0.05)
Finland	6 (0.5)	568 (7.6)	30 (0.9)	565 (2.9)	64 (1.0)	547 (2.4)	8.9 (0.04)
Lebanon	– –	– –	– –	– –	– –	– –	– –
International Avg.	25 (0.3)	466 (1.4)	36 (0.2)	476 (1.1)	39 (0.3)	486 (1.1)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

may be partly due to the nature of the questions making up the Students Value Science scale, several of which may be more suited to a general subject such as reading, mathematics, or science than to the more specific biology, chemistry, physics, and earth science. For example, students may indeed value science very highly and yet not agree that they "need biology to learn other school subjects" (question 2 on the scale), or that they "need to do well in earth science to get the job I want" (question 4 on the scale). As a result, the Students Value Science scale may underestimate the extent to which students in separate science countries actually value science, and inflate the percentage of students in the **Do Not Value** category. This may somewhat explain the absence of relationship with science achievement in chemistry and physics and the anomalous finding of higher average science achievement among students who **Do Not Value** biology and earth science compared to those who do value these subjects.

Students Confident in Science

Exhibit 8.4 presents the fourth grade results for the TIMSS 2011 Students Confident in Science scale, which includes six statements such as "Science is harder for me than for many of my classmates" (reverse coded) and "My teacher tells me I am good at science" (see second page of exhibit for all six statements). **Confident** students "agreed a lot" with three of the six statements and "agreed a little" to the other three, on average. Students **Not Confident** in science "disagreed a little" with three of the statements and "agreed a little" with the other three, on average.

Internationally, on average, 43 percent of the fourth grade students expressed confidence in their science ability. Average science achievement was highest for the **Confident** fourth grade students and lowest (by 68 points) for the students lacking confidence (21% across countries). Similar to the results for "liking" to learn science at the eighth grade, students in some of the highest performing countries expressed the least confidence. For the sixth grade participants, somewhat fewer students expressed confidence (28–39%) and somewhat more expressed a lack of confidence (23–30%).

As shown in Exhibit 8.5 (second page), the TIMSS 2011 Student Confidence with Science scale for the eighth grade included nine statements, five of which also were included in the fourth grade scale. As with the other attitudinal scales, students in countries teaching the sciences as separate subjects were asked about each of the four science subjects and the results were scaled separately. On average internationally, only 20 percent of the eighth grade

students in general or integrated science countries expressed confidence in their science ability, with 49 percent **Somewhat Confident** and 31 percent **Not Confident**. The average achievement gap was large—86 points—between the **Confident** students and those **Not Confident**. To at least some extent, the eighth grade results for general or integrated science held constant across the ninth grade and benchmarking participants.

The eighth grade students in separate science countries were similar to students in general or integrated countries in their confidence with biology and earth science (21–19% confident, respectively), but less confident with chemistry and physics (14% confident for each). In all four science subjects there was a strong positive relationship between student confidence and average science achievement.

Exhibit 8.4: Students Confident in Science

TIMSS 2011 4th Grade Science

Reported by Students

Students were scored according to their degree of agreement with six statements on the *Students Confident in Science* scale. Students **Confident** in science had a score on the scale of at least 10.1, which corresponds to their "agreeing a lot" with three of the six statements and "agreeing a little" with the other three, on average. Students who were **Not Confident** had a score no higher than 8.3, which corresponds to their "disagreeing a little" with three of the six statements and "agreeing a little" with the other three, on average. All other students were **Somewhat Confident** in science.

Country	Confident		Somewhat Confident		Not Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Croatia	62 (0.9)	529 (2.0)	25 (0.8)	505 (3.1)	13 (0.7)	479 (3.9)	10.9 (0.05)
Iran, Islamic Rep. of	61 (1.0)	479 (3.5)	27 (0.8)	423 (5.1)	11 (0.6)	393 (6.5)	10.9 (0.05)
Austria	59 (1.0)	549 (2.9)	28 (0.9)	522 (3.0)	13 (0.7)	478 (5.2)	10.7 (0.04)
Turkey	57 (1.0)	498 (3.3)	30 (0.7)	437 (4.7)	13 (0.7)	389 (6.8)	10.6 (0.05)
Saudi Arabia	56 (1.5)	463 (5.0)	28 (1.0)	409 (6.6)	16 (1.0)	370 (10.0)	10.7 (0.07)
Norway	55 (1.3)	507 (2.1)	33 (1.1)	486 (4.0)	11 (0.7)	466 (4.8)	10.5 (0.05)
Germany	53 (1.1)	548 (3.0)	33 (0.9)	524 (3.5)	13 (0.8)	483 (4.5)	10.4 (0.05)
Georgia	53 (1.2)	488 (3.2)	28 (1.0)	443 (5.0)	19 (0.9)	412 (5.7)	10.5 (0.06)
Oman	52 (0.9)	426 (4.5)	29 (0.7)	344 (5.1)	19 (0.6)	303 (6.5)	10.5 (0.05)
Romania	52 (1.3)	544 (4.5)	29 (1.0)	491 (7.5)	19 (1.2)	435 (10.1)	10.4 (0.06)
Kazakhstan	52 (1.5)	509 (5.2)	33 (1.3)	485 (6.2)	15 (0.9)	479 (7.7)	10.4 (0.07)
United Arab Emirates	51 (0.8)	463 (2.8)	30 (0.6)	411 (3.6)	18 (0.5)	368 (3.6)	10.4 (0.03)
Tunisia	51 (1.4)	380 (6.2)	35 (1.2)	329 (6.4)	14 (0.8)	278 (10.5)	10.3 (0.07)
Serbia	51 (1.4)	536 (3.1)	35 (1.1)	512 (4.0)	14 (1.0)	456 (7.4)	10.4 (0.06)
Kuwait	50 (1.2)	388 (5.5)	31 (0.8)	338 (5.9)	19 (0.9)	285 (7.2)	10.4 (0.05)
Hungary	50 (1.0)	568 (3.4)	30 (0.8)	520 (4.1)	21 (0.9)	483 (5.1)	10.3 (0.05)
Sweden	49 (1.2)	547 (3.0)	40 (1.1)	530 (3.3)	11 (0.7)	500 (5.5)	10.2 (0.05)
Russian Federation	48 (1.2)	570 (3.9)	32 (0.8)	548 (4.2)	20 (0.8)	521 (4.1)	10.2 (0.05)
United States	48 (0.8)	567 (2.0)	32 (0.6)	538 (3.2)	20 (0.6)	507 (3.0)	10.1 (0.03)
Azerbaijan r	47 (1.8)	482 (5.6)	32 (1.3)	435 (6.0)	20 (1.0)	409 (6.2)	10.2 (0.07)
Ireland	47 (1.5)	533 (3.6)	36 (1.1)	516 (3.7)	17 (1.0)	481 (7.0)	10.1 (0.06)
Malta	47 (0.9)	478 (2.4)	29 (0.8)	435 (3.0)	24 (0.7)	400 (4.0)	10.1 (0.04)
Poland	46 (0.9)	528 (2.5)	35 (0.7)	502 (3.1)	19 (0.7)	460 (5.2)	10.1 (0.04)
Slovenia	46 (1.0)	543 (2.5)	37 (0.8)	515 (3.4)	17 (0.7)	475 (4.8)	10.1 (0.05)
Bahrain	46 (1.5)	488 (3.5)	33 (1.1)	448 (3.6)	21 (1.0)	396 (5.7)	10.2 (0.07)
Armenia	46 (1.2)	440 (4.0)	30 (0.8)	409 (5.8)	25 (1.0)	386 (5.1)	10.2 (0.06)
Qatar	45 (1.3)	453 (5.3)	31 (0.9)	378 (4.8)	24 (1.2)	333 (7.4)	10.2 (0.05)
Lithuania	45 (1.0)	534 (2.5)	37 (1.0)	511 (2.9)	18 (0.8)	478 (4.1)	10.0 (0.04)
Slovak Republic	44 (1.1)	556 (3.2)	35 (0.9)	529 (4.7)	20 (0.8)	488 (4.9)	10.0 (0.05)
Chinese Taipei	44 (1.3)	573 (2.4)	35 (0.8)	550 (3.2)	21 (1.0)	512 (4.4)	10.1 (0.06)
Australia	42 (1.0)	535 (3.2)	36 (0.9)	516 (3.4)	22 (0.9)	484 (4.4)	9.9 (0.04)
Spain	41 (1.2)	532 (2.4)	33 (1.0)	499 (4.0)	26 (1.1)	477 (4.0)	9.8 (0.05)
Portugal	41 (1.7)	548 (4.2)	44 (1.4)	514 (3.7)	15 (1.1)	474 (5.6)	10.0 (0.06)
Netherlands	39 (1.5)	545 (2.9)	44 (1.0)	529 (2.4)	17 (0.9)	507 (4.0)	9.8 (0.05)
Italy	39 (1.0)	540 (2.8)	44 (0.8)	524 (3.0)	17 (0.8)	496 (4.5)	9.9 (0.04)
Czech Republic	38 (1.2)	556 (3.0)	38 (1.1)	538 (3.1)	24 (1.0)	505 (4.2)	9.7 (0.06)
Finland	38 (1.1)	587 (3.3)	43 (0.9)	571 (2.6)	19 (0.8)	540 (4.6)	9.7 (0.04)
Northern Ireland	37 (1.4)	537 (2.9)	40 (1.0)	520 (3.0)	23 (1.1)	482 (4.4)	9.7 (0.05)
Belgium (Flemish)	37 (1.0)	525 (2.4)	42 (0.9)	510 (2.2)	22 (0.8)	478 (3.0)	9.7 (0.04)
Denmark	36 (1.0)	540 (3.1)	44 (0.9)	529 (2.8)	20 (0.9)	509 (4.9)	9.7 (0.04)
England	33 (1.3)	549 (4.5)	38 (1.1)	530 (3.8)	29 (1.1)	506 (3.4)	9.5 (0.05)
Yemen	30 (1.9)	269 (7.4)	41 (1.3)	204 (7.7)	29 (1.7)	171 (8.4)	9.6 (0.07)
Chile	30 (0.9)	520 (3.5)	37 (0.7)	481 (2.7)	33 (0.9)	449 (3.0)	9.4 (0.04)
New Zealand	28 (1.2)	530 (3.4)	40 (1.0)	504 (3.5)	32 (1.0)	463 (3.6)	9.3 (0.05)
Morocco	27 (1.4)	317 (5.3)	43 (1.0)	257 (5.7)	31 (1.6)	231 (6.0)	9.4 (0.06)
Singapore	26 (0.6)	620 (3.6)	36 (0.6)	592 (3.6)	37 (0.7)	552 (4.0)	9.1 (0.03)
Hong Kong SAR	25 (0.9)	560 (4.6)	36 (0.9)	539 (3.8)	39 (1.3)	516 (4.8)	9.1 (0.05)
Thailand	19 (1.0)	500 (5.9)	49 (1.2)	471 (6.2)	32 (1.3)	458 (6.9)	9.1 (0.04)
Japan	17 (0.8)	581 (3.1)	48 (0.9)	564 (2.2)	34 (1.0)	541 (3.2)	8.9 (0.03)
Korea, Rep. of	15 (0.7)	623 (3.8)	45 (0.8)	598 (2.1)	40 (1.0)	562 (2.3)	8.8 (0.03)
International Avg.	43 (0.2)	514 (0.5)	36 (0.1)	480 (0.6)	21 (0.1)	446 (0.8)	

Centerpoint of scale set at 10.

( ) 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.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.4: Students Confident in Science (Continued)

Country	Confident		Somewhat Confident		Not Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Sixth Grade Participants							
Yemen	39 (1.9)	389 (7.5)	38 (1.2)	335 (6.9)	23 (1.6)	298 (9.2)	10.0 (0.08)
Botswana	32 (1.3)	448 (6.2)	41 (0.9)	348 (5.6)	27 (1.0)	308 (6.6)	9.6 (0.05)
Honduras	28 (1.7)	474 (8.0)	42 (1.2)	429 (5.2)	30 (1.3)	402 (5.9)	9.5 (0.07)
Benchmarking Participants							
North Carolina, US	55 (1.5)	556 (4.5)	30 (1.4)	531 (5.5)	16 (1.2)	498 (6.5)	10.4 (0.06)
Dubai, UAE	53 (0.9)	494 (3.1)	30 (0.9)	452 (3.4)	16 (0.6)	400 (5.6)	10.4 (0.04)
Alberta, Canada	53 (1.3)	557 (2.6)	34 (1.0)	533 (3.0)	14 (0.7)	506 (5.9)	10.4 (0.06)
Abu Dhabi, UAE	50 (1.7)	449 (4.9)	31 (1.1)	393 (6.8)	19 (1.1)	354 (6.0)	10.3 (0.07)
Quebec, Canada	47 (1.3)	528 (2.9)	38 (1.0)	512 (3.2)	15 (0.9)	491 (4.5)	10.1 (0.05)
Florida, US	47 (1.6)	565 (4.5)	30 (1.5)	540 (4.2)	23 (1.3)	517 (4.5)	10.1 (0.07)
Ontario, Canada	41 (1.0)	548 (3.2)	38 (0.9)	525 (3.6)	21 (1.1)	497 (4.7)	9.9 (0.05)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

How much do you agree with these statements about science?

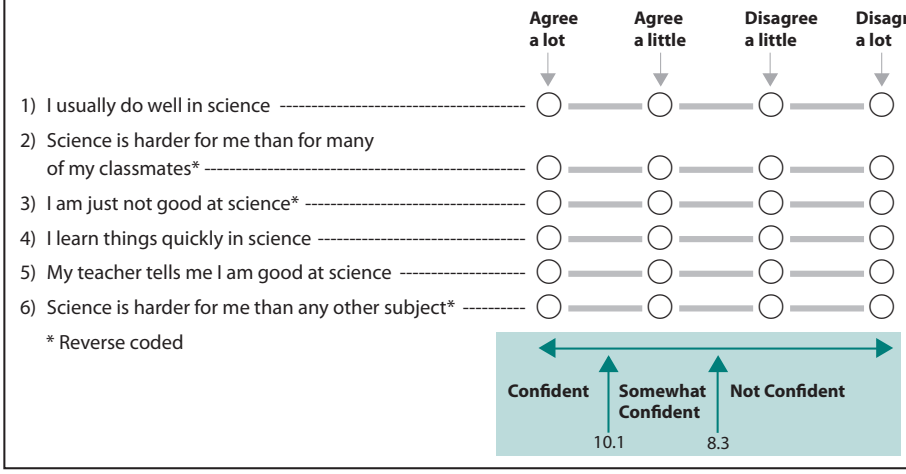


Exhibit 8.5: Students Confident in Science

TIMSS 2011 Science 8th Grade

Reported by Students

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

For general/integrated science, students were scored according to their degree of agreement with nine statements on the *Students Confident in Science* scale. Students **Confident** in science had a score on the scale of at least 11.5, which corresponds to their "agreeing a lot" with five of the nine statements and "agreeing a little" with the other four, on average. Students who were **Not Confident** had a score no higher than 9.0, which corresponds to their "disagreeing a little" with five of the nine statements and "agreeing a little" with the other four, on average. All other students were **Somewhat Confident** in science. For biology, chemistry, physics, and earth science, a comparable procedure was used.

Students Confident in General/Integrated Science

General/Integrated Science	Confident		Somewhat Confident		Not Confident		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Tunisia	37 (1.1)	464 (2.9)	51 (0.9)	427 (2.4)	11 (0.6)	414 (3.9)	11.1 (0.05)
Iran, Islamic Rep. of	33 (1.0)	509 (4.5)	50 (0.7)	463 (4.0)	17 (0.8)	443 (4.7)	10.8 (0.05)
Israel	33 (1.2)	568 (4.0)	43 (1.0)	501 (4.6)	24 (1.1)	477 (4.8)	10.6 (0.07)
Oman	29 (0.9)	487 (2.9)	57 (0.8)	407 (3.3)	14 (0.4)	360 (5.2)	10.7 (0.04)
Jordan	29 (1.0)	507 (3.4)	56 (0.8)	440 (4.0)	15 (0.7)	407 (6.5)	10.7 (0.04)
Saudi Arabia	29 (1.2)	481 (4.0)	54 (1.0)	426 (3.8)	17 (1.0)	401 (6.0)	10.6 (0.06)
United Arab Emirates	29 (0.7)	512 (2.7)	52 (0.5)	454 (2.8)	19 (0.7)	428 (3.1)	10.6 (0.04)
Qatar	28 (1.6)	496 (5.4)	51 (1.4)	404 (3.5)	22 (0.9)	368 (6.2)	10.5 (0.07)
Ghana	27 (1.1)	372 (5.1)	56 (0.8)	295 (5.1)	16 (0.8)	256 (8.8)	10.6 (0.05)
United States	26 (0.7)	565 (3.3)	47 (0.5)	524 (2.6)	27 (0.7)	492 (3.0)	10.3 (0.04)
Turkey	25 (1.0)	549 (5.8)	48 (0.9)	474 (3.4)	26 (0.9)	441 (3.9)	10.3 (0.05)
Palestinian Nat'l Auth.	23 (1.1)	480 (3.6)	55 (1.0)	414 (3.9)	22 (1.0)	379 (5.7)	10.4 (0.05)
Norway	23 (1.0)	535 (3.6)	55 (0.9)	494 (3.0)	22 (1.1)	456 (3.8)	10.4 (0.05)
England	23 (1.2)	579 (5.2)	52 (1.2)	529 (5.4)	25 (1.2)	503 (5.0)	10.2 (0.06)
Bahrain	23 (0.9)	511 (4.1)	52 (0.9)	450 (2.6)	25 (0.9)	418 (4.2)	10.2 (0.05)
Chile	18 (0.7)	498 (3.0)	55 (1.0)	459 (2.8)	27 (1.3)	444 (3.5)	10.0 (0.05)
Australia	16 (1.1)	575 (6.5)	49 (1.1)	527 (4.8)	35 (1.4)	486 (4.6)	9.8 (0.06)
Singapore	14 (0.5)	630 (5.9)	48 (0.7)	600 (4.8)	37 (0.8)	562 (4.2)	9.6 (0.03)
New Zealand	14 (0.9)	570 (5.8)	46 (0.9)	519 (5.3)	40 (1.2)	490 (4.6)	9.6 (0.05)
Italy	13 (0.8)	540 (3.8)	61 (1.0)	505 (2.7)	26 (1.1)	473 (4.2)	9.9 (0.04)
Hong Kong SAR	8 (0.6)	579 (4.9)	47 (1.1)	544 (4.1)	45 (1.3)	520 (3.4)	9.2 (0.04)
Chinese Taipei	6 (0.4)	648 (4.9)	27 (0.9)	599 (3.1)	67 (1.0)	543 (2.3)	8.3 (0.05)
Thailand	5 (0.4)	498 (7.8)	58 (1.3)	451 (4.3)	37 (1.5)	448 (4.2)	9.3 (0.04)
Korea, Rep. of	4 (0.3)	652 (4.6)	33 (0.8)	603 (2.1)	63 (0.9)	532 (1.9)	8.7 (0.03)
Malaysia	4 (0.4)	511 (9.0)	45 (1.1)	437 (6.2)	51 (1.3)	411 (6.5)	9.1 (0.04)
Japan	3 (0.3)	631 (7.7)	28 (0.9)	591 (2.6)	69 (1.1)	540 (2.6)	8.4 (0.04)
International Avg.	20 (0.2)	536 (1.0)	49 (0.2)	482 (0.8)	31 (0.2)	450 (0.9)	
Ninth Grade Participants							
South Africa	17 (0.6)	399 (4.1)	59 (0.6)	326 (3.5)	24 (0.7)	323 (5.6)	10.1 (0.03)
Honduras	16 (0.9)	404 (5.3)	60 (1.0)	368 (4.4)	24 (1.3)	353 (4.2)	10.0 (0.05)
Botswana	15 (0.7)	485 (4.3)	54 (0.9)	401 (3.7)	31 (1.1)	381 (4.7)	9.9 (0.04)
Benchmarking Participants							
Massachusetts, US	33 (2.1)	604 (6.4)	46 (1.2)	561 (5.0)	21 (1.9)	526 (4.4)	10.7 (0.12)
Dubai, UAE	32 (1.1)	528 (3.5)	50 (0.9)	474 (3.6)	18 (0.7)	446 (4.4)	10.7 (0.05)
Connecticut, US	28 (1.9)	576 (6.7)	44 (1.3)	531 (5.1)	28 (1.7)	501 (5.2)	10.4 (0.10)
North Carolina, US	28 (1.6)	575 (7.4)	46 (1.2)	532 (7.0)	27 (1.8)	490 (5.1)	10.3 (0.11)
Abu Dhabi, UAE	27 (1.1)	509 (5.4)	53 (0.9)	450 (4.5)	20 (1.1)	429 (5.1)	10.5 (0.05)
Indiana, US	27 (1.4)	570 (5.4)	46 (1.0)	532 (4.9)	27 (1.8)	500 (5.0)	10.4 (0.09)
Minnesota, US	27 (2.0)	595 (4.4)	45 (1.2)	553 (3.9)	27 (1.7)	515 (5.3)	10.3 (0.10)
California, US	27 (1.5)	544 (4.3)	47 (1.1)	496 (4.5)	27 (1.8)	464 (5.6)	10.4 (0.09)
Colorado, US	26 (1.4)	579 (5.5)	49 (1.1)	539 (5.4)	25 (1.7)	511 (5.0)	10.4 (0.08)
Florida, US	24 (1.8)	570 (7.9)	47 (1.6)	535 (7.6)	29 (2.4)	499 (8.3)	10.2 (0.11)
Alabama, US	24 (1.4)	517 (8.3)	47 (1.4)	488 (6.0)	29 (2.0)	462 (6.7)	10.2 (0.09)
Ontario, Canada	22 (0.9)	560 (3.7)	49 (1.0)	521 (2.9)	30 (1.1)	492 (3.4)	10.1 (0.05)
Alberta, Canada	21 (1.0)	588 (2.9)	53 (0.9)	543 (2.9)	26 (1.2)	519 (3.0)	10.2 (0.06)
Quebec, Canada	19 (1.0)	550 (3.7)	60 (0.8)	521 (2.7)	21 (1.0)	491 (3.7)	10.2 (0.05)

Centerpoint of scale set at 10.

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

A dash (–) indicates comparable data are 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.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.5: Students Confident in Science (Continued)

How much do you agree with these statements about <science/biology/chemistry/physics/earth science>?

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
1) I usually do well in <science>	○	○	○	○
2) <Science> is more difficult for me than for many of my classmates*	○	○	○	○
3) <Science> is not one of my strengths*	○	○	○	○
4) I learn things quickly in <science>	○	○	○	○
5) <Science> makes me confused and nervous*	○	○	○	○
6) I am good at working out difficult <science> problems	○	○	○	○
7) My teacher thinks I can do well in <science> <programs/classes/lessons> with difficult materials	○	○	○	○
8) My teacher tells me I am good at <science>	○	○	○	○
9) <Science> is harder for me than any other subject*	○	○	○	○

* Reverse coded

	Confident	Somewhat Confident	Not Confident
For General/ Integrated Science	11.5	9.0	
For Biology	11.4	8.5	
For Chemistry	11.9	9.3	
For Physics	11.9	9.2	
For Earth Science	11.5	8.7	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Separate Science Panels

Students Confident in Biology

Biology	Confident		Somewhat Confident		Not Confident		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Georgia	32 (1.0)	472 (3.2)	48 (0.9)	417 (3.3)	20 (0.9)	380 (4.6)	10.6 (0.06)
Syrian Arab Republic	31 (1.3)	458 (4.6)	58 (1.1)	418 (3.5)	11 (0.8)	398 (5.5)	10.7 (0.06)
Kazakhstan	27 (1.4)	516 (4.7)	61 (1.2)	486 (4.7)	11 (0.8)	469 (6.7)	10.5 (0.07)
Macedonia, Rep. of	27 (1.0)	478 (4.8)	54 (1.0)	392 (5.7)	19 (1.0)	381 (7.0)	10.3 (0.05)
Russian Federation	23 (0.9)	565 (4.2)	57 (0.9)	543 (3.3)	20 (0.8)	519 (3.9)	10.1 (0.05)
Hungary	22 (1.1)	563 (3.7)	52 (0.9)	518 (3.3)	25 (1.2)	499 (4.9)	10.0 (0.07)
Ukraine	22 (1.1)	533 (5.0)	58 (1.0)	501 (3.5)	20 (1.0)	472 (5.5)	10.1 (0.06)
Morocco	22 (0.7)	424 (2.6)	59 (0.7)	370 (2.7)	19 (0.6)	353 (3.2)	10.1 (0.03)
Romania	21 (1.1)	504 (3.6)	55 (0.9)	466 (3.7)	25 (1.2)	439 (6.1)	9.9 (0.06)
Lebanon	21 (1.1)	467 (6.4)	56 (1.1)	400 (5.5)	23 (1.2)	368 (5.8)	10.0 (0.06)
Lithuania	19 (0.8)	547 (4.0)	58 (0.9)	513 (2.7)	23 (1.1)	492 (4.4)	9.9 (0.05)
Armenia	16 (0.8)	486 (3.9)	55 (1.0)	438 (3.4)	29 (1.2)	419 (4.4)	9.6 (0.05)
Slovenia	15 (0.8)	572 (3.9)	61 (0.9)	547 (2.9)	24 (1.1)	517 (4.5)	9.7 (0.05)
Sweden	14 (0.7)	558 (4.8)	66 (0.9)	517 (2.5)	20 (0.9)	474 (3.3)	9.8 (0.04)
Finland	14 (0.8)	592 (3.9)	59 (1.0)	557 (2.5)	27 (1.1)	530 (3.4)	9.6 (0.05)
Indonesia	5 (0.5)	412 (10.7)	67 (1.4)	403 (5.1)	29 (1.6)	413 (4.5)	9.2 (0.04)
International Avg.	21 (0.2)	509 (1.2)	58 (0.2)	468 (0.9)	22 (0.3)	445 (1.2)	

Exhibit 8.5: Students Confident in Science (Continued)

Students Confident in Chemistry

Chemistry	Confident		Somewhat Confident		Not Confident		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Lebanon	21 (1.3)	462 (6.5)	57 (1.1)	399 (5.0)	22 (1.1)	376 (6.9)	10.6 (0.06)
Kazakhstan	21 (1.2)	523 (5.4)	55 (1.0)	487 (4.5)	24 (1.1)	478 (5.6)	10.7 (0.06)
Morocco	17 (0.6)	427 (2.9)	59 (0.6)	371 (2.7)	23 (0.6)	361 (3.3)	10.4 (0.03)
Syrian Arab Republic	17 (0.9)	462 (5.0)	60 (0.9)	424 (4.1)	23 (0.8)	419 (4.6)	10.4 (0.05)
Slovenia	16 (0.7)	595 (3.7)	49 (0.8)	550 (3.1)	35 (1.2)	513 (3.2)	10.1 (0.05)
Macedonia, Rep. of	15 (0.8)	493 (6.6)	51 (1.1)	403 (5.1)	34 (1.3)	396 (5.9)	10.1 (0.06)
Russian Federation	14 (0.8)	583 (4.8)	44 (1.1)	548 (4.1)	42 (1.3)	525 (3.3)	9.9 (0.05)
Hungary	14 (0.7)	572 (4.9)	40 (1.2)	521 (3.6)	46 (1.4)	511 (3.5)	9.7 (0.06)
Lithuania	13 (0.8)	562 (3.7)	44 (1.0)	517 (3.3)	43 (1.3)	498 (3.3)	9.8 (0.06)
Ukraine	13 (0.8)	552 (5.1)	42 (0.9)	506 (3.7)	45 (1.2)	485 (4.0)	9.8 (0.06)
Sweden	12 (0.7)	563 (5.1)	61 (1.0)	518 (2.8)	27 (1.2)	482 (3.3)	10.2 (0.04)
Finland	12 (0.7)	608 (4.2)	41 (1.2)	566 (2.7)	47 (1.6)	531 (2.9)	9.6 (0.07)
Romania	12 (0.8)	525 (5.7)	42 (1.2)	470 (4.4)	46 (1.6)	449 (3.6)	9.7 (0.06)
Armenia	9 (0.6)	504 (4.7)	42 (1.0)	444 (3.9)	50 (1.3)	428 (3.6)	9.4 (0.05)
Indonesia r	2 (0.4)	~ ~	53 (1.7)	389 (5.3)	44 (1.9)	415 (5.0)	9.5 (0.04)
Georgia	– –	– –	– –	– –	– –	– –	– –
International Avg.	14 (0.2)	531 (1.3)	49 (0.3)	474 (1.0)	37 (0.3)	458 (1.1)	

Students Confident in Physics

Physics	Confident		Somewhat Confident		Not Confident		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Georgia	20 (1.0)	479 (4.6)	46 (0.9)	428 (4.0)	34 (1.1)	398 (3.5)	10.3 (0.05)
Kazakhstan	20 (1.2)	520 (6.2)	55 (1.1)	488 (4.6)	25 (1.3)	480 (4.9)	10.5 (0.07)
Morocco	19 (0.7)	425 (3.0)	59 (0.7)	372 (2.5)	22 (0.7)	364 (3.2)	10.5 (0.03)
Syrian Arab Republic	18 (0.8)	465 (4.8)	63 (0.8)	423 (3.9)	19 (0.7)	418 (5.0)	10.5 (0.04)
Lebanon	18 (1.1)	463 (7.5)	55 (1.2)	403 (5.5)	27 (1.3)	379 (5.7)	10.4 (0.07)
Hungary	18 (0.8)	580 (3.7)	43 (0.9)	524 (3.9)	39 (1.0)	498 (3.1)	10.1 (0.06)
Russian Federation	17 (0.7)	584 (4.1)	51 (1.2)	545 (3.5)	32 (1.3)	517 (3.9)	10.3 (0.05)
Macedonia, Rep. of	17 (0.9)	492 (5.9)	53 (1.0)	398 (5.2)	31 (1.2)	400 (6.2)	10.2 (0.06)
Armenia	15 (0.7)	502 (4.4)	51 (0.9)	442 (3.4)	35 (1.1)	414 (3.8)	10.1 (0.05)
Ukraine	13 (1.0)	557 (6.5)	50 (1.2)	505 (3.6)	37 (1.5)	480 (3.8)	9.9 (0.07)
Sweden	11 (0.7)	569 (4.8)	62 (0.8)	520 (2.6)	26 (0.8)	480 (3.3)	10.1 (0.04)
Lithuania	9 (0.6)	563 (4.4)	41 (1.2)	519 (3.1)	50 (1.4)	502 (2.9)	9.4 (0.06)
Finland	9 (0.7)	609 (4.9)	39 (1.3)	569 (2.9)	52 (1.5)	535 (2.7)	9.3 (0.07)
Slovenia	9 (0.5)	614 (4.8)	40 (1.1)	559 (3.4)	52 (1.2)	521 (3.0)	9.3 (0.04)
Romania	8 (0.6)	520 (6.1)	45 (1.1)	471 (4.3)	47 (1.3)	455 (3.8)	9.5 (0.05)
Indonesia	3 (0.6)	392 (13.2)	57 (1.7)	401 (5.9)	40 (2.0)	423 (3.9)	9.6 (0.05)
International Avg.	14 (0.2)	521 (1.5)	51 (0.3)	473 (1.0)	35 (0.3)	454 (1.0)	

Students Confident in Earth Science

Earth Science	Confident		Somewhat Confident		Not Confident		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Macedonia, Rep. of	30 (1.1)	479 (5.4)	54 (0.9)	393 (6.0)	16 (0.8)	367 (6.4)	10.6 (0.06)
Kazakhstan	28 (1.5)	518 (4.7)	59 (1.2)	485 (4.7)	13 (0.9)	470 (5.7)	10.7 (0.07)
Georgia	26 (1.1)	482 (3.7)	50 (1.0)	420 (3.4)	24 (1.0)	385 (4.0)	10.3 (0.06)
Russian Federation	23 (0.9)	563 (3.3)	56 (0.9)	545 (3.2)	22 (1.0)	516 (4.8)	10.2 (0.05)
Syrian Arab Republic	22 (1.1)	460 (6.0)	62 (1.0)	421 (3.9)	16 (0.9)	411 (5.4)	10.2 (0.06)
Lithuania	21 (0.9)	550 (3.1)	52 (1.0)	513 (3.0)	27 (1.1)	490 (3.5)	10.0 (0.06)
Romania	21 (1.1)	509 (3.4)	53 (1.0)	467 (4.2)	26 (1.2)	434 (4.5)	10.0 (0.07)
Morocco	20 (0.5)	420 (2.8)	61 (0.6)	370 (2.4)	19 (0.5)	362 (3.1)	10.1 (0.03)
Hungary	19 (1.0)	555 (4.2)	48 (1.0)	521 (3.8)	33 (1.3)	509 (3.7)	9.8 (0.07)
Sweden	18 (0.9)	542 (4.4)	66 (0.9)	515 (2.7)	15 (0.7)	472 (5.0)	10.2 (0.04)
Slovenia	16 (0.7)	576 (4.4)	58 (1.1)	549 (2.8)	26 (1.3)	513 (3.7)	9.8 (0.05)
Armenia	16 (0.8)	489 (4.0)	57 (1.0)	440 (3.4)	27 (1.1)	415 (4.4)	9.7 (0.05)
Finland	15 (0.9)	590 (4.1)	58 (0.9)	558 (2.5)	28 (1.2)	525 (2.5)	9.7 (0.06)
Ukraine	15 (1.0)	546 (5.2)	56 (1.0)	504 (3.6)	29 (1.3)	477 (4.1)	9.7 (0.06)
Indonesia	3 (0.4)	389 (12.6)	60 (1.6)	398 (5.4)	37 (1.8)	419 (3.8)	9.1 (0.04)
Lebanon	– –	– –	– –	– –	– –	– –	– –
International Avg.	19 (0.2)	511 (1.4)	57 (0.3)	473 (1.0)	24 (0.3)	451 (1.1)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Instructional Time

Instructional Time Spent on Science

It is difficult to examine the effect of instructional time on student achievement, because a wide variety of factors influence the productivity of instruction hours—most importantly, the quality of the curriculum and instructional approaches (and all of the variables influencing them). In addition, the relationship between instructional time and student achievement is highly dependent on the effectiveness of the educational system. If an education system essentially is ineffective, increasing the amount of instruction time will have diminishing returns. Also, most countries implement levels of instructional time across their systems so that any variation is unintended and rarely related to achievement.

Despite the difficulties in studying its effects, instructional time remains a crucial resource in considering students' opportunity to learn. If everything else about schooling was equal and of high quality, more instructional time should result in increased student learning. For example, a recent study published by the London School of Economics used data from PISA 2006 and from 10- and 13-year-olds in Israel to compare achievement estimates for the same students across curriculum subjects, and found that instructional time has a positive and significant effect on achievement (Lavy, 2010).

Exhibits 8.6 and 8.7 present principals' and teachers' reports about the instructional hours per year spent on science instruction, respectively, at the fourth and eighth grades. The results for the time spent on science instruction were based on a series of calculations. As explained on the second page of the exhibits, principals provided the number of school days per year and the number of instructional hours per day. This information was combined to provide the yearly total number of instructional hours in each country shown in the first column of the exhibit. There was substantial variation across countries, but the fourth grade students in the TIMSS 2011 countries averaged about 900 hours per year of instruction, while those in the eighth grade averaged about 1,000 hours.

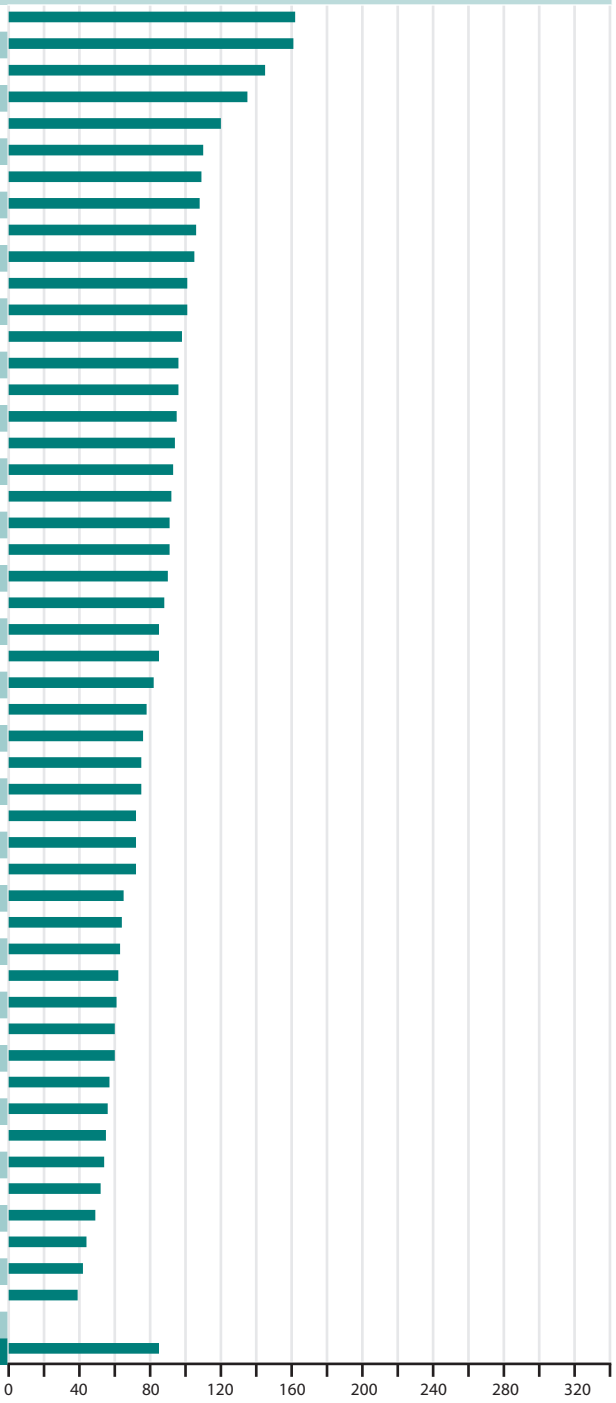
Teachers reported the weekly amount of instruction in science. This information was combined with the data provided by principals to estimate yearly amounts of instructional time in science for each TIMSS 2011 participant (second column in the exhibits). On average, the fourth grade countries reported devoting 85 hours per year to science instruction, although the amount of instructional time varied widely across the fourth grade, sixth grade, and benchmarking participants, from a low of 39 to a high of 162 hours.

Exhibit 8.6: Instructional Time Spent on Science

TIMSS 2011 4th Grade Science

Reported by Principals and Teachers

Country	Total Instructional Hours per Year	Hours per Year for Science Instruction
Portugal	r 940 (13.1)	r 162 (4.1)
Chile	r 1228 (22.6)	s 161 (6.4)
Spain	r 884 (9.7)	r 145 (2.6)
Qatar	1068 (9.1)	135 (6.8)
Oman	s 999 (17.4)	s 120 (2.4)
Georgia	r 748 (18.7)	r 110 (2.7)
Thailand	r 1201 (20.9)	109 (4.9)
United Arab Emirates	r 1025 (8.5)	s 108 (3.0)
Iran, Islamic Rep. of	727 (11.2)	106 (3.2)
United States	1078 (7.3)	r 105 (3.1)
Slovenia	684 (0.0)	101 (1.2)
Slovak Republic	780 (8.8)	101 (4.3)
Finland	779 (9.8)	98 (1.9)
Singapore	1012 (0.0)	96 (2.1)
Austria	808 (6.9)	96 (2.3)
Croatia	776 (19.4)	95 (2.4)
Turkey	900 (19.3)	94 (1.8)
Tunisia	r 963 (22.9)	r 93 (5.4)
Korea, Rep. of	789 (11.4)	92 (2.5)
Yemen	r 831 (14.1)	r 91 (5.6)
Japan	891 (3.7)	91 (0.8)
Chinese Taipei	r 989 (13.4)	90 (2.3)
Hong Kong SAR	r 1059 (11.2)	r 88 (4.2)
Kuwait	r 928 (23.1)	s 85 (5.8)
Bahrain	964 (10.8)	r 85 (2.7)
Saudi Arabia	r 977 (19.4)	r 82 (4.2)
Italy	1085 (12.6)	r 78 (1.8)
England	r 970 (8.3)	s 76 (3.2)
Sweden	r 849 (11.3)	s 75 (3.0)
Germany	r 863 (11.2)	s 75 (3.5)
Hungary	760 (12.2)	72 (2.2)
Serbia	778 (18.5)	72 (5.0)
Northern Ireland	r 970 (11.1)	s 72 (3.9)
Australia	1008 (6.9)	s 65 (2.3)
Poland	r 764 (13.5)	r 64 (3.1)
Ireland	854 (0.0)	63 (6.6)
Denmark	r 863 (9.4)	s 62 (1.9)
Azerbaijan	804 (27.7)	61 (1.4)
Lithuania	649 (9.0)	60 (1.5)
Czech Republic	782 (8.2)	60 (2.2)
Kazakhstan	779 (10.6)	57 (1.3)
Romania	796 (17.9)	56 (6.2)
Norway	817 (10.7)	55 (2.2)
Armenia	r 851 (17.1)	s 54 (0.6)
New Zealand	925 (3.9)	s 52 (3.0)
Russian Federation	r 660 (8.0)	49 (0.7)
Morocco	r 1040 (23.6)	s 44 (5.5)
Netherlands	s 1074 (9.9)	s 42 (2.4)
Malta	r 891 (0.2)	r 39 (0.1)
Belgium (Flemish)	r 1010 (16.8)	– –
International Avg.	897 (2.0)	85 (0.5)



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

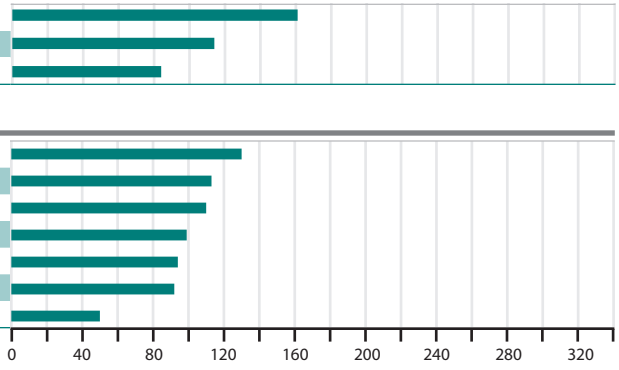
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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.

Exhibit 8.6: Instructional Time Spent on Science (Continued)

Country		Total Instructional Hours per Year		Hours per Year for Science Instruction
Sixth Grade Participants				
Honduras		1024 (16.9)	r	161 (5.0)
Botswana	s	1143 (23.2)	s	114 (5.0)
Yemen	r	831 (14.4)	r	84 (5.3)
Benchmarking Participants				
Alberta, Canada		1006 (8.8)	s	130 (4.1)
Florida, US	r	1073 (19.7)	s	113 (9.6)
Abu Dhabi, UAE	r	1033 (18.1)	s	110 (6.8)
Dubai, UAE	r	993 (0.7)	s	99 (1.6)
North Carolina, US	r	1113 (22.9)	r	94 (6.0)
Ontario, Canada		969 (7.4)	r	92 (3.2)
Quebec, Canada		916 (5.1)		50 (1.7)



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Total Instructional Hours per Year = Principal Reports of School Days per Year × Principal Reports of Instructional Hours per Day

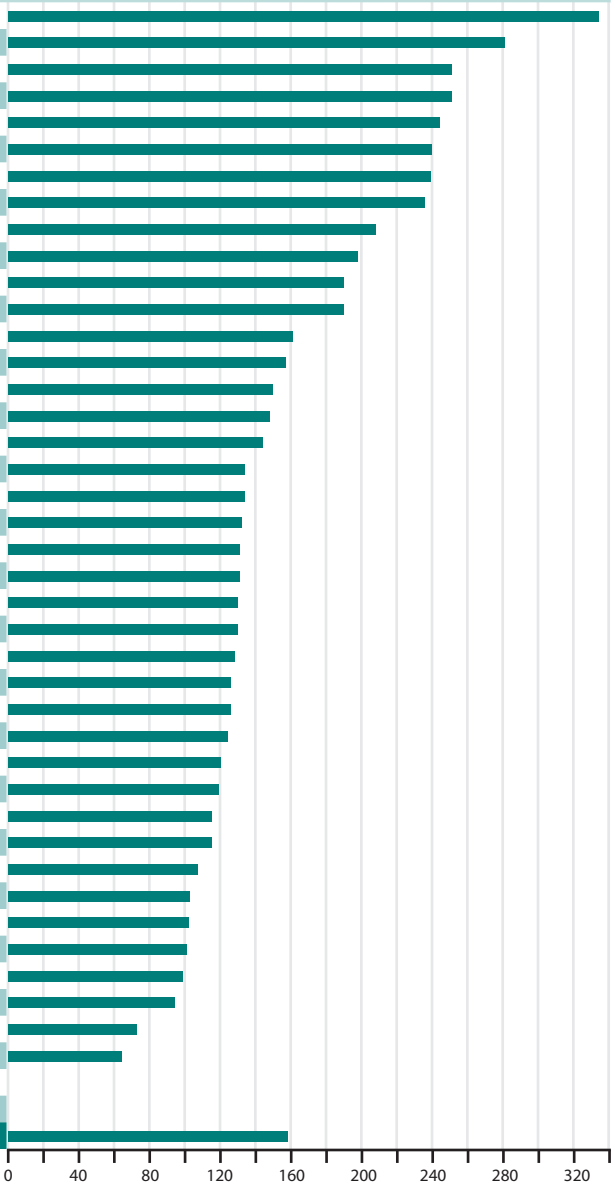
Hours per Year for Science Instruction = (Teacher Reports of Weekly Science Instructional Hours ÷ Principal Reports of School Days per Week) × Principal Reports of School Days per Year

Exhibit 8.7: Instructional Time Spent on Science

TIMSS 2011 8th Grade Science

Reported by Principals and Teachers

Country		Total Instructional Hours per Year		Hours per Year for Science Instruction*
Macedonia, Rep. of	r	1023 (21.4)	s	334 (14.7)
Romania		984 (15.5)		281 (10.1)
Lithuania		898 (13.9)	r	251 (5.2)
Slovenia		798 (0.0)		251 (4.6)
Kazakhstan		920 (9.9)		244 (4.8)
Armenia	r	979 (12.8)	s	240 (4.9)
Ukraine		901 (10.7)		239 (4.0)
Hungary		836 (12.2)		236 (4.8)
Russian Federation		882 (8.7)		208 (1.6)
Georgia	r	833 (10.8)	r	198 (6.8)
Finland		934 (11.7)	r	190 (6.0)
Indonesia	r	1494 (40.9)	r	190 (12.2)
Oman	r	1044 (17.7)	s	161 (3.8)
Chinese Taipei		1153 (11.7)		157 (2.7)
Syrian Arab Republic		811 (14.2)	r	150 (7.5)
Ghana	r	1153 (18.9)	r	148 (6.1)
Morocco	r	1303 (24.9)	r	144 (2.0)
Chile	r	1245 (23.5)	r	134 (3.8)
Jordan		1041 (11.9)		134 (3.1)
Israel	r	1108 (14.1)	r	132 (3.9)
Australia		1038 (7.2)	s	131 (4.5)
Qatar		1054 (1.3)		131 (6.9)
New Zealand		959 (4.4)	r	130 (2.6)
Bahrain		1019 (1.1)	r	130 (2.8)
Japan		1016 (6.7)		128 (1.7)
Korea, Rep. of		1006 (12.1)		126 (2.5)
Malaysia	r	1198 (13.7)		126 (3.6)
Saudi Arabia	r	1050 (20.9)	r	124 (6.8)
Iran, Islamic Rep. of		994 (15.9)		120 (3.6)
Thailand	r	1270 (15.1)		119 (2.9)
United Arab Emirates	r	1046 (8.0)	s	115 (2.7)
Singapore		1106 (0.0)		115 (2.1)
Palestinian Nat'l Auth.		918 (7.3)		107 (3.4)
Hong Kong SAR	r	1026 (11.3)	r	103 (4.6)
England	r	992 (8.4)	s	102 (3.1)
Norway		880 (6.3)		101 (3.3)
Turkey		889 (16.7)		99 (1.1)
Sweden	r	969 (13.5)	s	94 (3.1)
Italy		1085 (9.4)		73 (1.0)
Tunisia	r	1299 (25.4)	r	64 (1.9)
Lebanon	r	1028 (12.7)		x x
United States		1114 (6.6)		x x
International Avg.		1031 (2.3)		158 (0.8)



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

* For countries teaching science as separate subjects, total hours across subjects.

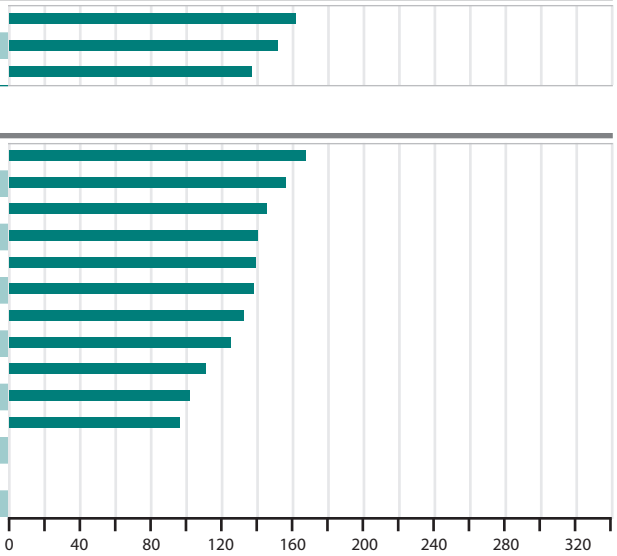
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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 less than 50% of students.

Exhibit 8.7: Instructional Time Spent on Science (Continued)

Country	Total Instructional Hours per Year	Hours per Year for Science Instruction*
Ninth Grade Participants		
Honduras	r 1152 (27.1)	r 162 (6.9)
South Africa	r 1193 (11.3)	s 152 (5.6)
Botswana	r 1114 (20.2)	r 137 (5.2)
Benchmarking Participants		
Alabama, US	r 1135 (16.3)	s 167 (6.0)
Massachusetts, US	1087 (13.6)	s 156 (6.1)
Alberta, Canada	1031 (10.0)	r 145 (4.0)
Minnesota, US	1043 (14.8)	s 140 (8.3)
Connecticut, US	1071 (19.3)	s 139 (6.2)
Colorado, US	1148 (17.0)	s 138 (6.0)
Indiana, US	r 1132 (14.9)	s 132 (6.5)
Dubai, UAE	r 1022 (1.5)	s 125 (3.6)
Abu Dhabi, UAE	r 1045 (16.6)	s 111 (4.8)
Quebec, Canada	913 (3.3)	r 102 (3.0)
Ontario, Canada	r 972 (7.4)	r 96 (3.5)
California, US	r 1040 (15.1)	x x
Florida, US	r 1119 (17.0)	x x
North Carolina, US	1159 (16.0)	x x



For Countries Teaching Science as Separate Subjects

Country	Hours per Year for Instruction									
	All Science Subjects		Biology		Chemistry		Physics		Earth Science	
Macedonia, Rep. of	s	334 (14.7)	s	86 (6.1)	s	84 (4.5)	s	85 (6.3)	s	80 (4.2)
Romania		281 (10.1)		50 (4.1)		83 (4.6)		77 (2.8)		71 (2.2)
Lithuania	r	251 (5.2)	r	44 (1.7)	r	70 (2.5)		67 (2.4)		70 (2.8)
Slovenia		251 (4.6)		60 (2.2)		69 (1.7)		64 (2.0)		58 (1.4)
Kazakhstan		244 (4.8)		57 (1.6)		70 (1.6)		60 (1.5)		56 (1.5)
Armenia	s	240 (4.9)	s	60 (2.0)	s	59 (1.2)	s	63 (2.2)	s	58 (1.4)
Ukraine		239 (4.0)		62 (1.2)		65 (2.9)		61 (0.9)		51 (1.4)
Hungary		236 (4.8)		62 (2.2)		59 (2.2)		56 (2.1)		60 (2.9)
Russian Federation		208 (1.6)		51 (0.6)		52 (0.7)		53 (1.0)		52 (0.6)
Georgia	r	198 (6.8)	r	71 (4.8)		– –	r	64 (2.4)	s	63 (2.9)
Finland	r	190 (6.0)	r	43 (2.0)		55 (2.1)		51 (1.7)	r	42 (2.2)
Indonesia	r	190 (12.2)	r	61 (5.5)	r	37 (2.5)	r	56 (5.0)	r	37 (2.5)
Syrian Arab Republic	r	150 (7.5)	r	53 (2.4)	r	40 (3.0)	r	40 (3.0)	r	18 (0.8)
Morocco	r	144 (2.0)	s	36 (0.6)	r	36 (0.6)	r	36 (0.6)	s	36 (0.6)
Lebanon		x x		x x		x x		x x		– –
International Avg.		225 (1.9)		57 (0.8)		56 (0.7)		59 (0.8)		54 (0.6)

Total Instructional Hours per Year = Principal Reports of School Days per Year x Principal Reports of Instructional Hours per Day

Hours per Year for Science Instruction = Teacher Reports of Weekly Science Instructional Hours / Principal Reports of School Days per Week x Principal Reports of School Days per Year

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Instructional time for science was much greater at the eighth grade, with the eighth grade countries devoting an average of 158 hours to science instruction, and there was greater variability across countries, from 64 to 334 hours. The large increase in science instructional time compared to the fourth grade was mainly the result of the greater attention given to science instruction in the separate science countries. For these countries, the number of hours reported for each of biology, chemistry, physics, and earth science is shown on the second page of Exhibit 8.7. The separate science countries devote 54 to 59 hours per year, on average, to each science subject, for an overall average of 225 hours of science instruction per year.

It should be noted that the variation across countries in science instructional time at both the fourth and eighth grades (including the sixth and ninth grades, respectively, and the benchmarking participants) is due to countries spending different amounts of time on total schooling, and allocating different amounts of the total time to science instruction, and in different ways. Finally, it should be understood that providing time for instruction is a necessary but not sufficient condition for student learning; the time allocated for instruction is a resource that needs to be used effectively, and efficiently.

Students Taught the TIMSS Science Topics

The science content and topic areas assessed in TIMSS 2011 are elaborated in the Science Framework, with each topic area for the fourth and eighth grades presented as comprehensive lists of objectives. Developed collaboratively by the participating countries, the TIMSS topics do not represent the "least common denominator" but rather a forward-looking conception of science teaching and learning.

Exhibit 8.8 presents teachers' reports about the TIMSS science topics that actually had been taught to students in fourth grade classrooms either prior to or during the year of the assessment. The exhibit shows, for each TIMSS participant, the percentage of students whose teachers reported that the students had been taught each of the topics, averaged across all science topics and across all topics within each science content domain. The topics are shown on the second page of the exhibit. At the fourth grade, teachers were asked about a total of 20 topics: six in life science, eight in physical science, and six in earth science.

At the fourth grade, according to their teachers, 64 percent of students, on average, had been taught the TIMSS science topics overall. There was considerable variation across countries, from 93 percent in Kuwait to 38 percent in Japan. On average, the percentage of students taught various topics was

highest for life science (75%), next highest for earth science (63%), and lowest for physical science (57%). However, including the fourth grade, sixth grade, and the benchmarking participants, there was considerable variation from topic to topic and from participant to participant.

Exhibit 8.9 presents teachers' reports about the TIMSS science topics that actually had been taught to students in eighth grade science classrooms either prior to or during the year of the assessment. The exhibit shows, for each participant, the percentage of students whose teachers reported that the students had been taught each of the topics, averaged across all science topics and across all topics within each science content domain. The topics are shown on the second page of the exhibit. At the eighth grade, teachers were asked about a total of 20 topics: seven in biology, four in chemistry, five in physics, and four in earth science.

At the eighth grade, on average, 72 percent of students had been taught the science topics overall. Teachers' reports about the degree of implementation ranged from 98 percent in Macedonia to 39 percent in Norway. Chemistry had the greatest degree of coverage, with 81 percent of students having been taught the chemistry topics at the eighth grade, followed by physics, with 75 percent of students taught the topics. The coverage for biology and earth science was similar, with 68 percent of the students being taught the topics in each of those two content areas. It should be emphasized that there was considerable variation across participants in relative coverage of the topics in the content domains.

National Research Coordinators were asked to indicate whether each of the TIMSS 2011 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." The results for the fourth and eighth grades are summarized in Exhibits 8.10 and 8.11. On average, across countries, the majority of the assessment topics were intended for all students—14 out of 20 at the fourth grade, and 17 out of 20 at the eighth grade.

At the fourth grade, the results varied topic by topic and country by country. However, of the six life science topics, on average, five were included in the curriculum for all students and one was not included; of the eight physical science topics, five were included and two were not; and of the six earth science topics, four were included and two were not. At the eighth grade, there was also considerable variation across countries, but with most of the topics in each content domain included in the curriculum for all students. On average across the eighth grade students, six of the seven biology topics, three of the four

Exhibit 8.8: Percentage of Students Taught the TIMSS Science Topics*

TIMSS 2011 4th Grade Science

Reported by Teachers

Country	All Science (20 Topics)	Life Science (6 Topics)	Physical Science (8 Topics)	Earth Science (6 Topics)
Armenia	r 69 (1.9)	s 73 (2.2)	s 56 (2.7)	s 81 (2.0)
Australia	r 58 (1.8)	r 69 (2.0)	s 47 (2.6)	s 62 (2.3)
Austria	71 (1.1)	83 (1.1)	58 (1.9)	76 (1.3)
Azerbaijan	77 (1.5)	80 (2.0)	69 (1.9)	86 (1.7)
Bahrain	76 (1.8)	80 (1.9)	75 (2.4)	75 (2.7)
Belgium (Flemish)	41 (1.2)	57 (1.9)	27 (1.5)	44 (1.6)
Chile	r 69 (1.2)	r 87 (1.3)	r 48 (2.6)	r 78 (1.7)
Chinese Taipei	58 (1.6)	69 (2.1)	61 (2.0)	43 (2.1)
Croatia	56 (1.1)	81 (1.4)	36 (1.6)	59 (1.3)
Czech Republic	59 (1.2)	85 (1.3)	37 (1.6)	62 (2.1)
Denmark	s 55 (1.4)	s 63 (2.4)	s 48 (1.9)	s 58 (2.2)
England	r 71 (1.7)	r 72 (2.4)	r 78 (1.8)	r 62 (2.9)
Finland	55 (1.2)	73 (1.6)	43 (1.8)	53 (1.6)
Georgia	70 (1.5)	85 (1.5)	46 (2.3)	86 (1.6)
Germany	59 (1.2)	73 (1.5)	52 (2.0)	53 (1.5)
Hong Kong SAR	56 (1.9)	72 (2.4)	48 (2.3)	51 (2.1)
Hungary	67 (1.2)	91 (1.1)	49 (1.9)	67 (1.7)
Iran, Islamic Rep. of	70 (1.3)	69 (2.2)	73 (1.3)	66 (1.4)
Ireland	71 (1.4)	73 (1.8)	68 (2.0)	72 (1.8)
Italy	57 (1.1)	69 (1.5)	44 (1.7)	64 (1.6)
Japan	38 (1.5)	34 (2.0)	42 (1.8)	36 (1.7)
Kazakhstan	– –	– –	– –	– –
Korea, Rep. of	50 (1.9)	56 (2.3)	44 (2.4)	52 (2.2)
Kuwait	93 (0.8)	96 (0.7)	93 (1.2)	91 (1.4)
Lithuania	79 (1.4)	98 (0.4)	64 (2.1)	81 (2.0)
Malta	58 (0.0)	67 (0.0)	57 (0.1)	53 (0.1)
Morocco	r 50 (1.6)	r 72 (1.6)	r 45 (1.9)	r 34 (2.2)
Netherlands	r 47 (2.0)	s 60 (2.0)	s 32 (2.5)	s 54 (3.4)
New Zealand	54 (1.7)	66 (2.0)	44 (2.2)	56 (1.9)
Northern Ireland	r 61 (2.1)	r 74 (2.3)	r 57 (2.8)	r 53 (3.0)
Norway	56 (1.4)	67 (1.9)	34 (2.0)	75 (2.0)
Oman	70 (1.0)	87 (1.0)	73 (1.1)	49 (1.6)
Poland	66 (1.2)	83 (1.3)	41 (2.1)	82 (1.0)
Portugal	85 (1.7)	96 (1.0)	75 (3.3)	88 (1.0)
Qatar	64 (1.6)	77 (2.4)	58 (2.1)	60 (1.8)
Romania	92 (0.9)	95 (1.1)	93 (1.3)	88 (1.0)
Russian Federation	– –	– –	– –	– –
Saudi Arabia	81 (1.3)	82 (1.6)	88 (1.5)	70 (1.9)
Serbia	85 (1.1)	88 (1.3)	92 (1.5)	74 (1.5)
Singapore	41 (0.8)	47 (1.3)	59 (0.9)	12 (1.1)
Slovak Republic	87 (0.8)	96 (0.7)	83 (1.3)	85 (1.1)
Slovenia	64 (1.4)	71 (1.5)	69 (2.0)	52 (2.0)
Spain	72 (1.3)	89 (1.2)	56 (2.4)	76 (1.8)
Sweden	r 53 (1.6)	r 59 (2.7)	r 34 (1.9)	s 73 (2.4)
Thailand	66 (2.3)	79 (2.0)	54 (3.1)	68 (2.9)
Tunisia	46 (1.2)	75 (1.7)	42 (1.5)	23 (1.7)
Turkey	75 (1.2)	69 (1.9)	88 (0.9)	66 (2.0)
United Arab Emirates	65 (1.0)	64 (1.1)	62 (1.3)	69 (1.3)
United States	r 72 (1.0)	r 73 (1.2)	r 67 (1.4)	r 77 (1.3)
Yemen	54 (1.9)	65 (2.1)	54 (2.3)	43 (2.5)
International Avg.	64 (0.2)	75 (0.2)	57 (0.3)	63 (0.3)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

* Percentage mostly taught before or in the assessment year averaged across topics.

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

A dash (–) indicates comparable data are 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.

Exhibit 8.8: Percentage of Students Taught the TIMSS Science Topics* (Continued)

Country	All Science (20 Topics)	Life Science (6 Topics)	Physical Science (8 Topics)	Earth Science (6 Topics)
Sixth Grade Participants				
Botswana	86 (1.3)	90 (1.4)	91 (1.4)	76 (2.3)
Honduras	78 (1.3)	98 (0.5)	54 (2.9)	90 (1.5)
Yemen	71 (1.7)	79 (2.0)	74 (2.0)	58 (2.8)
Benchmarking Participants				
Alberta, Canada	r 48 (1.6)	r 60 (2.4)	r 46 (2.3)	r 40 (2.4)
Ontario, Canada	52 (1.5)	67 (2.1)	r 46 (2.3)	r 44 (2.0)
Quebec, Canada	52 (1.9)	59 (2.4)	43 (2.4)	58 (2.3)
Abu Dhabi, UAE	65 (1.7)	61 (2.1)	66 (2.3)	66 (2.2)
Dubai, UAE	r 63 (1.2)	r 66 (1.4)	r 59 (1.3)	r 66 (2.3)
Florida, US	s 79 (1.7)	s 74 (3.2)	s 77 (3.0)	s 86 (2.6)
North Carolina, US	r 66 (1.9)	r 76 (2.7)	r 56 (2.8)	r 71 (3.4)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

TIMSS 2011 Science Topics

A. Life Science

1) Major body structures and their functions in humans and other organisms (plants and animals)
2) Life cycles and reproduction in plants and animals
3) Physical features, behavior, and survival of organisms living in different environments
4) Relationships in a given community (e.g., simple food chains, predator-prey relationships)
5) Changes in environments (effects of human activity, pollution and its prevention)
6) Human health (e.g., transmission/prevention of communicable diseases, signs of health/illness, diet, exercise)

B. Physical Science

1) States of matter (solids, liquids, gases) and differences in their physical properties (shape, volume), including changes in state of matter by heating and cooling
2) Classification of objects/materials based on physical properties (e.g., weight/mass, volume, magnetic attraction)
3) Forming and separating mixtures
4) Familiar changes in materials (e.g., decaying, burning, rusting, cooking)
5) Common energy sources/forms and their practical uses (e.g., the Sun, electricity, water, wind)
6) Light (e.g., sources, behavior)
7) Electrical circuits and properties of magnets
8) Forces that cause objects to move (e.g., gravity, push/pull forces)

C. Earth Science

1) Water on Earth (location, types, and movement) and air (composition, proof of its existence, uses)
2) Common features of Earth's landscape (e.g., mountains, plains, rivers, deserts) and relationship to human use (e.g., farming, irrigation, land development)
3) Weather conditions from day to day or over the seasons
4) Fossils of animals and plants (age, location, formation)
5) Earth's solar system (planets, Sun, moon)
6) Day, night, and shadows due to Earth's rotation and its relationship to the Sun

Exhibit 8.9: Percentage of Students Taught the TIMSS Science Topics*

TIMSS 2011 8th Grade Science

Reported by Teachers

Country	All Science (20 Topics)	Biology (7 Topics)	Chemistry (4 Topics)	Physics (5 Topics)	Earth Science (4 Topics)
Armenia	93 (0.6)	89 (1.0)	97 (1.0)	96 (0.9)	r 90 (1.8)
Australia	s 58 (1.1)	s 47 (1.6)	s 66 (2.3)	s 63 (1.8)	s 61 (3.0)
Bahrain	85 (0.8)	81 (1.2)	90 (0.8)	81 (1.2)	89 (1.2)
Chile	78 (1.2)	83 (1.5)	73 (1.8)	76 (2.0)	76 (3.0)
Chinese Taipei	68 (0.9)	92 (1.9)	98 (1.0)	59 (1.5)	5 (1.5)
England	r 87 (1.3)	r 86 (1.5)	r 91 (1.7)	r 89 (1.9)	r 83 (2.0)
Finland	59 (1.0)	35 (1.5)	91 (1.4)	60 (1.9)	67 (2.6)
Georgia	64 (0.7)	63 (1.6)	– –	40 (0.7)	97 (0.8)
Ghana	68 (1.5)	73 (1.7)	76 (1.6)	71 (2.4)	49 (2.7)
Hong Kong SAR	56 (1.3)	54 (1.9)	61 (1.9)	76 (1.6)	32 (3.0)
Hungary	83 (0.8)	75 (1.7)	98 (0.6)	86 (0.9)	75 (1.8)
Indonesia	67 (1.6)	73 (2.2)	r 82 (3.2)	79 (1.3)	r 27 (3.8)
Iran, Islamic Rep. of	91 (0.6)	82 (1.2)	98 (0.6)	98 (0.5)	91 (1.0)
Israel	74 (1.0)	70 (1.4)	94 (1.1)	80 (1.0)	s 53 (2.8)
Italy	77 (1.1)	81 (1.1)	82 (2.1)	71 (1.6)	71 (2.3)
Japan	57 (0.7)	35 (1.1)	86 (1.3)	76 (1.4)	41 (1.3)
Jordan	89 (0.9)	89 (1.1)	91 (1.3)	87 (1.3)	90 (1.3)
Kazakhstan	– –	– –	– –	– –	– –
Korea, Rep. of	54 (0.9)	38 (1.3)	42 (1.4)	79 (1.5)	64 (1.4)
Lebanon	r 80 (1.3)	r 71 (2.0)	92 (1.5)	84 (2.0)	– –
Lithuania	72 (1.0)	69 (1.9)	65 (1.4)	65 (2.0)	91 (1.1)
Macedonia, Rep. of	r 98 (0.3)	r 97 (0.6)	r 100 (0.2)	99 (0.6)	r 95 (1.0)
Malaysia	63 (1.0)	61 (1.4)	80 (1.5)	72 (1.2)	38 (2.0)
Morocco	57 (0.7)	56 (1.2)	r 59 (1.7)	55 (1.6)	s 62 (1.7)
New Zealand	48 (1.3)	40 (1.7)	62 (2.2)	58 (1.5)	38 (2.8)
Norway	39 (1.0)	29 (1.5)	55 (2.4)	28 (1.4)	55 (3.2)
Oman	77 (0.8)	73 (1.0)	78 (1.2)	77 (1.3)	84 (1.6)
Palestinian Nat'l Auth.	86 (1.0)	80 (1.5)	95 (0.8)	83 (1.5)	89 (1.4)
Qatar	79 (1.9)	75 (2.2)	86 (2.4)	78 (2.7)	82 (1.6)
Romania	95 (0.4)	90 (1.1)	98 (0.7)	99 (0.4)	97 (0.8)
Russian Federation	– –	– –	– –	– –	– –
Saudi Arabia	88 (1.0)	86 (1.3)	91 (1.8)	85 (1.6)	92 (1.5)
Singapore	65 (1.1)	63 (1.4)	80 (1.5)	83 (1.1)	r 31 (2.4)
Slovenia	63 (0.8)	61 (1.5)	56 (1.1)	57 (1.6)	81 (1.9)
Sweden	r 67 (1.3)	r 58 (1.5)	r 74 (1.7)	r 73 (2.1)	x x
Syrian Arab Republic	66 (1.8)	63 (2.4)	r 85 (1.9)	r 66 (2.3)	r 54 (4.0)
Thailand	74 (1.4)	69 (2.1)	92 (1.5)	67 (1.9)	72 (2.9)
Tunisia	40 (1.4)	46 (1.6)	– –	– –	29 (2.2)
Turkey	89 (0.6)	93 (0.7)	99 (0.3)	97 (0.5)	63 (2.1)
Ukraine	70 (0.8)	46 (1.9)	73 (0.9)	79 (0.7)	96 (1.1)
United Arab Emirates	72 (1.0)	r 63 (1.3)	r 77 (1.5)	r 74 (1.4)	r 82 (1.2)
United States	s 84 (0.8)	s 88 (1.1)	s 79 (1.5)	s 77 (1.6)	s 92 (1.1)
International Avg.	72 (0.2)	68 (0.2)	81 (0.3)	75 (0.2)	68 (0.3)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

* Percentage mostly taught before or in the assessment year averaged across topics.

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

A dash (–) indicates comparable data are 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 less than 50% of students.

Exhibit 8.9: Percentage of Students Taught the TIMSS Science Topics* (Continued)

Country	All Science (20 Topics)	Biology (7 Topics)	Chemistry (4 Topics)	Physics (5 Topics)	Earth Science (4 Topics)
Ninth Grade Participants					
Botswana	54 (1.2)	68 (1.7)	35 (1.9)	72 (1.3)	28 (2.5)
Honduras	70 (1.6)	80 (2.2)	70 (2.8)	55 (2.8)	71 (2.5)
South Africa	76 (1.3)	78 (1.5)	82 (1.8)	72 (1.8)	72 (3.0)
Benchmarking Participants					
Alberta, Canada	63 (1.0)	63 (1.6)	38 (1.8)	72 (1.7)	74 (1.8)
Ontario, Canada	r 71 (1.5)	r 76 (1.6)	r 52 (2.9)	r 74 (2.0)	r 79 (2.8)
Quebec, Canada	67 (1.1)	r 59 (1.8)	r 76 (2.2)	51 (1.9)	89 (1.6)
Abu Dhabi, UAE	72 (1.7)	r 62 (2.6)	r 76 (2.6)	r 77 (2.4)	r 80 (2.4)
Dubai, UAE	r 72 (2.0)	s 65 (2.6)	r 76 (1.8)	s 73 (1.8)	s 79 (2.9)
Alabama, US	s 86 (1.9)	s 87 (3.9)	s 88 (3.4)	s 78 (3.0)	s 93 (2.5)
California, US	s 86 (2.3)	s 90 (3.7)	s 93 (1.4)	s 75 (2.4)	s 85 (3.5)
Colorado, US	s 88 (2.1)	s 93 (2.1)	s 83 (5.1)	s 79 (3.2)	s 97 (1.5)
Connecticut, US	s 85 (1.4)	s 89 (1.6)	s 82 (3.0)	s 77 (3.1)	s 91 (2.3)
Florida, US	x x	x x	x x	x x	x x
Indiana, US	s 80 (2.1)	s 80 (3.1)	s 69 (4.6)	s 82 (3.4)	s 91 (3.3)
Massachusetts, US	s 82 (1.9)	s 89 (2.1)	s 71 (4.5)	s 72 (3.4)	s 94 (2.0)
Minnesota, US	r 79 (3.1)	r 87 (3.8)	r 67 (5.5)	r 63 (5.1)	r 96 (1.2)
North Carolina, US	s 89 (1.9)	s 89 (2.6)	s 88 (4.0)	s 84 (3.4)	s 96 (1.6)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

TIMSS 2011 Science Topics

A. Biology

1) Major organs and organ systems in humans and other organisms (structure/function, life processes that maintain stable bodily conditions)
2) Cells and their functions, including respiration and photosynthesis as cellular processes
3) Reproduction (sexual and asexual) and heredity (passing on of traits, inherited versus acquired/learned characteristics)
4) Role of variation and adaptation in survival/extinction of species in a changing environment
5) Interdependence of populations of organisms in an ecosystem (e.g., energy flow, food webs, competition, predation) and the impact of changes in the physical environment on populations (e.g., climate, water supply)
6) Reasons for increase in world's human population (e.g., advances in medicine, sanitation), and the effects of population growth on the environment
7) Human health (causes of infectious diseases, methods of infection, prevention, immunity) and the importance of diet and exercise in maintaining health

B. Chemistry

1) Classification, composition, and particulate structure of matter (elements, compounds, mixtures, molecules, atoms, protons, neutrons, electrons)
2) Solutions (solvent, solute, concentration/dilution, effect of temperature on solubility)
3) Properties and uses of common acids and bases
4) Chemical change (transformation of reactants, evidence of chemical change, conservation of matter, common oxidation reactions - combustion, rusting, tarnishing)

C. Physics

1) Physical states and changes in matter (explanations of properties in terms of movement and distance between particles; phase change, thermal expansion, and changes in volume and/or pressure)
2) Energy forms, transformations, heat, and temperature
3) Basic properties/behaviors of light (reflection, refraction, light and color, simple ray diagrams) and sound (transmission through media, loudness, pitch, amplitude, frequency, relative speed of light and sound)
4) Electric circuits (flow of current; types of circuits - parallel/series; current/voltage relationship) and properties and uses of permanent magnets and electromagnets
5) Forces and motion (types of forces, basic description of motion, effects of density and pressure)

D. Earth Science

1) Earth's structure and physical features (Earth's crust, mantle and core; composition and relative distribution of water, and composition of air)
2) Earth's processes, cycles, and history (rock cycle; water cycle; weather patterns; major geological events; formation of fossils and fossil fuels)
3) Earth's resources, their use, and conservation (e.g., renewable/nonrenewable resources, human use of land/soil, water resources)
4) Earth in the solar system and the universe (phenomena on Earth - day/night, tides, phases of moon, eclipses, seasons; physical features of Earth compared to other bodies; the Sun as a star)

Exhibit 8.10: Number of TIMSS Science Topics Intended to Be Taught by the End of Fourth Grade

TIMSS 2011 Science 4th Grade

Reported by National Research Coordinators

Country	All Science (20 Topics)			Life Science (6 Topics)			Physical Science (8 Topics)			Earth Science (6 Topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4
Armenia	14	0	6	5	0	1	4	0	4	5	0	1
Australia	15	1	4	5	0	1	5	1	2	5	0	1
Austria	16	0	4	6	0	0	7	0	1	3	0	3
Azerbaijan	4	8	8	2	3	1	0	2	6	2	3	1
Bahrain	20	0	0	6	0	0	8	0	0	6	0	0
Belgium (Flemish)	16	4	0	6	0	0	6	2	0	4	2	0
Chile	6	0	14	2	0	4	2	0	6	2	0	4
Chinese Taipei	11	0	9	4	0	2	5	0	3	2	0	4
Croatia	18	0	2	6	0	0	6	0	2	6	0	0
Czech Republic	12	0	8	6	0	0	3	0	5	3	0	3
Denmark	14	0	6	6	0	0	3	0	5	5	0	1
England	16	0	4	6	0	0	7	0	1	3	0	3
Finland	11	0	9	3	0	3	4	0	4	4	0	2
Georgia	14	2	4	5	0	1	3	2	3	6	0	0
Germany	16	0	4	5	0	1	7	0	1	4	0	2
Hong Kong SAR	17	0	3	6	0	0	7	0	1	4	0	2
Hungary	12	0	8	6	0	0	5	0	3	1	0	5
Iran, Islamic Rep. of	20	0	0	6	0	0	8	0	0	6	0	0
Ireland	18	0	2	6	0	0	8	0	0	4	0	2
Italy	12	0	8	5	0	1	3	0	5	4	0	2
Japan	13	0	7	2	0	4	6	0	2	5	0	1
Kazakhstan	16	0	4	6	0	0	4	0	4	6	0	0
Korea, Rep. of	8	2	10	2	0	4	3	2	3	3	0	3
Kuwait	20	0	0	6	0	0	8	0	0	6	0	0
Lithuania	16	2	2	6	0	0	5	2	1	5	0	1
Malta	12	0	8	3	0	3	6	0	2	3	0	3
Morocco	19	0	1	6	0	0	8	0	0	5	0	1
* Netherlands												
New Zealand	12	8	0	3	3	0	5	3	0	4	2	0
Northern Ireland	20	0	0	6	0	0	8	0	0	6	0	0
Norway	12	0	8	4	0	2	4	0	4	4	0	2
Oman	20	0	0	6	0	0	8	0	0	6	0	0
Poland	8	0	12	3	0	3	2	0	6	3	0	3
Portugal	15	0	5	5	0	1	5	0	3	5	0	1
Qatar	12	6	2	5	1	0	4	4	0	3	1	2
Romania	19	0	1	6	0	0	8	0	0	5	0	1
Russian Federation	12	0	8	4	0	2	2	0	6	6	0	0
Saudi Arabia	19	0	1	6	0	0	8	0	0	5	0	1
Serbia	18	0	2	6	0	0	8	0	0	4	0	2
Singapore	6	0	14	3	0	3	3	0	5	0	0	6
Slovak Republic	17	0	3	6	0	0	6	0	2	5	0	1
Slovenia	15	0	5	4	0	2	7	0	1	4	0	2
Spain	7	0	13	2	0	4	3	0	5	2	0	4
Sweden	19	0	1	6	0	0	8	0	0	5	0	1
Thailand	14	0	6	3	0	3	5	0	3	6	0	0
Tunisia	5	0	15	2	0	4	3	0	5	0	0	6
Turkey	19	0	1	5	0	1	8	0	0	6	0	0
United Arab Emirates	20	0	0	6	0	0	8	0	0	6	0	0
United States	15	0	5	3	0	3	8	0	0	4	0	2
Yemen	18	0	2	6	0	0	7	0	1	5	0	1
International Avg.	14	1	5	5	0	1	5	0	2	4	0	2

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

* No grade-specific science curriculum prescribed.

Because of rounding some results may appear inconsistent.

TIMSS & PIRLS International Study Center
Lynch School of Education, Boston College

Exhibit 8.10: Number of TIMSS Science Topics Intended to Be Taught by the End of Fourth Grade (Continued)

Country	All Science (20 Topics)			Life Science (6 Topics)			Physical Science (8 Topics)			Earth Science (6 Topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4
Sixth Grade Participants												
Botswana	6	0	14	2	0	4	3	0	5	1	0	5
Honduras	16	0	4	6	0	0	6	0	2	4	0	2
Benchmarking Participants												
Alberta, Canada	13	0	7	5	0	1	6	0	2	2	0	4
Ontario, Canada	13	0	7	5	0	1	6	0	2	2	0	4
Quebec, Canada	9	2	9	2	1	3	4	1	3	3	0	3
Abu Dhabi, UAE	19	0	1	6	0	0	8	0	0	5	0	1
Dubai, UAE	20	0	0	6	0	0	8	0	0	6	0	0
Florida, US	12	0	8	3	0	3	5	0	3	4	0	2
North Carolina, US	12	0	8	3	0	3	6	0	2	3	0	3

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.11: Number of TIMSS Science Topics Intended to Be Taught by the End of Eighth Grade

TIMSS 2011 8th Grade Science

Reported by National Research Coordinators

Country	All Science (20 Topics)			Biology (7 Topics)			Chemistry (4 Topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8
Armenia	20	0	0	7	0	0	4	0	0
Australia	18	1	1	6	0	1	3	1	0
Bahrain	20	0	0	7	0	0	4	0	0
Chile	17	0	3	7	0	0	2	0	2
Chinese Taipei	19	0	1	6	0	1	4	0	0
England	19	0	1	6	0	1	4	0	0
Finland	15	0	5	3	0	4	4	0	0
Georgia	9	4	7	4	3	0	0	0	4
Ghana	20	0	0	7	0	0	4	0	0
Hong Kong SAR	18	0	2	7	0	0	2	0	2
Hungary	19	0	1	7	0	0	4	0	0
Indonesia	19	0	1	7	0	0	3	0	1
Iran, Islamic Rep. of	20	0	0	7	0	0	4	0	0
Israel	16	2	2	5	1	1	3	1	0
Italy	17	2	1	5	2	0	4	0	0
Japan	17	0	3	5	0	2	4	0	0
Jordan	20	0	0	7	0	0	4	0	0
Kazakhstan	20	0	0	7	0	0	4	0	0
Korea, Rep. of	13	5	2	2	3	2	3	1	0
Lebanon	9	2	9	0	0	7	2	0	2
Lithuania	16	0	4	7	0	0	3	0	1
Macedonia, Rep. of	20	0	0	7	0	0	4	0	0
Malaysia	15	0	5	4	0	3	3	0	1
Morocco	6	0	14	1	0	6	2	0	2
New Zealand	16	4	0	6	1	0	3	1	0
Norway	12	0	8	3	0	4	2	0	2
Oman	20	0	0	7	0	0	4	0	0
Palestinian Nat'l Auth.	20	0	0	7	0	0	4	0	0
Qatar	8	0	12	3	0	4	0	0	4
Romania	20	0	0	7	0	0	4	0	0
Russian Federation	20	0	0	7	0	0	4	0	0
Saudi Arabia	19	0	1	6	0	1	4	0	0
Singapore	14	0	6	4	0	3	4	0	0
Slovenia	15	0	5	5	0	2	2	0	2
Sweden	20	0	0	7	0	0	4	0	0
Syrian Arab Republic	20	0	0	7	0	0	4	0	0
Thailand	20	0	0	7	0	0	4	0	0
Tunisia	9	0	11	5	0	2	2	0	2
Turkey	20	0	0	7	0	0	4	0	0
Ukraine	12	5	3	0	5	2	3	0	1
United Arab Emirates	20	0	0	7	0	0	4	0	0
United States	16	0	4	6	0	1	2	0	2
International Avg.	17	1	3	6	0	1	3	0	1

Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.11: Number of TIMSS Science Topics Intended to Be Taught by the End of Eighth Grade (Continued)

Country	Physics (5 Topics)			Earth Science (4 Topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8
Armenia	5	0	0	4	0	0
Australia	5	0	0	4	0	0
Bahrain	5	0	0	4	0	0
Chile	4	0	1	4	0	0
Chinese Taipei	5	0	0	4	0	0
England	5	0	0	4	0	0
Finland	4	0	1	4	0	0
Georgia	2	0	3	3	1	0
Ghana	5	0	0	4	0	0
Hong Kong SAR	5	0	0	4	0	0
Hungary	5	0	0	3	0	1
Indonesia	5	0	0	4	0	0
Iran, Islamic Rep. of	5	0	0	4	0	0
Israel	4	0	1	4	0	0
Italy	4	0	1	4	0	0
Japan	4	0	1	4	0	0
Jordan	5	0	0	4	0	0
Kazakhstan	5	0	0	4	0	0
Korea, Rep. of	5	0	0	3	1	0
Lebanon	5	0	0	2	2	0
Lithuania	2	0	3	4	0	0
Macedonia, Rep. of	5	0	0	4	0	0
Malaysia	5	0	0	3	0	1
Morocco	0	0	5	3	0	1
New Zealand	3	2	0	4	0	0
Norway	4	0	1	3	0	1
Oman	5	0	0	4	0	0
Palestinian Nat'l Auth.	5	0	0	4	0	0
Qatar	4	0	1	1	0	3
Romania	5	0	0	4	0	0
Russian Federation	5	0	0	4	0	0
Saudi Arabia	5	0	0	4	0	0
Singapore	4	0	1	2	0	2
Slovenia	4	0	1	4	0	0
Sweden	5	0	0	4	0	0
Syrian Arab Republic	5	0	0	4	0	0
Thailand	5	0	0	4	0	0
Tunisia	2	0	3	0	0	4
Turkey	5	0	0	4	0	0
Ukraine	5	0	0	4	0	0
United Arab Emirates	5	0	0	4	0	0
United States	4	0	1	4	0	0
International Avg.	4	0	1	4	0	0

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.11: Number of TIMSS Science Topics Intended to Be Taught by the End of Eighth Grade (Continued)

Country	All Science (20 Topics)			Biology (7 Topics)			Chemistry (4 Topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8
Ninth Grade Participants									
Botswana	10	0	10	6	0	1	1	0	3
Honduras	20	0	0	7	0	0	4	0	0
South Africa	20	0	0	7	0	0	4	0	0
Benchmarking Participants									
Alberta, Canada	15	0	5	5	0	2	1	0	3
Ontario, Canada	18	0	2	7	0	0	3	0	1
Quebec, Canada	10	1	9	3	1	3	3	0	1
Abu Dhabi, UAE	19	0	1	7	0	0	3	0	1
Dubai, UAE	20	0	0	7	0	0	4	0	0
Alabama, US	18	0	2	5	0	2	4	0	0
California, US	16	0	4	5	0	2	2	0	2
Colorado, US	18	0	2	6	0	1	3	0	1
Connecticut, US	20	0	0	7	0	0	4	0	0
Florida, US	18	0	2	5	0	2	4	0	0
Indiana, US	16	0	4	5	0	2	2	0	2
Massachusetts, US	16	0	4	5	0	2	2	0	2
Minnesota, US	13	0	7	4	0	3	2	0	2
North Carolina, US	15	0	5	7	0	0	1	0	3

Country	Physics (5 topics)			Earth Science (4 topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8
Ninth Grade Participants						
Botswana	2	0	3	1	0	3
Honduras	5	0	0	4	0	0
South Africa	5	0	0	4	0	0
Benchmarking Participants						
Alberta, Canada	5	0	0	4	0	0
Ontario, Canada	5	0	0	3	0	1
Quebec, Canada	0	0	5	4	0	0
Abu Dhabi, UAE	5	0	0	4	0	0
Dubai, UAE	5	0	0	4	0	0
Alabama, US	5	0	0	4	0	0
California, US	5	0	0	4	0	0
Colorado, US	5	0	0	4	0	0
Connecticut, US	5	0	0	4	0	0
Florida, US	5	0	0	4	0	0
Indiana, US	5	0	0	4	0	0
Massachusetts, US	5	0	0	4	0	0
Minnesota, US	5	0	0	2	0	2
North Carolina, US	4	0	1	3	0	1

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

chemistry topics, four of the five physics topics, and all four of the earth science topics were included in the curriculum for all students. However, there were a number of countries where none of the topics in a content area were included in the eighth grade science curriculum for all students, including Lebanon and the Ukraine (no biology), Georgia and Qatar (no chemistry), Morocco and Québec, Canada (no physics), and Tunisia (no earth science).

Collaborate to Improve Teaching

Part of creating a school learning environment focused on academic success involves a staff that collaborates on curricular activities. For example, a study including a comprehensive theoretical review and a meta-analysis of studies about professional communities indicated a small but positive effect of professional communities on student achievement (Lomos, Roelande, & Bosker, 2011). Because teacher collaboration with colleagues is important in building a professional community, TIMSS 2011 included the Collaborate to Improve Teaching scale. Although the idea of teacher collegiality and collaboration can involve a variety of theoretical perspectives and terms, the TIMSS 2011 scale was designed to focus on the idea of collaboration for the purpose of improving teaching. Therefore, the scale was based on how often teachers interacted with other teachers regarding each of five areas:

- Discuss how to teach a particular topic;
- Collaborate in planning and preparing instructional materials;
- Share what I have learned about my teaching experiences;
- Visit another classroom to learn more about teaching; and
- Work together to try out new ideas.

Students were scored according to their teachers responses, with **Very Collaborative** teachers having interactions with other teachers at least "one to three times per week" in each of three of the five areas and "two or three times per month" in each of the other two, on average.

Exhibit 8.12 presents the results for the fourth grade. In general, most science teachers of fourth grade students reported a high degree of collaboration with other teachers with the goal of improving teaching and learning. Internationally, on average, about one-third of the fourth grade students (35%) had **Very Collaborative** teachers. Another 53 percent of students, on average, had teachers that reported being **Collaborative** (e.g., interacting two or three times a month for all areas). Few fourth grade students (12%, on average) had

Exhibit 8.12: Collaborate to Improve Teaching

TIMSS 2011 4th Grade Science

Reported by Teachers

Students were scored according to their teachers' responses to how often they interacted with other teachers in each of five teaching areas on the *Collaborate to Improve Teaching* scale. Students with **Very Collaborative** teachers had a score on the scale of at least 11.0, which corresponds to their teachers having interactions with other teachers at least "one to three times per week" in each of three of the five areas and "two or three times per month" in each of the other two, on average. Students with **Somewhat Collaborative** teachers had a score no higher than 7.3, which corresponds to their teachers interacting with other teachers "never or almost never" in each of three of the five areas and "two or three times per month" in each of the other two, on average. All other students had **Collaborative** teachers.

Country	Very Collaborative		Collaborative		Somewhat Collaborative		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Slovenia	73 (3.5)	521 (3.0)	25 (3.4)	518 (4.5)	2 (0.8)	~ ~	11.8 (0.14)
Kuwait	69 (3.6)	350 (5.5)	27 (3.5)	343 (9.3)	3 (1.4)	311 (15.3)	11.3 (0.15)
Romania	68 (3.8)	503 (7.2)	31 (3.9)	507 (8.2)	1 (0.6)	~ ~	11.4 (0.12)
Kazakhstan	59 (3.9)	490 (5.6)	41 (4.0)	503 (9.5)	0 (0.3)	~ ~	11.1 (0.08)
Armenia	57 (3.8)	420 (4.6)	42 (3.9)	412 (5.6)	1 (0.9)	~ ~	11.1 (0.11)
Serbia	52 (4.0)	522 (3.8)	46 (4.0)	508 (4.5)	2 (0.9)	~ ~	10.8 (0.13)
Oman	52 (3.3)	384 (4.2)	47 (3.4)	371 (6.6)	1 (0.6)	~ ~	10.8 (0.07)
Slovak Republic	50 (3.4)	532 (4.9)	48 (3.5)	534 (4.4)	2 (0.9)	~ ~	10.7 (0.09)
Korea, Rep. of	49 (3.7)	592 (2.7)	48 (3.6)	582 (2.6)	3 (1.5)	570 (10.3)	10.6 (0.15)
United States r	49 (2.8)	547 (2.9)	40 (2.7)	546 (3.8)	11 (1.7)	535 (6.8)	10.4 (0.14)
Azerbaijan	47 (4.1)	439 (8.4)	49 (4.3)	440 (7.4)	4 (1.9)	410 (42.0)	10.6 (0.13)
Portugal	45 (4.8)	521 (7.0)	50 (4.9)	522 (4.2)	5 (1.4)	525 (8.0)	10.6 (0.18)
Turkey	44 (3.3)	461 (7.8)	46 (2.9)	462 (6.5)	9 (1.8)	468 (8.6)	10.2 (0.12)
Australia r	43 (3.4)	520 (5.4)	44 (3.9)	520 (5.4)	13 (2.8)	515 (8.5)	10.3 (0.15)
Hungary	43 (4.2)	532 (6.6)	54 (4.1)	536 (5.4)	3 (1.1)	528 (12.6)	10.5 (0.12)
United Arab Emirates	43 (2.7)	437 (4.4)	51 (2.6)	426 (3.9)	6 (1.3)	416 (11.2)	10.4 (0.09)
England	42 (3.7)	523 (5.8)	47 (3.9)	534 (4.4)	11 (2.0)	537 (13.8)	10.3 (0.14)
New Zealand	41 (3.1)	496 (5.0)	54 (2.9)	500 (3.5)	5 (1.3)	476 (12.8)	10.4 (0.11)
Croatia	41 (3.8)	519 (3.0)	57 (3.8)	515 (2.6)	2 (0.9)	~ ~	10.5 (0.11)
Lithuania	40 (3.4)	516 (3.9)	55 (3.5)	514 (4.1)	5 (1.5)	511 (10.1)	10.4 (0.11)
Chile	39 (4.2)	487 (5.2)	40 (4.4)	478 (5.2)	22 (3.5)	471 (9.5)	9.7 (0.19)
Thailand	38 (3.5)	473 (8.2)	57 (3.8)	473 (7.6)	5 (1.7)	462 (15.7)	10.5 (0.15)
Spain	38 (3.8)	514 (3.6)	51 (3.8)	502 (4.2)	11 (2.3)	493 (6.1)	9.9 (0.17)
Qatar	35 (4.1)	391 (11.6)	62 (4.1)	395 (6.4)	3 (1.3)	409 (38.3)	10.3 (0.18)
Sweden r	35 (4.6)	535 (4.5)	51 (4.6)	533 (4.0)	14 (3.5)	542 (4.9)	9.8 (0.23)
Norway	34 (4.0)	497 (3.0)	55 (4.1)	493 (3.4)	11 (3.1)	491 (7.9)	9.9 (0.17)
Georgia	33 (3.1)	449 (7.4)	62 (3.4)	460 (4.0)	5 (1.5)	431 (26.7)	10.3 (0.11)
Poland	32 (3.0)	500 (3.6)	66 (3.1)	508 (3.2)	2 (0.9)	~ ~	10.3 (0.08)
Japan	32 (3.8)	563 (2.8)	55 (4.2)	559 (2.4)	13 (2.8)	543 (5.2)	9.8 (0.13)
Russian Federation	31 (3.9)	550 (6.7)	67 (4.0)	553 (3.6)	1 (0.8)	~ ~	10.3 (0.08)
Iran, Islamic Rep. of	31 (3.0)	449 (7.6)	60 (2.9)	452 (4.9)	9 (2.0)	473 (12.3)	10.0 (0.14)
Singapore	31 (2.5)	581 (5.9)	61 (2.8)	584 (4.3)	9 (1.4)	580 (14.4)	9.9 (0.10)
Bahrain	29 (4.9)	464 (7.1)	58 (5.1)	448 (4.8)	13 (2.8)	436 (13.2)	9.7 (0.16)
Italy	27 (3.1)	527 (6.1)	58 (3.5)	524 (3.6)	15 (2.5)	522 (6.8)	9.4 (0.13)
Chinese Taipei	27 (3.6)	556 (4.5)	56 (4.0)	552 (3.1)	18 (3.0)	547 (5.1)	9.4 (0.17)
Germany	25 (2.9)	522 (4.8)	59 (3.6)	529 (3.5)	16 (2.6)	537 (5.6)	9.5 (0.12)
Finland	25 (2.7)	571 (4.6)	62 (2.6)	571 (2.9)	13 (1.8)	565 (6.2)	9.6 (0.13)
Northern Ireland r	22 (4.1)	515 (5.7)	54 (4.9)	519 (4.1)	24 (3.7)	514 (7.0)	9.3 (0.22)
Belgium (Flemish)	20 (2.5)	508 (3.4)	62 (3.5)	508 (2.5)	18 (2.8)	513 (5.2)	9.3 (0.14)
Austria	19 (3.1)	521 (7.5)	55 (3.8)	532 (3.2)	26 (3.0)	540 (4.2)	9.0 (0.15)
Saudi Arabia	18 (3.2)	429 (11.4)	59 (4.2)	439 (6.5)	24 (3.2)	414 (10.2)	9.1 (0.14)
Netherlands r	18 (3.9)	532 (6.1)	57 (4.6)	531 (3.4)	26 (4.5)	527 (4.3)	9.0 (0.19)
Hong Kong SAR	16 (3.6)	536 (7.0)	74 (3.7)	534 (4.9)	10 (2.5)	538 (8.6)	9.4 (0.14)
Morocco	16 (2.4)	261 (11.5)	43 (3.7)	270 (8.1)	41 (3.4)	260 (8.3)	8.1 (0.19)
Ireland	16 (2.6)	522 (9.7)	59 (3.6)	512 (3.8)	25 (3.1)	525 (5.6)	8.8 (0.14)
Czech Republic	15 (2.5)	529 (4.9)	70 (3.6)	540 (3.0)	15 (3.0)	529 (5.2)	9.2 (0.14)
Yemen	14 (3.0)	196 (16.5)	60 (4.2)	221 (8.4)	25 (3.7)	187 (13.8)	8.8 (0.16)
Denmark	14 (2.7)	537 (5.2)	67 (3.5)	530 (3.4)	19 (3.0)	526 (5.9)	9.3 (0.13)
Malta	14 (0.1)	461 (3.5)	45 (0.1)	447 (2.5)	41 (0.1)	441 (2.4)	8.1 (0.01)
Tunisia	13 (2.3)	350 (17.1)	57 (3.9)	347 (7.4)	31 (3.6)	340 (9.8)	8.5 (0.17)
International Avg.	35 (0.5)	487 (1.0)	53 (0.5)	487 (0.7)	12 (0.3)	479 (2.1)	

Centerpoint of scale set at 10.

( ) 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 2011

TIMSS & PIRLS International Study Center
Lynch School of Education, Boston College

Exhibit 8.12: Collaborate to Improve Teaching (Continued)

Country	Very Collaborative		Collaborative		Somewhat Collaborative		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Sixth Grade Participants							
Botswana	56 (4.3)	362 (6.4)	37 (4.2)	380 (11.5)	7 (2.3)	384 (51.4)	10.9 (0.19)
Honduras	35 (4.8)	425 (14.9)	51 (4.6)	434 (5.7)	14 (2.4)	443 (10.4)	9.9 (0.23)
Yemen	17 (3.0)	326 (16.0)	61 (3.5)	359 (8.5)	22 (3.5)	324 (15.1)	8.9 (0.16)
Benchmarking Participants							
North Carolina, US	62 (7.2)	535 (6.6)	34 (6.6)	542 (6.9)	4 (2.1)	536 (10.5)	11.1 (0.26)
Dubai, UAE	62 (4.0)	470 (6.0)	37 (4.0)	463 (9.0)	2 (0.3)	~ ~	11.0 (0.09)
Florida, US r	52 (4.9)	546 (5.6)	44 (4.8)	543 (6.6)	5 (2.3)	539 (29.0)	10.9 (0.21)
Abu Dhabi, UAE	40 (4.4)	413 (8.3)	54 (4.5)	415 (7.9)	6 (1.8)	404 (6.2)	10.4 (0.14)
Alberta, Canada r	33 (4.1)	542 (4.5)	53 (4.9)	540 (4.3)	14 (3.2)	546 (5.6)	9.8 (0.19)
Ontario, Canada	27 (3.5)	528 (4.3)	57 (4.0)	526 (4.0)	17 (2.9)	533 (5.5)	9.8 (0.18)
Quebec, Canada	20 (3.9)	514 (6.1)	58 (4.8)	516 (3.4)	22 (3.6)	519 (5.3)	9.1 (0.18)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

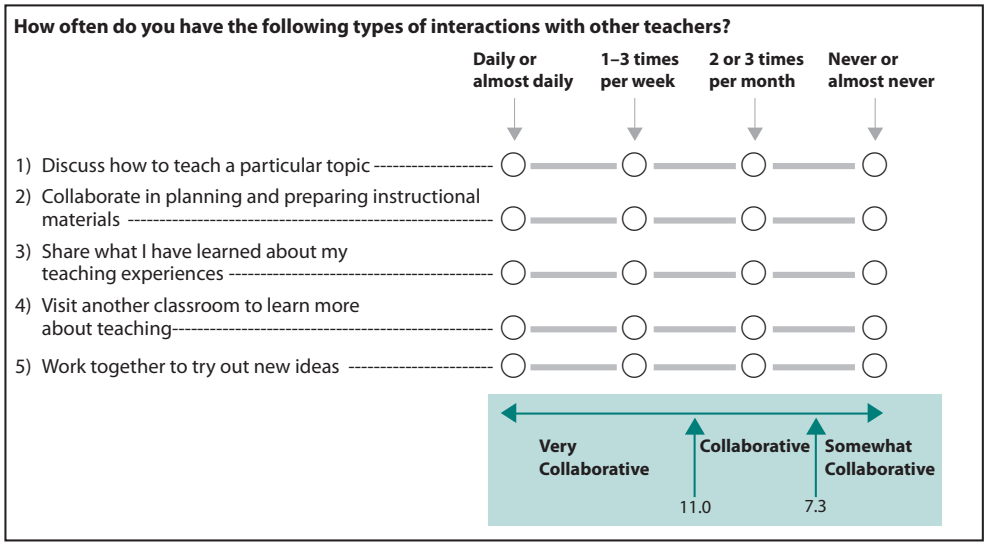


Exhibit 8.13: Collaborate to Improve Teaching

Reported by Teachers

Students were scored according to their teachers' responses to how often they interacted with other teachers in each of five teaching areas on the *Collaborate to Improve Teaching* scale. Students with **Very Collaborative** teachers had a score on the scale of at least 11.4, which corresponds to their teachers having interactions with other teachers at least "one to three times per week" in each of three of the five areas and "two or three times per month" in each of the other two, on average. Students with **Somewhat Collaborative** teachers had a score no higher than 7.5, which corresponds to their teachers interacting with other teachers "never or almost never" in each of three of the five areas and "two or three times per month" in each of the other two, on average. All other students had **Collaborative** teachers.

Country	Very Collaborative		Collaborative		Somewhat Collaborative		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Qatar	53 (4.2)	401 (8.3)	40 (4.4)	439 (11.2)	6 (1.2)	433 (14.7)	11.2 (0.11)
Israel	51 (3.3)	514 (5.6)	46 (3.3)	520 (6.5)	3 (1.1)	510 (40.2)	11.0 (0.12)
Bahrain	47 (2.6)	456 (3.4)	44 (2.1)	451 (2.8)	9 (1.7)	450 (14.0)	10.7 (0.13)
Kazakhstan	46 (2.8)	479 (5.3)	53 (2.8)	500 (4.9)	1 (0.2)	~ ~	11.1 (0.07)
Oman	46 (3.2)	429 (5.3)	48 (3.1)	412 (5.4)	6 (1.7)	417 (14.1)	10.9 (0.11)
Indonesia	45 (4.1)	399 (8.3)	50 (4.3)	410 (5.4)	5 (1.8)	412 (12.7)	10.7 (0.12)
Armenia	44 (2.9)	437 (4.2)	54 (2.8)	440 (4.2)	2 (0.5)	~ ~	11.1 (0.08)
Romania	41 (2.6)	465 (3.8)	55 (2.5)	466 (4.5)	4 (0.9)	456 (8.8)	10.8 (0.09)
Thailand	39 (3.8)	460 (8.6)	51 (3.5)	447 (4.5)	10 (2.4)	434 (14.2)	10.5 (0.17)
United Arab Emirates	38 (2.2)	463 (4.0)	56 (2.1)	458 (3.4)	6 (0.8)	485 (12.1)	10.6 (0.08)
United States r	38 (2.4)	528 (4.3)	47 (2.2)	529 (4.8)	16 (1.9)	516 (9.1)	10.2 (0.12)
Australia s	37 (3.6)	520 (7.1)	52 (3.4)	530 (6.8)	11 (2.2)	518 (13.8)	10.4 (0.16)
Ghana	37 (4.0)	298 (7.8)	52 (3.8)	316 (9.1)	12 (2.5)	283 (16.2)	10.5 (0.18)
Macedonia, Rep. of	34 (2.4)	405 (7.0)	61 (2.5)	413 (6.7)	5 (0.9)	412 (14.2)	10.5 (0.09)
Lebanon	34 (3.3)	417 (7.9)	60 (3.5)	402 (6.4)	6 (1.3)	381 (15.4)	10.4 (0.12)
Palestinian Nat'l Auth.	33 (4.1)	415 (6.3)	61 (4.0)	424 (4.9)	6 (1.9)	412 (17.2)	10.4 (0.14)
Malaysia	32 (3.8)	424 (9.8)	64 (3.8)	430 (8.2)	4 (1.5)	378 (30.8)	10.5 (0.11)
Georgia	31 (2.1)	416 (4.0)	67 (2.0)	422 (3.5)	3 (0.7)	419 (8.5)	10.5 (0.08)
Turkey	31 (3.1)	485 (8.5)	53 (3.6)	482 (4.6)	16 (2.7)	485 (9.0)	9.9 (0.14)
New Zealand	30 (2.8)	518 (8.4)	58 (3.9)	512 (6.4)	12 (2.7)	486 (10.9)	10.0 (0.11)
England r	27 (3.4)	521 (12.6)	57 (3.0)	536 (5.7)	16 (2.6)	535 (8.2)	9.9 (0.16)
Sweden r	26 (3.5)	508 (5.7)	50 (3.3)	515 (3.7)	24 (3.0)	504 (4.9)	9.6 (0.15)
Ukraine	26 (2.6)	498 (5.2)	70 (2.5)	502 (3.9)	4 (1.3)	496 (10.6)	10.4 (0.09)
Jordan	25 (3.3)	460 (7.8)	66 (3.8)	448 (5.4)	10 (2.5)	428 (18.8)	10.0 (0.13)
Slovenia	23 (1.9)	541 (3.3)	63 (2.1)	544 (2.9)	15 (1.6)	543 (4.3)	9.9 (0.08)
Singapore	22 (2.3)	585 (10.8)	66 (2.7)	595 (5.6)	11 (1.8)	573 (11.8)	9.9 (0.09)
Norway	22 (3.3)	501 (6.7)	60 (4.3)	493 (3.4)	18 (3.7)	490 (4.9)	9.7 (0.16)
Chile	21 (3.2)	470 (6.6)	44 (4.2)	459 (4.6)	35 (3.5)	457 (5.7)	9.0 (0.18)
Saudi Arabia	21 (3.4)	443 (7.3)	64 (4.1)	436 (4.9)	16 (3.1)	428 (12.3)	9.7 (0.16)
Hungary	20 (2.3)	506 (6.9)	65 (2.4)	526 (3.2)	15 (1.8)	531 (5.4)	9.8 (0.09)
Tunisia	19 (3.1)	436 (4.4)	63 (3.8)	440 (3.2)	18 (2.7)	437 (5.4)	9.4 (0.14)
Syrian Arab Republic	18 (2.3)	416 (6.2)	60 (3.6)	427 (5.1)	22 (3.4)	431 (9.2)	9.4 (0.15)
Korea, Rep. of	18 (2.7)	566 (5.0)	66 (3.7)	559 (2.3)	16 (2.9)	559 (4.3)	9.6 (0.13)
Lithuania	18 (1.7)	517 (5.1)	67 (2.0)	513 (2.6)	15 (1.5)	516 (6.0)	9.5 (0.08)
Japan	17 (3.3)	557 (6.8)	61 (4.0)	558 (3.1)	22 (3.2)	558 (5.6)	9.2 (0.16)
Finland	15 (1.8)	557 (3.9)	59 (2.2)	552 (2.6)	26 (2.2)	551 (3.7)	9.2 (0.11)
Russian Federation	15 (1.6)	543 (6.8)	81 (1.6)	542 (3.3)	4 (0.8)	545 (7.0)	10.1 (0.06)
Chinese Taipei	15 (3.1)	568 (8.9)	58 (4.3)	563 (3.8)	28 (4.0)	563 (4.7)	9.0 (0.17)
Italy	13 (2.8)	504 (9.8)	56 (3.7)	504 (4.0)	30 (3.5)	498 (4.5)	8.8 (0.18)
Hong Kong SAR	13 (3.3)	520 (10.8)	73 (4.4)	537 (4.9)	14 (2.8)	536 (10.7)	9.4 (0.14)
Iran, Islamic Rep. of	13 (2.5)	482 (9.5)	69 (3.2)	477 (4.5)	18 (2.7)	459 (10.5)	9.3 (0.12)
Morocco	13 (1.3)	384 (5.8)	47 (2.5)	377 (2.9)	40 (2.4)	374 (3.1)	8.4 (0.11)
International Avg.	29 (0.5)	476 (1.1)	58 (0.5)	479 (0.8)	13 (0.4)	472 (2.1)	

Centerpoint of scale set at 10.

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

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

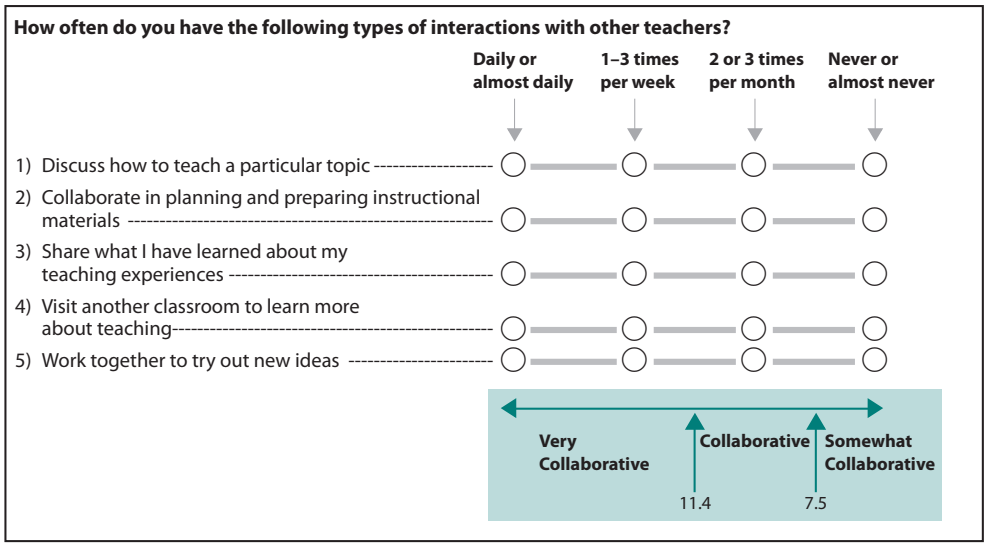
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.
An "x" indicates data are available for less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.13: Collaborate to Improve Teaching (Continued)

Country		Very Collaborative		Collaborative		Somewhat Collaborative		Average Scale Score
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Ninth Grade Participants								
Botswana		44 (4.2)	406 (5.3)	48 (4.2)	405 (5.8)	8 (2.4)	390 (13.9)	10.8 (0.17)
South Africa		37 (3.8)	324 (7.5)	51 (3.9)	332 (7.4)	13 (2.4)	334 (14.3)	10.4 (0.15)
Honduras		21 (3.9)	364 (7.4)	52 (4.6)	376 (7.0)	27 (3.7)	360 (6.6)	9.2 (0.19)
Benchmarking Participants								
North Carolina, US	s	63 (7.0)	530 (12.8)	19 (5.7)	540 (13.1)	17 (6.3)	498 (20.4)	10.7 (0.33)
Dubai, UAE	r	46 (3.0)	481 (5.2)	49 (3.0)	477 (4.3)	5 (0.7)	495 (26.3)	10.9 (0.09)
Abu Dhabi, UAE		40 (4.4)	461 (7.1)	54 (4.2)	455 (5.7)	6 (1.7)	501 (21.3)	10.5 (0.15)
Colorado, US		40 (6.2)	534 (9.1)	44 (5.9)	542 (9.7)	16 (5.1)	556 (15.1)	10.2 (0.30)
Ontario, Canada		35 (3.7)	522 (3.5)	47 (4.1)	522 (4.2)	17 (3.2)	520 (5.8)	10.2 (0.20)
California, US	s	34 (5.3)	487 (8.1)	56 (5.3)	513 (7.8)	10 (3.4)	468 (13.4)	10.2 (0.23)
Connecticut, US	r	34 (6.4)	556 (6.6)	42 (5.5)	529 (13.1)	25 (5.7)	508 (16.3)	9.6 (0.37)
Indiana, US	r	31 (6.2)	525 (7.1)	42 (7.2)	539 (9.3)	27 (5.7)	539 (7.4)	9.5 (0.26)
Massachusetts, US	r	26 (7.3)	569 (18.7)	56 (7.6)	562 (9.5)	18 (5.3)	558 (21.9)	9.7 (0.34)
Alberta, Canada		26 (2.8)	543 (4.4)	46 (3.5)	549 (3.7)	28 (3.3)	544 (3.9)	9.5 (0.16)
Alabama, US	r	26 (5.7)	490 (9.6)	62 (7.0)	481 (8.8)	13 (4.6)	482 (16.9)	9.7 (0.26)
Minnesota, US	r	23 (5.6)	539 (19.4)	48 (7.8)	564 (7.4)	28 (7.5)	546 (8.1)	9.2 (0.36)
Quebec, Canada		14 (2.7)	524 (7.8)	62 (3.7)	518 (3.8)	24 (3.5)	525 (6.1)	9.1 (0.17)
Florida, US		x x	x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



science teachers that were only **Somewhat Collaborative** (e.g., never or almost never interacting in three of the five areas).

Looking across the countries at the fourth and sixth grades as well as the benchmarking participants, it is clear that there are differences from country to country. However, primarily these differences were between the percentages of students with **Very Collaborative** and **Collaborative** teachers, although they had the same achievement (487), on average.

Exhibit 8.13 presents the teacher collaboration results for the eighth grade. The science teachers of eighth grade students reported a degree of collaboration with other teachers comparable to their colleagues at the fourth grade. Nearly one-third of the eighth grade students (29%) had **Very Collaborative** teachers and another 58 percent had **Collaborative** teachers, with 13 percent having only **Somewhat Collaborative** teachers. Just like at the fourth grade, eighth grade students had essentially the same average science achievement whether their teachers were **Very Collaborative** or **Collaborative** (476 and 479, respectively). In general, the ninth grade and benchmarking students also had teachers that reported a considerable amount of collaboration with other teachers. According to TIMSS 2011 reports from teachers, almost all students have the benefit of teachers who collaborate with other teachers to improve instruction.

Instruction to Engage Students in Learning

Historically, educational studies, including TIMSS, have struggled to link student achievement to instructional activities. Typically, teachers are asked to report how frequently they use various instruction activities and strategies, and such information can be very useful. However, in light of the growing body of evidence about the complexities of teaching and learning, researchers are beginning to understand these lists of activities cannot be used as proxies for the characteristics of good teaching.

To help build a better bridge between curriculum and instruction, TIMSS 2011 collected information about the concept of student content engagement as described by McLaughlin, McGrath, Burian-Fitzgerald, Lanahan, Scotchmer, Enyeart, and Salganik (2005). According to this work, supported by the U.S. National Center for Education Statistics, student content engagement focuses on the importance of the activity that brings the student and the subject matter content together. Engagement refers to the cognitive interaction between the student and instructional content, and may take the form of listening to the teacher or providing an explanation of a problem solution. It is the student's in-the-moment cognitive interaction with instructional content.

To measure aspects of student content engagement, TIMSS 2011 developed both a teacher scale, called the Engaging Students in Learning scale, and a student scale called the Engaged in Science Lessons scale.

Exhibit 8.14 presents the fourth grade results for the Engaging Students in Learning scale. The scale contains six items related to teachers' instructional practices intended to interest students and reinforce learning:

- Summarizing the lesson's learning goals;
- Relating the lesson to students' daily lives;
- Questioning to elicit reasons and explanations;
- Encouraging students to show improvement;
- Praising students for good effort; and
- Bringing interesting materials to class.

Students were categorized according to their teachers' responses, with **Most Lessons** corresponding to teachers who used three of the six practices in "every or almost every lesson" and the other three in "about half the lessons," on average.

Many fourth grade students, 71 percent on average, internationally, had teachers that made efforts to engage them in instruction by using a variety of strategies in **Most Lessons**, and most of the remaining students had teachers that used engaging instructional practices in **About Half the Lessons** (with a few exceptions). Although the fourth grade students whose teachers used engaging instruction in **Most Lessons** had somewhat higher average science achievement than other students, the pattern varied considerably across the fourth grade, sixth grade, and benchmarking participants.

Exhibit 8.15 presents the eighth grade results based on a somewhat shorter Engaging Students in Learning scale. At the eighth grade, two items were removed from the scale because relatively small percentages of students had teachers that frequently related lessons to students' daily lives, and even smaller percentages had teachers that routinely brought interesting materials to class (see Exhibit 8.16). Perhaps eighth grade teachers should make greater efforts to make science relevant to students' daily lives and provide interesting materials, especially in light of the drop by the eighth grade in students' liking science learning. On the other hand, teachers in some of the highest achieving countries reported the least use of these instructional practices.

Exhibit 8.14: Instruction to Engage Students in Learning

Reported by Teachers

Students were scored according to their teachers' responses to how often they used each of six instructional practices on the *Engaging Students in Learning* scale. Students with teachers who used engagement practices in **Most Lessons** had a score on the scale of at least 9.1, which corresponds to their teachers using three of the six practices "every or almost every lesson" and using the other three in "about half the lessons," on average. Students with teachers who used engagement practices in **Some Lessons** had a score no higher than 6.0, which corresponds to their teachers using three of the six practices in "some lessons" and using the other three in "about half the lessons," on average. All other students had teachers who used engagement practices in **About Half the Lessons**.

Country	Most Lessons		About Half the Lessons		Some Lessons		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Romania	94 (1.8)	505 (6.3)	6 (1.5)	495 (19.2)	1 (0.0)	~ ~	11.4 (0.15)
Lithuania	93 (1.6)	514 (2.6)	7 (1.6)	517 (8.6)	0 (0.0)	~ ~	11.1 (0.10)
United Arab Emirates	90 (1.4)	432 (2.8)	9 (1.4)	412 (10.2)	1 (0.0)	~ ~	11.4 (0.09)
Bahrain	90 (2.2)	452 (3.9)	10 (2.2)	422 (12.5)	0 (0.0)	~ ~	11.0 (0.17)
Qatar	90 (2.4)	390 (4.6)	10 (2.4)	429 (20.3)	0 (0.0)	~ ~	11.3 (0.13)
Portugal	89 (2.1)	522 (4.3)	10 (2.1)	516 (8.7)	0 (0.0)	~ ~	10.8 (0.13)
Kazakhstan	89 (2.1)	496 (5.6)	11 (2.1)	492 (12.6)	0 (0.0)	~ ~	11.6 (0.14)
United States r	88 (1.5)	544 (2.1)	11 (1.4)	549 (7.9)	1 (0.5)	~ ~	10.9 (0.09)
Hungary	88 (1.9)	533 (4.2)	12 (1.9)	535 (8.8)	0 (0.0)	~ ~	10.8 (0.11)
Croatia	87 (2.2)	517 (2.2)	12 (2.2)	509 (6.1)	0 (0.2)	~ ~	10.5 (0.10)
Oman	86 (2.4)	380 (3.8)	14 (2.4)	368 (16.8)	1 (0.6)	~ ~	10.7 (0.12)
England	85 (3.1)	529 (3.6)	15 (3.1)	530 (8.9)	0 (0.0)	~ ~	10.3 (0.13)
Malta	85 (0.1)	447 (2.0)	15 (0.1)	445 (3.9)	0 (0.0)	~ ~	10.9 (0.00)
Slovak Republic	84 (2.2)	530 (4.2)	16 (2.2)	539 (6.0)	0 (0.3)	~ ~	10.5 (0.11)
Slovenia	84 (2.8)	519 (2.9)	16 (2.8)	526 (7.0)	0 (0.0)	~ ~	10.5 (0.13)
Chile	83 (3.5)	479 (3.1)	17 (3.5)	493 (8.4)	0 (0.0)	~ ~	11.0 (0.16)
Russian Federation	82 (3.0)	552 (3.5)	17 (2.9)	551 (7.6)	1 (0.7)	~ ~	10.7 (0.16)
Georgia	81 (2.2)	457 (4.0)	19 (2.2)	448 (11.2)	0 (0.0)	~ ~	10.6 (0.13)
Northern Ireland r	80 (3.6)	515 (3.6)	19 (3.6)	525 (7.1)	1 (0.6)	~ ~	9.8 (0.12)
Tunisia	78 (3.7)	344 (6.1)	21 (3.5)	353 (10.1)	2 (1.1)	~ ~	10.4 (0.18)
Serbia	78 (3.4)	516 (3.7)	22 (3.4)	514 (5.2)	0 (0.4)	~ ~	10.3 (0.12)
Australia r	78 (3.4)	522 (3.6)	22 (3.4)	511 (7.3)	0 (0.2)	~ ~	10.1 (0.13)
Iran, Islamic Rep. of	75 (2.7)	457 (5.0)	24 (2.8)	439 (7.8)	1 (0.4)	~ ~	10.3 (0.13)
Kuwait	74 (3.5)	349 (5.8)	24 (3.4)	344 (10.9)	2 (1.1)	~ ~	10.2 (0.17)
Poland	74 (3.1)	503 (3.1)	25 (3.1)	509 (4.0)	1 (0.6)	~ ~	10.2 (0.12)
Saudi Arabia	73 (3.3)	432 (6.3)	25 (3.1)	424 (10.4)	1 (1.1)	~ ~	10.3 (0.15)
Italy	73 (3.1)	524 (3.5)	27 (3.0)	528 (4.7)	1 (0.0)	~ ~	10.3 (0.14)
Czech Republic	72 (3.7)	539 (2.6)	27 (3.6)	530 (6.2)	1 (0.8)	~ ~	9.7 (0.12)
Thailand	69 (3.5)	477 (6.3)	29 (3.5)	463 (10.9)	2 (1.0)	~ ~	10.0 (0.17)
Azerbaijan	69 (3.4)	442 (6.7)	31 (3.4)	431 (11.7)	0 (0.0)	~ ~	9.9 (0.12)
Korea, Rep. of	69 (4.2)	589 (2.4)	30 (4.1)	580 (3.2)	1 (0.9)	~ ~	10.3 (0.19)
Armenia	69 (3.7)	418 (4.5)	31 (3.7)	414 (8.0)	1 (0.5)	~ ~	10.1 (0.16)
Singapore	68 (2.5)	581 (4.6)	28 (2.8)	583 (6.6)	4 (1.1)	612 (11.3)	9.8 (0.12)
Ireland	68 (3.1)	513 (3.6)	31 (3.1)	522 (7.1)	1 (0.5)	~ ~	9.8 (0.12)
New Zealand	67 (3.1)	497 (3.5)	32 (3.0)	497 (4.1)	0 (0.4)	~ ~	9.7 (0.10)
Spain	66 (3.5)	506 (3.2)	33 (3.5)	506 (5.5)	2 (1.1)	~ ~	9.9 (0.16)
Morocco	64 (3.7)	270 (6.6)	33 (3.6)	252 (7.6)	3 (1.3)	249 (29.4)	9.7 (0.16)
Turkey	64 (3.5)	472 (5.5)	34 (3.4)	444 (8.2)	2 (0.9)	~ ~	9.9 (0.13)
Chinese Taipei	62 (4.2)	552 (3.1)	31 (3.8)	552 (4.1)	7 (2.0)	540 (6.9)	9.6 (0.22)
Hong Kong SAR	62 (4.7)	538 (4.0)	35 (4.4)	527 (10.8)	3 (1.5)	552 (4.6)	9.3 (0.17)
Belgium (Flemish)	56 (3.2)	511 (2.7)	43 (3.3)	507 (3.0)	1 (0.5)	~ ~	9.1 (0.10)
Sweden r	55 (4.4)	539 (3.6)	42 (4.6)	529 (4.7)	2 (1.2)	~ ~	9.1 (0.16)
Japan	52 (4.0)	559 (2.3)	44 (4.2)	558 (2.8)	4 (1.3)	558 (8.8)	8.9 (0.13)
Austria	51 (3.4)	528 (3.3)	46 (3.3)	535 (4.4)	3 (1.3)	535 (9.6)	9.1 (0.13)
Germany	47 (3.4)	520 (3.9)	49 (3.4)	534 (3.6)	4 (1.4)	552 (6.5)	8.7 (0.11)
Yemen	43 (4.6)	216 (9.2)	51 (4.5)	205 (10.7)	5 (1.9)	199 (25.1)	8.8 (0.17)
Netherlands r	41 (3.9)	528 (3.4)	55 (4.2)	532 (3.4)	4 (2.0)	531 (12.0)	8.5 (0.11)
Norway	41 (5.0)	493 (3.8)	56 (5.1)	496 (3.1)	3 (1.5)	481 (8.4)	8.8 (0.16)
Finland	33 (3.1)	576 (3.1)	61 (3.1)	567 (3.5)	5 (1.3)	576 (6.0)	8.4 (0.10)
Denmark	27 (2.9)	529 (4.8)	65 (3.1)	531 (3.2)	8 (2.3)	525 (12.0)	8.1 (0.12)
International Avg.	71 (0.5)	487 (0.6)	27 (0.4)	484 (1.2)	2 (0.1)	~ ~	

Centerpoint of scale set at 10.

( ) 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 2011

Exhibit 8.14: Instruction to Engage Students in Learning (Continued)

Country		Most Lessons		About Half the Lessons		Some Lessons		Average Scale Score
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Sixth Grade Participants								
Honduras		79 (4.1)	440 (6.0)	20 (4.1)	405 (15.6)	1 (1.0)	~ ~	10.3 (0.18)
Botswana		76 (3.8)	373 (7.3)	24 (3.8)	366 (13.7)	0 (0.0)	~ ~	10.3 (0.16)
Yemen		40 (4.0)	351 (10.4)	51 (4.3)	337 (10.1)	9 (2.6)	369 (17.7)	8.6 (0.16)
Benchmarking Participants								
Florida, US	s	96 (1.9)	543 (3.8)	4 (1.9)	538 (30.3)	0 (0.0)	~ ~	11.1 (0.16)
Dubai, UAE	r	94 (0.8)	466 (3.6)	4 (0.8)	494 (13.8)	2 (0.1)	~ ~	11.5 (0.10)
Abu Dhabi, UAE		90 (2.2)	414 (5.4)	10 (2.2)	412 (19.2)	0 (0.0)	~ ~	11.6 (0.15)
North Carolina, US		88 (2.8)	536 (5.0)	10 (3.1)	553 (12.7)	1 (1.3)	~ ~	10.8 (0.15)
Alberta, Canada	r	84 (3.8)	543 (3.2)	16 (3.8)	537 (9.0)	0 (0.0)	~ ~	10.3 (0.13)
Ontario, Canada		79 (3.1)	528 (3.0)	21 (3.1)	526 (7.0)	0 (0.0)	~ ~	10.0 (0.12)
Quebec, Canada		58 (4.2)	518 (3.7)	41 (4.3)	514 (3.9)	2 (0.6)	~ ~	9.3 (0.14)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

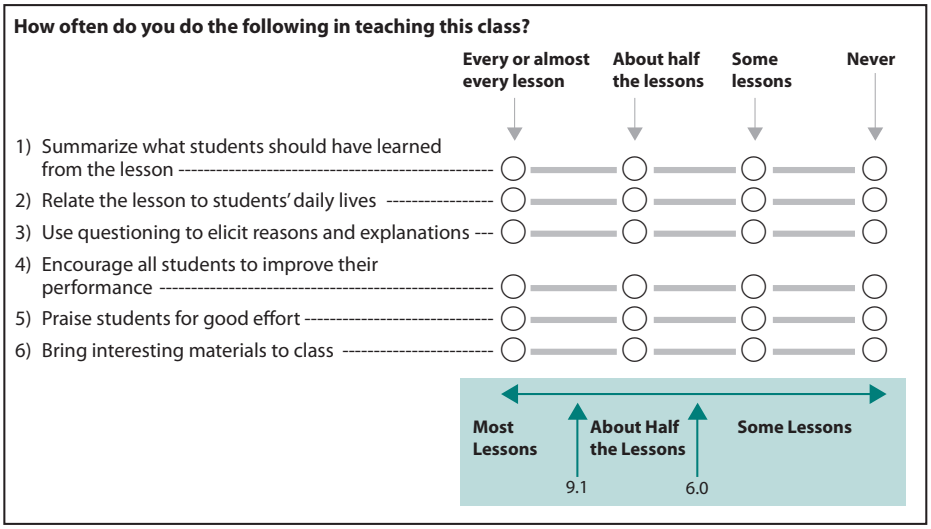


Exhibit 8.15: Instruction to Engage Students in Learning

Reported by Teachers

Students were scored according to their teachers' responses to how often they used each of four instructional practices on the *Engaging Students in Learning* scale. Students with teachers who used engagement practices in **Most Lessons** had a score on the scale of at least 8.7, which corresponds to their teachers using two of the four practices "every or almost every lesson" and using the other two in "about half the lessons," on average. Students with teachers who used engagement practices in **Some Lessons** had a score no higher than 5.7, which corresponds to their teachers using two of the four practices in "some lessons" and using the other two in "about half the lessons," on average. All other students had teachers who used engagement practices in **About Half the Lessons**.

Country	Most Lessons		About Half the Lessons		Some Lessons		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Palestinian Nat'l Auth.	94 (1.6)	422 (3.2)	6 (1.6)	398 (15.6)	0 (0.0)	~ ~	10.9 (0.12)
United Arab Emirates	94 (1.1)	462 (2.5)	6 (1.1)	471 (11.6)	0 (0.0)	~ ~	10.9 (0.07)
Qatar	93 (1.7)	420 (3.8)	6 (1.4)	411 (12.0)	1 (0.9)	~ ~	10.5 (0.15)
Indonesia	93 (1.1)	404 (4.7)	7 (1.1)	416 (8.9)	0 (0.3)	~ ~	10.8 (0.12)
England r	93 (1.6)	532 (5.6)	7 (1.6)	533 (13.0)	1 (0.4)	~ ~	10.8 (0.10)
Kazakhstan	91 (1.2)	493 (4.1)	8 (1.2)	468 (8.7)	0 (0.2)	~ ~	10.8 (0.08)
Romania	91 (1.4)	466 (3.4)	8 (1.2)	456 (7.5)	1 (0.6)	~ ~	10.7 (0.09)
Lithuania	90 (1.1)	514 (2.6)	10 (1.2)	519 (5.1)	0 (0.2)	~ ~	10.5 (0.07)
Ukraine	89 (1.6)	502 (3.7)	10 (1.6)	491 (6.4)	1 (0.3)	~ ~	10.6 (0.09)
Morocco	89 (1.4)	377 (2.4)	10 (1.4)	375 (5.1)	1 (0.5)	~ ~	10.5 (0.09)
Jordan	89 (2.2)	451 (4.4)	9 (2.1)	441 (18.4)	2 (1.0)	~ ~	10.4 (0.12)
Saudi Arabia	89 (2.7)	438 (4.3)	11 (2.7)	428 (8.6)	0 (0.0)	~ ~	10.2 (0.14)
Macedonia, Rep. of	89 (1.3)	414 (5.7)	9 (1.2)	385 (10.6)	2 (0.6)	~ ~	10.7 (0.08)
United States s	88 (1.9)	532 (3.3)	10 (1.8)	514 (12.1)	1 (0.6)	~ ~	10.5 (0.10)
Lebanon	88 (2.3)	406 (4.8)	11 (2.1)	404 (13.4)	1 (0.5)	~ ~	10.4 (0.12)
Syrian Arab Republic	88 (2.4)	424 (4.1)	11 (2.3)	437 (10.4)	1 (0.6)	~ ~	10.2 (0.11)
Chile	87 (2.6)	461 (3.0)	12 (2.5)	464 (10.1)	1 (0.0)	~ ~	10.4 (0.15)
Ghana	86 (3.0)	305 (5.8)	14 (3.0)	303 (14.9)	0 (0.0)	~ ~	10.6 (0.15)
Oman	85 (2.2)	422 (3.4)	15 (2.2)	406 (10.7)	0 (0.1)	~ ~	10.3 (0.12)
Georgia	84 (1.7)	420 (3.2)	14 (1.6)	424 (4.4)	2 (0.5)	~ ~	10.3 (0.10)
Bahrain	84 (2.1)	460 (2.8)	16 (2.1)	418 (8.5)	0 (0.0)	~ ~	10.5 (0.10)
Russian Federation	83 (1.0)	545 (3.0)	15 (1.0)	533 (6.8)	1 (0.4)	~ ~	10.0 (0.05)
Thailand	83 (3.2)	450 (4.6)	12 (2.7)	456 (14.1)	5 (1.8)	443 (21.7)	10.2 (0.16)
Israel	83 (2.5)	518 (4.6)	16 (2.4)	525 (9.7)	1 (0.8)	~ ~	10.2 (0.13)
Tunisia	83 (2.8)	438 (2.9)	14 (2.3)	439 (4.7)	4 (1.5)	437 (6.7)	10.3 (0.15)
Hungary	83 (1.6)	520 (3.2)	16 (1.5)	534 (5.0)	2 (0.5)	~ ~	10.2 (0.09)
New Zealand	81 (3.5)	510 (5.1)	16 (3.3)	520 (10.4)	3 (1.4)	503 (50.3)	9.7 (0.15)
Iran, Islamic Rep. of	81 (2.6)	477 (4.2)	18 (2.6)	460 (10.0)	1 (0.6)	~ ~	10.0 (0.12)
Australia s	81 (2.7)	527 (6.9)	18 (2.7)	524 (7.9)	1 (0.3)	~ ~	9.8 (0.12)
Slovenia	81 (1.8)	542 (2.6)	17 (1.7)	545 (4.3)	2 (0.5)	~ ~	9.9 (0.07)
Turkey	79 (2.7)	482 (4.1)	17 (2.5)	482 (8.8)	3 (1.1)	513 (30.9)	9.9 (0.13)
Italy	78 (3.2)	501 (3.2)	20 (3.1)	506 (6.5)	1 (0.9)	~ ~	9.8 (0.15)
Armenia	77 (2.2)	437 (3.4)	21 (2.2)	442 (5.9)	3 (0.8)	435 (11.2)	10.0 (0.11)
Malaysia	77 (3.2)	427 (6.8)	19 (2.8)	418 (17.3)	4 (1.6)	425 (36.0)	9.7 (0.16)
Sweden r	65 (3.2)	511 (3.3)	28 (2.8)	507 (4.3)	7 (1.9)	529 (8.5)	9.0 (0.14)
Singapore	63 (2.6)	593 (6.0)	30 (2.7)	585 (8.5)	7 (1.2)	586 (13.2)	9.1 (0.12)
Chinese Taipei	61 (4.4)	562 (3.7)	26 (4.0)	569 (5.0)	13 (2.7)	563 (7.2)	8.8 (0.22)
Korea, Rep. of	58 (3.3)	559 (2.6)	33 (3.1)	560 (3.6)	9 (2.1)	567 (8.1)	9.0 (0.17)
Hong Kong SAR	51 (4.9)	539 (5.9)	35 (4.5)	532 (6.6)	14 (3.1)	527 (15.8)	8.4 (0.22)
Finland	48 (2.8)	555 (3.0)	45 (2.5)	549 (2.6)	7 (1.3)	549 (5.8)	8.4 (0.10)
Norway	46 (4.1)	488 (4.0)	48 (4.5)	499 (3.3)	6 (2.1)	497 (12.1)	8.4 (0.15)
Japan	44 (4.2)	560 (3.7)	44 (4.1)	556 (3.9)	12 (2.8)	559 (6.0)	8.2 (0.18)
International Avg.	80 (0.4)	478 (0.6)	17 (0.4)	474 (1.5)	3 (0.2)	509 (5.6)	

Centerpoint of scale set at 10.

( ) 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 less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.15: Instruction to Engage Students in Learning (Continued)

Country		Most Lessons		About Half the Lessons		Some Lessons		Average Scale Score
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Ninth Grade Participants								
Botswana		90 (2.2)	404 (4.0)	8 (2.2)	398 (7.3)	1 (1.0)	~ ~	10.4 (0.13)
Honduras		85 (3.3)	369 (4.7)	14 (3.2)	367 (6.7)	0 (0.4)	~ ~	10.4 (0.17)
South Africa		76 (3.0)	323 (4.5)	19 (2.8)	346 (14.2)	5 (1.9)	353 (22.4)	9.5 (0.15)
Benchmarking Participants								
Dubai, UAE	r	95 (1.2)	484 (3.2)	5 (1.2)	411 (17.6)	0 (0.0)	~ ~	11.0 (0.07)
Abu Dhabi, UAE		93 (2.3)	459 (4.5)	7 (2.3)	495 (18.2)	0 (0.0)	~ ~	10.7 (0.13)
Connecticut, US	s	92 (3.2)	539 (7.1)	7 (2.9)	495 (45.5)	1 (0.1)	~ ~	11.1 (0.19)
Indiana, US	s	91 (3.5)	532 (5.4)	8 (3.4)	533 (17.5)	1 (1.1)	~ ~	10.6 (0.23)
Massachusetts, US	s	91 (4.4)	563 (7.4)	9 (4.4)	579 (15.1)	0 (0.0)	~ ~	10.5 (0.22)
North Carolina, US	s	88 (4.9)	531 (10.3)	11 (4.8)	501 (33.4)	1 (0.1)	~ ~	10.8 (0.30)
Alberta, Canada		86 (2.7)	546 (2.7)	14 (2.7)	546 (6.0)	0 (0.0)	~ ~	10.1 (0.13)
California, US	s	85 (4.0)	506 (8.0)	13 (3.2)	487 (14.0)	2 (1.8)	~ ~	10.2 (0.21)
Ontario, Canada		85 (2.7)	520 (3.0)	14 (2.6)	525 (8.6)	1 (0.7)	~ ~	10.2 (0.14)
Alabama, US	s	85 (4.8)	483 (9.0)	11 (3.8)	508 (19.3)	4 (3.2)	466 (33.6)	10.5 (0.20)
Colorado, US	s	84 (4.6)	544 (6.6)	15 (4.5)	554 (19.2)	1 (0.8)	~ ~	10.5 (0.29)
Minnesota, US	r	83 (5.0)	552 (7.0)	16 (5.1)	556 (9.7)	1 (0.7)	~ ~	9.8 (0.25)
Quebec, Canada		63 (4.5)	518 (3.5)	31 (4.1)	527 (6.3)	6 (1.9)	518 (12.6)	8.8 (0.16)
Florida, US		x x	x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

How often do you do the following in teaching this class?

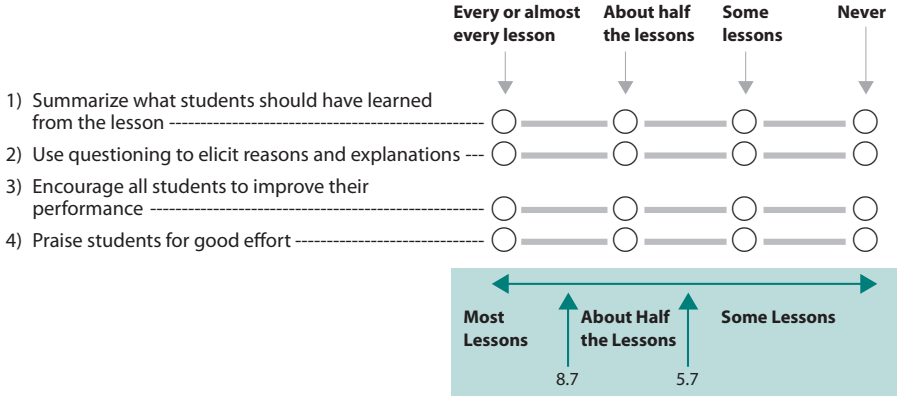


Exhibit 8.16: Teachers Relate Lessons to Students' Daily Lives and Bring Interesting Materials to Class

TIMSS 2011 8th Grade Science

Reported by Teachers

Country	Relate Lessons to Students' Daily Lives					Bring Interesting Materials to Class				
	Every Lesson or Almost Every Lesson		About Half the Lessons or Less			Every Lesson or Almost Every Lesson		About Half the Lessons or Less		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement		Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	59 (2.4)	441 (3.7)	41 (2.4)	434 (4.6)		27 (2.8)	447 (5.5)	73 (2.8)	435 (3.8)	
Australia	50 (3.6)	531 (8.8)	50 (3.6)	522 (6.1)		25 (3.9)	518 (11.9)	75 (3.9)	529 (6.2)	
Bahrain	61 (3.4)	462 (3.3)	39 (3.4)	439 (4.7)		40 (2.9)	475 (5.9)	60 (2.9)	440 (3.2)	
Chile	78 (2.7)	461 (3.1)	22 (2.7)	461 (6.2)		34 (4.0)	456 (6.4)	66 (4.0)	463 (3.2)	
Chinese Taipei	55 (4.0)	558 (3.5)	45 (4.0)	571 (3.9)		15 (3.0)	555 (8.7)	85 (3.0)	565 (2.5)	
England	42 (3.2)	530 (7.7)	58 (3.2)	534 (6.1)		23 (3.4)	530 (13.6)	77 (3.4)	533 (5.9)	
Finland	53 (2.6)	555 (2.9)	47 (2.6)	548 (2.7)		17 (1.8)	560 (3.7)	83 (1.8)	550 (2.5)	
Georgia	56 (2.5)	421 (3.9)	44 (2.5)	418 (3.6)		44 (2.5)	419 (4.5)	56 (2.5)	421 (3.1)	
Ghana	77 (3.6)	305 (6.3)	23 (3.6)	306 (11.1)		36 (4.2)	302 (10.1)	64 (4.2)	307 (6.9)	
Hong Kong SAR	47 (4.6)	533 (6.0)	53 (4.6)	537 (6.0)		19 (4.0)	543 (9.5)	81 (4.0)	533 (4.3)	
Hungary	75 (1.8)	523 (3.3)	25 (1.8)	521 (4.7)		34 (2.3)	518 (5.0)	66 (2.3)	525 (3.3)	
Indonesia	86 (2.7)	407 (4.2)	14 (2.7)	419 (9.7)		38 (3.6)	415 (5.3)	62 (3.6)	399 (6.4)	
Iran, Islamic Rep. of	52 (3.5)	483 (5.2)	48 (3.5)	465 (6.2)		29 (3.5)	488 (7.7)	71 (3.5)	469 (4.5)	
Israel	68 (3.7)	514 (4.8)	32 (3.7)	526 (7.1)		47 (3.6)	517 (5.6)	53 (3.6)	518 (6.6)	
Italy	41 (3.7)	503 (4.1)	59 (3.7)	501 (4.1)		14 (2.8)	503 (6.3)	86 (2.8)	502 (2.9)	
Japan	32 (3.9)	557 (3.1)	68 (3.9)	558 (3.1)		15 (3.2)	565 (6.8)	85 (3.2)	556 (2.5)	
Jordan	80 (2.8)	452 (5.2)	20 (2.8)	436 (10.3)		31 (3.6)	446 (6.0)	69 (3.6)	451 (5.4)	
Kazakhstan	73 (2.5)	493 (4.4)	27 (2.5)	484 (7.0)		63 (2.7)	490 (4.4)	37 (2.7)	490 (6.5)	
Korea, Rep. of	57 (3.6)	560 (2.3)	43 (3.6)	561 (3.3)		35 (3.6)	563 (2.9)	65 (3.6)	559 (2.6)	
Lebanon	72 (2.3)	408 (5.2)	28 (2.3)	398 (8.2)		31 (2.8)	407 (8.1)	69 (2.8)	404 (5.8)	
Lithuania	62 (2.2)	515 (3.0)	38 (2.2)	513 (3.1)		40 (2.2)	516 (3.0)	60 (2.2)	514 (2.9)	
Macedonia, Rep. of	75 (2.2)	412 (5.7)	25 (2.2)	407 (10.3)		59 (2.4)	422 (6.3)	41 (2.4)	395 (6.7)	
Malaysia	62 (3.5)	428 (6.5)	38 (3.5)	424 (11.2)		16 (2.8)	431 (14.5)	84 (2.8)	424 (6.6)	
Morocco	70 (2.0)	377 (2.6)	30 (2.0)	376 (4.2)		33 (2.2)	385 (3.8)	67 (2.2)	373 (2.6)	
New Zealand	47 (3.9)	505 (5.7)	53 (3.9)	517 (7.5)		15 (2.3)	500 (9.7)	85 (2.3)	513 (5.1)	
Norway	32 (3.9)	494 (4.7)	68 (3.9)	493 (2.9)		18 (3.1)	485 (7.6)	82 (3.1)	495 (2.6)	
Oman	66 (3.1)	424 (4.4)	34 (3.1)	411 (7.9)		27 (2.6)	423 (7.8)	73 (2.6)	418 (4.6)	
Palestinian Nat'l Auth.	77 (3.7)	422 (4.0)	23 (3.7)	416 (8.1)		45 (3.9)	424 (6.3)	55 (3.9)	417 (4.7)	
Qatar	67 (3.8)	427 (5.7)	33 (3.8)	405 (10.1)		46 (4.8)	423 (8.4)	54 (4.8)	417 (9.2)	
Romania	81 (2.0)	467 (3.5)	19 (2.0)	456 (6.6)		48 (2.6)	467 (3.8)	52 (2.6)	462 (4.3)	
Russian Federation	64 (2.0)	545 (3.8)	36 (2.0)	538 (3.7)		43 (1.6)	545 (4.1)	57 (1.6)	541 (3.5)	
Saudi Arabia	80 (3.4)	433 (4.0)	20 (3.4)	450 (10.0)		37 (4.0)	439 (6.1)	63 (4.0)	435 (5.0)	
Singapore	46 (2.8)	590 (6.1)	54 (2.8)	591 (5.6)		14 (1.7)	600 (13.1)	86 (1.7)	589 (4.6)	
Slovenia	71 (1.7)	543 (3.0)	29 (1.7)	543 (3.0)		29 (2.1)	542 (2.7)	71 (2.1)	543 (3.0)	
Sweden	44 (3.8)	516 (4.1)	56 (3.8)	508 (3.7)		27 (2.8)	512 (5.5)	73 (2.8)	511 (3.2)	
Syrian Arab Republic	73 (3.2)	423 (4.7)	27 (3.2)	434 (7.7)		34 (3.9)	433 (6.8)	66 (3.9)	423 (4.6)	
Thailand	54 (3.6)	455 (5.2)	46 (3.6)	446 (6.3)		36 (3.8)	462 (7.9)	64 (3.8)	444 (5.0)	
Tunisia	70 (3.1)	441 (2.8)	30 (3.1)	434 (4.3)		29 (3.3)	441 (5.4)	71 (3.3)	437 (2.7)	
Turkey	76 (2.4)	482 (4.1)	24 (2.4)	488 (6.4)		18 (2.4)	490 (12.9)	82 (2.4)	482 (3.6)	
Ukraine	61 (2.8)	509 (3.5)	39 (2.8)	488 (4.6)		39 (2.8)	504 (4.3)	61 (2.8)	499 (3.8)	
United Arab Emirates	75 (2.1)	459 (2.9)	25 (2.1)	472 (5.8)		45 (2.3)	459 (3.8)	55 (2.3)	465 (3.5)	
United States	64 (2.5)	531 (4.4)	36 (2.5)	527 (4.6)		38 (2.7)	536 (5.1)	62 (2.7)	526 (4.2)	
International Avg.	63 (0.5)	478 (0.7)	37 (0.5)	476 (1.0)		32 (0.5)	480 (1.1)	68 (0.5)	476 (0.7)	

( ) 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 less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.16: Teachers Relate Lessons to Students' Daily Lives and Bring Interesting Materials to Class (Continued)

Country	Relate Lessons to Students' Daily Lives					Bring Interesting Materials to Class				
	Every Lesson or Almost Every Lesson		About Half the Lessons or Less			Every Lesson or Almost Every Lesson		About Half the Lessons or Less		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement		Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Ninth Grade Participants										
Botswana	75 (3.6)	399 (4.1)	25 (3.6)	418 (8.7)		31 (4.0)	412 (7.4)	69 (4.0)	400 (4.1)	
Honduras	81 (3.4)	370 (4.6)	19 (3.4)	365 (8.8)		23 (2.6)	372 (7.5)	77 (2.6)	369 (4.9)	
South Africa	61 (3.6)	323 (5.4)	39 (3.6)	338 (7.2)		21 (2.9)	309 (7.3)	79 (2.9)	334 (5.0)	
Benchmarking Participants										
Alberta, Canada	54 (4.2)	544 (3.3)	46 (4.2)	549 (3.2)		24 (3.5)	544 (4.8)	76 (3.5)	547 (2.9)	
Ontario, Canada	57 (4.4)	520 (3.7)	43 (4.4)	523 (3.8)		22 (2.9)	522 (6.2)	78 (2.9)	521 (3.1)	
Quebec, Canada	41 (4.1)	518 (4.0)	59 (4.1)	522 (4.3)		29 (4.5)	515 (6.4)	71 (4.5)	523 (3.6)	
Abu Dhabi, UAE	71 (3.9)	457 (4.6)	29 (3.9)	472 (10.4)		45 (4.1)	458 (6.6)	55 (4.1)	465 (6.4)	
Dubai, UAE	r 74 (4.3)	477 (4.7)	26 (4.3)	492 (10.0)		r 46 (4.6)	476 (6.4)	54 (4.6)	484 (5.8)	
Alabama, US	s 67 (6.3)	486 (10.1)	33 (6.3)	482 (10.4)		s 48 (6.9)	481 (10.2)	52 (6.9)	488 (9.2)	
California, US	s 58 (6.0)	508 (9.4)	42 (6.0)	500 (10.2)		s 36 (4.9)	521 (8.6)	64 (4.9)	496 (8.5)	
Colorado, US	s 63 (8.1)	544 (8.1)	37 (8.1)	548 (9.9)		s 35 (6.1)	540 (14.4)	65 (6.1)	548 (7.5)	
Connecticut, US	s 67 (5.6)	529 (7.4)	33 (5.6)	548 (14.7)		s 43 (7.0)	527 (9.9)	57 (7.0)	540 (9.6)	
Florida, US	x x	x x	x x	x x		x x	x x	x x	x x	
Indiana, US	s 70 (5.6)	530 (6.1)	30 (5.6)	536 (7.1)		s 48 (5.6)	530 (5.6)	52 (5.6)	533 (8.4)	
Massachusetts, US	s 56 (6.2)	559 (9.2)	44 (6.2)	572 (10.6)		s 37 (5.5)	542 (12.5)	63 (5.5)	578 (6.5)	
Minnesota, US	r 56 (6.0)	555 (10.0)	44 (6.0)	551 (6.7)		r 39 (6.3)	562 (9.1)	61 (6.3)	547 (8.1)	
North Carolina, US	s 69 (8.5)	544 (11.3)	31 (8.5)	491 (16.0)		s 28 (7.0)	553 (21.4)	72 (7.0)	519 (11.8)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Based on the shorter four-item scale, on average, 80 percent of the eighth grade students had teachers that reported using engaging practices in most lessons, and almost all of the rest had teachers that reported using engaging practices in about half the lessons. Across the eighth grade, ninth grade, and benchmarking participants, students often had somewhat higher average science achievement if their teachers used engaging instruction in **Most Lessons** rather than **About Half the Lessons**.

Exhibits 8.17 and 8.18 present the results for the TIMSS 2011 Engaged in Science Lessons scale that looks at engagement from the student perspective. This scale asks how much students agree with the following five statements:

- I know what my teacher expects me to do;
- I think of things not related to the lesson (reverse coded);
- My teacher is easy to understand;
- I am interested in what my teacher says; and
- My teacher gives me interesting things to do.

Students considered to be **Engaged** had a score on the scale corresponding to "agreeing a lot" with at least three of the statements and "agreeing a little" with the other two, on average. Being in the **Not Engaged** category was based on a scale score corresponding to, at most, "agreeing a little" with no more than two statements and "disagreeing a little" with the other three, on average. All other students were considered to be **Somewhat Engaged**.

At the fourth grade, internationally, on average, 45 percent of students reported being **Engaged** during their science lessons, another 47 percent reported being **Somewhat Engaged**, and only 8 percent reported being **Not Engaged**. Across the fourth grade, sixth grade, and benchmarking participants, there was a positive relationship between students' reports about being more engaged and average science achievement. **Engaged** students had higher achievement than their counterparts who reported being only **Somewhat Engaged**, and students **Not Engaged** had the lowest achievement (504 vs. 476 and 457, respectively).

At the eighth grade, internationally, on average, smaller percentages of students than at the fourth grade reported being engaged in their science lessons. In countries teaching general or integrated science, only 29 percent of the eighth grade students, on average, reported being **Engaged** during their science lessons. The majority (51%) reported being **Somewhat Engaged** and 21 percent reported being **Not Engaged**. For the general or integrated science countries, there was a direct relationship between student engagement and average science achievement—the more engaged students reported being, the higher their average science achievement; and this held across the eighth grade, ninth grade, and across benchmarking participants. Among the separate science subject countries, students reported somewhat more engagement in biology and earth science lessons (33% and 31% **Engaged**, respectively) than in chemistry and physics lessons (26% and 27% **Engaged**, respectively). In each of the science subjects, students reporting being engaged in their lessons had higher science achievement than those who were only somewhat or not engaged.

Exhibit 8.17: Students Engaged in Science Lessons

TIMSS 2011 4th Grade Science

Reported by Students

Students were scored according to their degree of agreement with five statements on the *Engaged in Science Lessons* scale. Students **Engaged** in science lessons had a score on the scale of at least 10.1, which corresponds to their "agreeing a lot" with three of the five statements and "agreeing a little" with the other two, on average. Students who were **Not Engaged** had a score no higher than 7.4, which corresponds to their "disagreeing a little" with three of the five statements and "agreeing a little" with the other two, on average. All other students were **Somewhat Engaged** in science lessons.

Country	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Tunisia	65 (1.6)	373 (5.3)	32 (1.4)	308 (6.7)	3 (0.4)	258 (14.1)	11.1 (0.07)
Iran, Islamic Rep. of	61 (1.1)	467 (3.8)	35 (1.0)	438 (4.8)	5 (0.5)	393 (9.7)	10.7 (0.05)
Russian Federation	59 (1.1)	559 (3.6)	36 (1.1)	545 (4.1)	5 (0.4)	544 (6.9)	10.6 (0.05)
Romania	58 (1.7)	531 (5.8)	37 (1.5)	480 (7.2)	5 (0.6)	436 (17.9)	10.6 (0.07)
Armenia	57 (1.3)	433 (4.1)	35 (1.0)	402 (4.5)	8 (0.7)	368 (8.4)	10.7 (0.07)
Malta	55 (0.8)	468 (2.0)	36 (0.8)	424 (3.4)	9 (0.4)	405 (7.2)	10.4 (0.03)
Portugal	54 (1.9)	535 (4.1)	44 (1.7)	507 (4.6)	2 (0.4)	~ ~	10.4 (0.07)
Hungary	54 (1.1)	553 (3.5)	39 (0.9)	515 (4.4)	7 (0.5)	520 (7.5)	10.4 (0.05)
Bahrain	53 (1.3)	482 (3.0)	40 (1.0)	427 (4.4)	7 (0.8)	413 (11.4)	10.5 (0.06)
Poland	52 (1.1)	515 (2.8)	42 (1.1)	497 (3.3)	6 (0.4)	491 (7.7)	10.3 (0.04)
United States	51 (0.8)	561 (2.1)	41 (0.7)	530 (2.6)	7 (0.4)	521 (5.1)	10.2 (0.03)
Ireland	51 (1.3)	529 (3.5)	41 (1.0)	506 (4.2)	8 (0.7)	503 (6.3)	10.2 (0.06)
Serbia	51 (1.4)	525 (3.0)	43 (1.1)	508 (4.0)	5 (0.6)	498 (8.8)	10.2 (0.07)
United Arab Emirates	51 (0.8)	457 (2.9)	43 (0.7)	406 (3.2)	6 (0.3)	377 (6.0)	10.4 (0.04)
Turkey	51 (1.2)	498 (3.4)	44 (0.9)	438 (4.5)	5 (0.5)	366 (10.0)	10.3 (0.05)
Kuwait	51 (1.3)	382 (5.4)	42 (1.2)	329 (4.8)	7 (0.6)	300 (10.3)	10.5 (0.05)
Lithuania	50 (1.2)	524 (2.5)	44 (1.1)	507 (3.5)	6 (0.5)	499 (6.0)	10.2 (0.04)
Kazakhstan	50 (1.7)	511 (5.0)	47 (1.7)	483 (6.0)	3 (0.3)	462 (16.4)	10.4 (0.07)
Czech Republic	49 (1.3)	540 (3.1)	43 (1.1)	533 (3.1)	8 (0.7)	537 (5.8)	10.1 (0.06)
Oman	49 (1.1)	415 (4.4)	46 (1.0)	350 (4.8)	5 (0.3)	285 (8.4)	10.3 (0.05)
Saudi Arabia	49 (1.4)	462 (5.3)	45 (1.3)	411 (6.6)	6 (0.6)	367 (12.3)	10.3 (0.07)
Norway	48 (1.5)	503 (2.5)	44 (1.3)	488 (3.0)	8 (0.8)	489 (5.8)	10.1 (0.07)
Slovenia	48 (1.2)	529 (3.0)	46 (1.2)	514 (3.1)	6 (0.5)	501 (9.4)	10.1 (0.05)
Germany	47 (1.2)	539 (3.2)	46 (1.0)	525 (3.4)	7 (0.6)	516 (7.2)	10.0 (0.05)
Croatia	47 (1.2)	520 (2.4)	46 (1.0)	514 (2.8)	7 (0.7)	509 (4.4)	10.1 (0.05)
Australia	46 (1.0)	532 (2.9)	44 (0.9)	506 (3.4)	9 (0.6)	498 (6.9)	10.0 (0.05)
Spain	46 (1.5)	519 (2.8)	46 (1.3)	495 (3.9)	8 (0.7)	500 (5.6)	10.0 (0.07)
Georgia	46 (1.0)	480 (3.3)	51 (1.0)	448 (4.6)	3 (0.3)	391 (10.3)	10.4 (0.04)
Thailand	46 (1.7)	491 (5.3)	49 (1.5)	461 (6.5)	5 (0.4)	420 (11.6)	10.1 (0.06)
Austria	44 (1.0)	539 (3.2)	47 (0.9)	526 (3.4)	9 (0.7)	526 (4.9)	9.9 (0.05)
Northern Ireland	44 (1.4)	531 (3.3)	49 (1.2)	509 (3.6)	8 (0.7)	495 (7.0)	9.9 (0.05)
England	44 (1.2)	534 (4.1)	47 (1.1)	527 (3.2)	9 (0.7)	520 (5.6)	9.8 (0.05)
Morocco	43 (2.0)	299 (5.7)	48 (1.8)	243 (4.3)	8 (0.9)	219 (10.3)	10.0 (0.08)
Italy	43 (1.2)	534 (3.4)	50 (1.0)	520 (3.1)	6 (0.5)	512 (5.9)	9.9 (0.05)
Slovak Republic	41 (1.0)	542 (4.4)	51 (0.9)	526 (3.7)	8 (0.5)	527 (6.0)	9.8 (0.04)
Azerbaijan r	41 (1.5)	472 (6.8)	55 (1.4)	439 (5.5)	4 (0.4)	397 (12.5)	10.1 (0.06)
Chile	40 (1.0)	505 (3.1)	52 (0.9)	468 (2.8)	8 (0.5)	457 (5.6)	9.9 (0.04)
Singapore	40 (0.8)	604 (3.3)	49 (0.7)	572 (4.0)	11 (0.5)	567 (5.3)	9.7 (0.04)
Chinese Taipei	40 (1.2)	564 (2.4)	47 (0.9)	548 (2.9)	13 (0.9)	528 (4.8)	9.7 (0.06)
Qatar	39 (1.5)	448 (5.7)	52 (1.5)	376 (4.9)	8 (0.7)	343 (13.9)	10.0 (0.06)
New Zealand	39 (0.9)	511 (3.0)	51 (0.9)	490 (3.0)	10 (0.6)	488 (4.7)	9.7 (0.04)
Belgium (Flemish)	37 (1.1)	514 (2.4)	56 (1.0)	506 (2.4)	7 (0.5)	500 (3.5)	9.6 (0.04)
Sweden	37 (1.2)	538 (3.3)	55 (0.9)	534 (3.0)	8 (0.6)	528 (6.7)	9.5 (0.05)
Netherlands	35 (1.2)	538 (2.8)	56 (1.0)	529 (2.7)	9 (0.5)	526 (4.4)	9.5 (0.05)
Hong Kong SAR	34 (1.2)	550 (3.7)	50 (1.1)	527 (5.3)	16 (0.8)	528 (4.0)	9.4 (0.06)
Yemen	31 (1.9)	245 (7.7)	58 (1.7)	206 (7.7)	11 (1.3)	170 (13.9)	9.6 (0.09)
Denmark	27 (1.1)	533 (3.9)	56 (0.9)	527 (3.3)	18 (1.0)	528 (3.7)	9.0 (0.05)
Finland	23 (0.9)	578 (3.7)	57 (1.1)	571 (2.8)	20 (1.0)	565 (3.5)	8.8 (0.04)
Korea, Rep. of	19 (0.9)	605 (3.9)	58 (0.9)	590 (2.1)	23 (1.0)	568 (3.4)	8.6 (0.04)
Japan	12 (0.8)	573 (3.9)	54 (1.2)	561 (1.7)	34 (1.6)	551 (3.1)	8.2 (0.06)
International Avg.	45 (0.2)	504 (0.6)	47 (0.2)	476 (0.6)	8 (0.1)	457 (1.2)	

Centerpoint of scale set at 10.

( ) 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 2011

Exhibit 8.17: Students Engaged in Science Lessons (Continued)

Country	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Sixth Grade Participants							
Honduras	38 (1.5)	447 (6.6)	59 (1.5)	424 (5.9)	3 (0.4)	439 (12.0)	9.9 (0.05)
Botswana	37 (1.2)	436 (5.8)	52 (1.0)	341 (5.5)	11 (0.6)	273 (9.6)	9.7 (0.05)
Yemen	37 (1.7)	372 (7.5)	55 (1.4)	337 (7.7)	8 (0.9)	305 (15.2)	9.8 (0.08)
Benchmarking Participants							
North Carolina, US	56 (1.8)	556 (4.4)	38 (1.3)	519 (4.7)	5 (0.8)	518 (11.1)	10.5 (0.07)
Alberta, Canada	55 (1.4)	551 (2.7)	40 (1.3)	533 (3.3)	5 (0.5)	518 (9.6)	10.4 (0.06)
Dubai, UAE	53 (1.1)	489 (2.7)	42 (1.0)	444 (3.8)	5 (0.4)	401 (8.5)	10.4 (0.05)
Abu Dhabi, UAE	51 (1.8)	440 (5.5)	42 (1.4)	389 (5.2)	7 (0.7)	367 (11.3)	10.4 (0.08)
Florida, US	51 (1.3)	559 (4.6)	42 (1.2)	534 (3.9)	8 (0.6)	526 (5.9)	10.2 (0.06)
Ontario, Canada	48 (1.2)	538 (2.9)	44 (1.0)	521 (4.0)	7 (0.6)	508 (7.5)	10.0 (0.05)
Quebec, Canada	48 (1.2)	525 (2.5)	44 (1.2)	508 (3.5)	8 (0.5)	507 (5.5)	10.0 (0.05)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

How much do you agree with these statements about your science lessons?

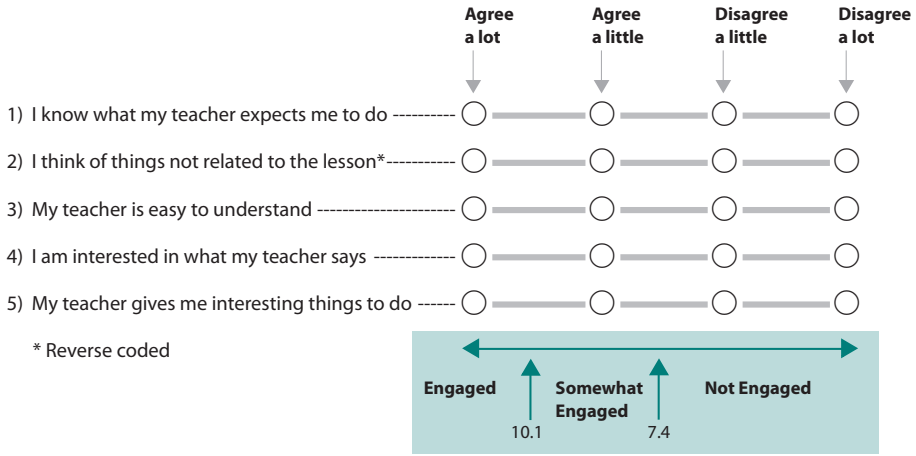


Exhibit 8.18: Students Engaged in Science Lessons

TIMSS 2011 8th Grade Science

Reported by Students

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

For general/integrated science, students were scored according to their degree of agreement with five statements on the *Engaged in Science Lessons* scale. Students **Engaged** in science lessons had a score on the scale of at least 11.2, which corresponds to their "agreeing a lot" with three of the five statements and "agreeing a little" with the other two, on average. Students who were **Not Engaged** had a score no higher than 8.4, which corresponds to their "disagreeing a little" with three of the five statements and "agreeing a little" with the other two, on average. All other students were **Somewhat Engaged** in science lessons. For biology, chemistry, physics, and earth science, a comparable procedure was used.

Students Engaged in General/Integrated Science Lessons

General/Integrated Science	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Tunisia	55 (0.9)	446 (2.6)	39 (0.7)	430 (3.0)	6 (0.5)	431 (6.0)	11.3 (0.04)
Jordan	46 (1.0)	483 (3.3)	46 (0.9)	436 (4.1)	8 (0.5)	395 (8.7)	11.0 (0.04)
Palestinian Nat'l Auth.	44 (1.4)	448 (3.3)	47 (1.3)	406 (4.1)	9 (0.7)	381 (9.1)	10.8 (0.06)
Iran, Islamic Rep. of	43 (1.1)	482 (4.7)	47 (0.8)	468 (4.0)	9 (0.6)	477 (7.2)	10.8 (0.05)
Oman	42 (0.9)	460 (3.0)	50 (0.7)	406 (3.5)	8 (0.4)	349 (7.1)	10.8 (0.04)
Ghana	41 (1.3)	342 (5.3)	53 (1.1)	293 (5.7)	6 (0.5)	236 (12.0)	10.9 (0.05)
United Arab Emirates	38 (0.9)	487 (2.6)	49 (0.6)	454 (2.7)	12 (0.6)	445 (4.5)	10.6 (0.04)
Saudi Arabia	36 (1.3)	462 (4.1)	51 (1.1)	427 (3.9)	12 (1.0)	411 (8.4)	10.5 (0.06)
Turkey	35 (1.1)	520 (4.5)	52 (1.1)	469 (3.3)	13 (0.7)	449 (6.1)	10.4 (0.05)
Bahrain	34 (0.7)	479 (2.8)	51 (0.8)	447 (2.5)	15 (0.8)	428 (7.7)	10.4 (0.04)
Chile	33 (1.1)	472 (2.6)	53 (0.8)	456 (2.8)	14 (0.8)	463 (4.9)	10.3 (0.05)
Qatar	32 (1.4)	464 (4.6)	51 (1.1)	409 (4.3)	17 (1.1)	378 (7.1)	10.3 (0.07)
Israel	28 (1.1)	540 (4.3)	46 (1.0)	510 (4.6)	26 (1.3)	503 (5.0)	9.8 (0.07)
United States	28 (0.8)	543 (3.4)	50 (0.7)	526 (2.5)	22 (0.7)	506 (4.0)	9.9 (0.04)
Malaysia	25 (1.2)	444 (5.9)	57 (1.0)	430 (6.3)	18 (1.2)	392 (9.9)	9.9 (0.06)
England	24 (1.1)	551 (5.4)	54 (0.9)	533 (5.6)	22 (1.3)	518 (5.9)	9.8 (0.06)
Norway	23 (1.3)	514 (4.2)	54 (1.3)	495 (3.2)	23 (1.5)	475 (3.4)	9.7 (0.07)
Australia	21 (1.2)	547 (6.2)	51 (1.2)	522 (5.0)	28 (1.4)	497 (5.9)	9.5 (0.07)
New Zealand	21 (1.2)	538 (5.7)	52 (0.9)	513 (4.6)	27 (1.6)	499 (6.2)	9.5 (0.07)
Thailand	21 (1.0)	463 (4.4)	70 (1.0)	449 (4.0)	9 (0.6)	447 (7.6)	10.0 (0.04)
Singapore	20 (0.7)	600 (6.0)	59 (0.7)	593 (4.4)	21 (0.9)	574 (5.4)	9.7 (0.04)
Italy	18 (0.9)	517 (3.6)	62 (0.8)	501 (2.9)	21 (1.0)	488 (3.3)	9.6 (0.04)
Hong Kong SAR	17 (1.0)	556 (4.6)	59 (1.0)	537 (3.7)	24 (1.3)	518 (4.7)	9.5 (0.06)
Chinese Taipei	9 (0.6)	610 (4.6)	42 (1.1)	578 (2.5)	50 (1.5)	544 (2.9)	8.6 (0.06)
Japan	5 (0.5)	607 (7.3)	36 (1.5)	575 (2.7)	59 (1.7)	543 (2.6)	8.2 (0.07)
Korea, Rep. of	4 (0.3)	626 (5.4)	39 (1.2)	582 (2.4)	57 (1.3)	541 (2.2)	8.3 (0.05)
International Avg.	29 (0.2)	508 (0.9)	51 (0.2)	479 (0.8)	21 (0.2)	457 (1.3)	
Ninth Grade Participants							
Honduras	40 (1.2)	381 (5.2)	52 (1.0)	362 (3.8)	7 (0.5)	373 (6.4)	10.7 (0.05)
Botswana	39 (1.1)	440 (2.8)	49 (0.9)	392 (4.3)	11 (0.7)	359 (8.9)	10.6 (0.05)
South Africa	35 (1.0)	372 (3.5)	54 (0.7)	320 (3.8)	11 (0.6)	322 (8.2)	10.5 (0.04)
Benchmarking Participants							
Dubai, UAE	39 (1.2)	501 (2.9)	48 (0.8)	482 (3.3)	13 (1.0)	461 (6.2)	10.6 (0.06)
Abu Dhabi, UAE	38 (1.5)	486 (4.5)	50 (1.1)	448 (4.3)	12 (0.9)	445 (7.6)	10.5 (0.07)
Massachusetts, US	33 (1.8)	577 (7.1)	49 (1.4)	566 (5.6)	18 (1.9)	553 (6.4)	10.2 (0.10)
Connecticut, US	30 (1.7)	552 (5.4)	47 (1.6)	529 (5.7)	23 (2.1)	525 (9.0)	9.9 (0.11)
Colorado, US	30 (2.0)	557 (6.0)	52 (1.9)	539 (5.1)	18 (1.8)	528 (6.9)	10.0 (0.09)
California, US	28 (1.4)	527 (4.8)	51 (1.3)	495 (5.0)	22 (1.4)	479 (6.4)	9.9 (0.07)
North Carolina, US	28 (2.1)	549 (7.3)	50 (1.2)	532 (7.2)	23 (2.3)	514 (7.8)	9.8 (0.12)
Florida, US	27 (2.0)	557 (8.2)	51 (1.4)	531 (7.7)	22 (1.8)	510 (8.2)	9.8 (0.10)
Indiana, US	26 (1.8)	550 (5.8)	48 (1.7)	532 (5.4)	25 (2.2)	519 (6.3)	9.7 (0.11)
Minnesota, US	26 (2.2)	578 (4.7)	51 (1.3)	549 (5.0)	23 (1.9)	538 (6.0)	9.8 (0.11)
Ontario, Canada	26 (1.1)	532 (4.1)	54 (1.1)	518 (3.0)	20 (1.2)	514 (3.4)	9.9 (0.06)
Alabama, US	25 (1.2)	499 (8.1)	52 (2.1)	482 (5.8)	23 (2.0)	485 (8.0)	9.8 (0.07)
Alberta, Canada	24 (1.3)	561 (3.5)	55 (1.2)	544 (2.5)	21 (1.4)	537 (3.6)	9.8 (0.07)
Quebec, Canada	21 (0.9)	533 (3.8)	56 (1.0)	523 (2.5)	23 (1.4)	504 (4.4)	9.6 (0.06)

Centerpoint of scale set at 10.

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

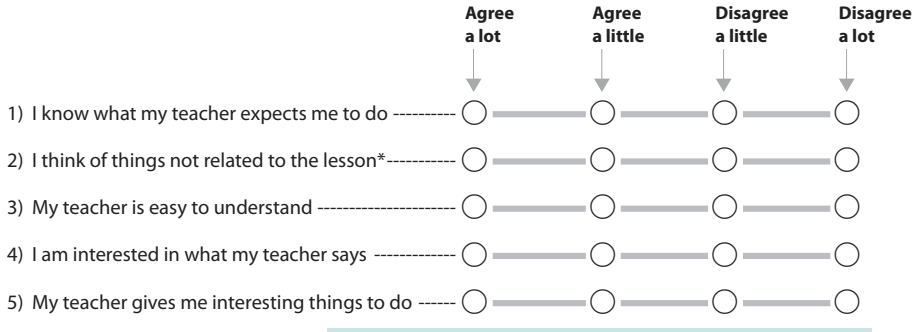
A dash (–) indicates comparable data are not available.

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 2011

Exhibit 8.18: Students Engaged in Science Lessons (Continued)

How much do you agree with these statements about your <science/biology/chemistry/physics/earth science> lessons?



* Reverse coded

	Engaged	Somewhat Engaged	Not Engaged
For General/ Integrated Science	11.2	8.4	
For Biology	10.9	8.0	
For Chemistry	11.2	8.6	
For Physics	11.1	8.5	
For Earth Science	11.0	8.1	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Separate Science Panels

Students Engaged in Biology Lessons

Biology	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Syrian Arab Republic	52 (1.3)	444 (3.9)	42 (1.1)	413 (3.9)	6 (0.6)	402 (7.4)	11.0 (0.06)
Armenia	52 (1.5)	454 (3.4)	41 (1.0)	423 (3.8)	7 (0.7)	445 (6.1)	10.9 (0.07)
Ukraine	49 (1.5)	512 (3.9)	44 (1.2)	493 (4.2)	7 (0.7)	492 (8.9)	10.7 (0.06)
Georgia	49 (1.3)	449 (3.3)	44 (1.0)	411 (3.6)	6 (0.6)	382 (7.3)	10.8 (0.06)
Morocco	46 (0.9)	396 (2.5)	48 (0.8)	365 (2.5)	6 (0.3)	358 (7.4)	10.7 (0.03)
Macedonia, Rep. of	46 (1.5)	430 (4.9)	44 (1.2)	397 (6.1)	11 (1.0)	418 (12.8)	10.5 (0.07)
Kazakhstan	35 (1.8)	510 (4.5)	59 (1.6)	482 (4.6)	6 (0.6)	487 (8.7)	10.3 (0.07)
Lebanon	34 (1.3)	430 (5.7)	52 (1.1)	397 (5.6)	14 (0.7)	383 (7.8)	10.1 (0.06)
Russian Federation	34 (1.0)	549 (4.3)	52 (1.0)	538 (3.2)	14 (0.9)	545 (5.4)	10.0 (0.05)
Romania	32 (1.3)	482 (4.2)	50 (1.0)	461 (3.8)	17 (1.0)	457 (6.3)	9.9 (0.07)
Hungary	28 (1.3)	530 (3.7)	52 (0.9)	517 (4.0)	20 (1.5)	529 (4.0)	9.6 (0.08)
Lithuania	22 (1.1)	518 (3.5)	53 (1.1)	513 (3.0)	25 (1.3)	517 (3.5)	9.3 (0.07)
Slovenia	16 (0.8)	549 (3.9)	56 (1.1)	541 (2.9)	28 (1.4)	545 (4.0)	9.0 (0.06)
Indonesia	15 (0.9)	402 (8.4)	78 (0.8)	406 (4.3)	7 (0.7)	415 (7.4)	9.5 (0.04)
Sweden	12 (0.8)	533 (4.4)	62 (1.0)	516 (2.9)	26 (1.2)	499 (3.2)	8.9 (0.05)
Finland	10 (0.6)	577 (4.6)	55 (1.3)	559 (2.5)	35 (1.5)	541 (2.8)	8.7 (0.05)
International Avg.	33 (0.3)	485 (1.1)	52 (0.3)	465 (1.0)	15 (0.2)	463 (1.7)	

Exhibit 8.18: Students Engaged in Science Lessons (Continued)

Students Engaged in Chemistry Lessons

Chemistry	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Morocco	42 (0.9)	397 (2.1)	50 (0.8)	365 (3.3)	9 (0.4)	369 (4.7)	10.9 (0.03)
Syrian Arab Republic	41 (1.2)	447 (4.4)	48 (1.0)	417 (4.0)	11 (0.7)	412 (7.7)	10.8 (0.05)
Armenia	39 (1.5)	461 (3.4)	43 (1.0)	427 (3.9)	18 (1.2)	431 (4.7)	10.5 (0.08)
Ukraine	38 (1.7)	519 (4.3)	45 (1.2)	493 (4.1)	17 (1.3)	489 (5.0)	10.5 (0.08)
Kazakhstan	33 (1.6)	515 (4.6)	57 (1.5)	482 (4.5)	9 (0.6)	472 (6.3)	10.6 (0.06)
Macedonia, Rep. of	33 (1.4)	444 (5.6)	48 (1.0)	396 (5.7)	19 (1.5)	410 (8.5)	10.3 (0.08)
Lebanon	32 (1.4)	435 (5.6)	54 (1.1)	396 (5.4)	15 (1.0)	386 (7.7)	10.5 (0.06)
Russian Federation	28 (1.0)	563 (4.1)	49 (0.7)	537 (3.7)	23 (1.0)	531 (4.1)	10.0 (0.05)
Romania	22 (1.3)	500 (5.0)	47 (1.0)	459 (3.6)	32 (1.6)	456 (4.7)	9.6 (0.08)
Hungary	21 (1.0)	541 (3.6)	46 (1.0)	514 (4.1)	33 (1.5)	527 (3.2)	9.5 (0.07)
Lithuania	21 (1.0)	535 (3.7)	47 (0.9)	511 (3.1)	32 (1.3)	508 (3.6)	9.5 (0.06)
Slovenia	17 (0.8)	571 (3.8)	54 (1.0)	544 (3.0)	28 (1.4)	527 (3.2)	9.5 (0.06)
Sweden	11 (0.7)	541 (5.6)	58 (1.0)	516 (2.8)	30 (1.3)	497 (3.1)	9.3 (0.05)
Finland	9 (0.7)	591 (5.1)	45 (1.4)	564 (2.7)	46 (1.8)	537 (2.8)	8.8 (0.07)
Indonesia r	8 (0.7)	391 (8.4)	76 (1.1)	399 (4.6)	16 (1.1)	408 (8.3)	9.5 (0.03)
Georgia	– –	– –	– –	– –	– –	– –	– –
International Avg.	26 (0.3)	497 (1.2)	51 (0.3)	468 (1.0)	23 (0.3)	464 (1.4)	

Students Engaged in Physics Lessons

Physics	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	48 (1.5)	463 (3.5)	41 (1.2)	422 (3.8)	10 (0.7)	415 (6.5)	11.0 (0.06)
Morocco	41 (0.7)	397 (2.3)	50 (0.7)	369 (3.1)	9 (0.3)	368 (4.6)	10.8 (0.03)
Syrian Arab Republic	41 (1.3)	449 (4.4)	47 (1.1)	416 (3.8)	12 (0.6)	418 (7.1)	10.8 (0.05)
Georgia	40 (1.2)	455 (3.6)	47 (1.0)	411 (3.5)	13 (0.9)	406 (6.2)	10.7 (0.06)
Ukraine	39 (1.6)	522 (4.4)	46 (1.1)	493 (3.6)	15 (1.0)	481 (5.5)	10.5 (0.08)
Macedonia, Rep. of	35 (1.2)	446 (5.4)	48 (0.9)	396 (5.8)	17 (0.9)	398 (9.2)	10.4 (0.06)
Russian Federation	33 (1.2)	564 (3.9)	50 (0.9)	537 (3.5)	18 (1.0)	521 (4.2)	10.3 (0.06)
Kazakhstan	31 (1.7)	515 (5.3)	57 (1.4)	482 (4.4)	11 (0.9)	483 (6.9)	10.4 (0.07)
Lebanon	29 (1.4)	436 (6.0)	54 (1.2)	398 (5.7)	18 (1.2)	389 (7.1)	10.2 (0.07)
Hungary	24 (1.0)	546 (3.5)	49 (0.9)	519 (3.7)	28 (1.2)	514 (4.2)	9.7 (0.06)
Romania	19 (1.2)	496 (4.8)	47 (1.2)	463 (4.2)	34 (1.4)	458 (4.4)	9.4 (0.07)
Lithuania	18 (0.9)	532 (4.6)	46 (0.9)	512 (3.1)	35 (1.3)	511 (2.9)	9.3 (0.06)
Sweden	11 (0.6)	543 (4.7)	59 (1.1)	517 (3.0)	30 (1.2)	502 (2.9)	9.3 (0.04)
Slovenia	10 (0.6)	578 (5.5)	49 (1.2)	546 (3.4)	41 (1.4)	532 (3.2)	8.9 (0.05)
Indonesia	10 (0.7)	407 (8.1)	77 (0.8)	409 (5.1)	14 (1.0)	416 (6.0)	9.6 (0.04)
Finland	8 (0.7)	598 (5.6)	42 (1.4)	564 (2.8)	50 (1.7)	540 (2.8)	8.6 (0.07)
International Avg.	27 (0.3)	497 (1.2)	51 (0.3)	466 (1.0)	22 (0.3)	459 (1.4)	

Students Engaged in Earth Science Lessons

Earth Science	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	50 (1.4)	455 (3.3)	41 (1.1)	424 (4.2)	9 (0.7)	436 (7.5)	10.9 (0.06)
Georgia	44 (1.5)	453 (3.4)	47 (1.1)	411 (3.1)	8 (0.9)	396 (6.8)	10.7 (0.06)
Macedonia, Rep. of	44 (1.4)	437 (5.2)	46 (1.0)	393 (5.4)	11 (1.0)	407 (12.8)	10.6 (0.07)
Syrian Arab Republic	43 (1.3)	445 (4.4)	47 (1.0)	416 (4.3)	10 (0.8)	402 (7.0)	10.7 (0.05)
Morocco	43 (0.7)	393 (2.0)	49 (0.7)	367 (2.8)	8 (0.3)	372 (5.9)	10.7 (0.03)
Ukraine	40 (1.6)	512 (4.5)	49 (1.2)	497 (3.7)	11 (1.0)	491 (6.7)	10.4 (0.07)
Kazakhstan	34 (1.5)	511 (4.6)	58 (1.3)	481 (4.7)	8 (0.7)	493 (7.7)	10.4 (0.07)
Romania	33 (1.4)	486 (4.3)	49 (1.0)	461 (4.3)	19 (1.1)	449 (5.5)	10.1 (0.08)
Russian Federation	29 (1.0)	551 (4.0)	52 (0.8)	540 (3.4)	19 (1.1)	539 (4.4)	9.9 (0.06)
Lithuania	26 (1.3)	526 (3.7)	49 (1.0)	510 (3.3)	25 (1.3)	514 (3.3)	9.6 (0.08)
Hungary	24 (1.4)	526 (4.6)	49 (0.9)	517 (3.7)	28 (1.5)	533 (3.7)	9.4 (0.08)
Sweden	18 (0.9)	529 (4.9)	62 (1.0)	513 (3.0)	20 (1.0)	498 (3.6)	9.4 (0.05)
Slovenia	16 (0.9)	553 (4.6)	56 (1.3)	542 (3.1)	28 (1.6)	540 (3.5)	9.1 (0.07)
Finland	11 (0.7)	576 (5.1)	55 (1.2)	560 (2.5)	34 (1.5)	536 (2.8)	8.8 (0.05)
Indonesia	10 (0.8)	398 (8.1)	77 (0.8)	405 (4.6)	14 (1.0)	410 (6.4)	9.3 (0.04)
Lebanon	– –	– –	– –	– –	– –	– –	– –
International Avg.	31 (0.3)	490 (1.2)	52 (0.3)	469 (1.0)	17 (0.3)	468 (1.6)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Students Ready to Learn

Instruction Limited by Students Lacking Prerequisite Knowledge or Skills

The characteristics of the students themselves can be very important to the classroom atmosphere. To begin, students need the prerequisite science skills before they can make gains in achievement. Because prior knowledge guides learning, effective science teachers assess students' knowledge, skills, and conceptual understanding, and link new ideas, skills, and competencies to prior understandings. Lack of prerequisite knowledge and skills are psychological barriers to further science learning, because it is well known that students' new learning depends on that prior knowledge: "Every new thing that a person learns must be attached to what the person already knows" (McLaughlin et al., 2005, p. 5).

Exhibit 8.19 presents teachers' reports at the fourth grade about whether their science instruction was limited by students lacking prerequisite knowledge or skills. On average, internationally, 28 percent of the fourth grade students were in classes where students had the necessary prerequisite skills for science instruction to proceed according to teachers' plans, and 60 percent were in classes where instruction was limited to some extent. It is consistent with teachers' reports that the students in classes where instruction was progressing unimpeded had higher average science achievement than did their counterparts in classes where instruction was limited to some extent (501 vs. 485). Also consistent with teachers' reports, average science achievement was substantially lower (460) for the fourth grade students in classrooms where instruction was limited "a lot" because students lacked the prerequisite knowledge or skills. This overall pattern also was evidenced at the sixth grade and for the benchmarking participants.

Exhibit 8.20 presents teachers' reports at the eighth grade about whether their science instruction was limited by students lacking prerequisite knowledge or skills. On average, internationally, just 20 percent of the eighth grade students were in classes where students had the necessary prerequisite skills for science instruction to proceed according to teachers' plans. According to their teachers, 61 percent were in classes where instruction was limited to some extent and 19 percent in classes where instruction was limited "a lot." As students progress through school, the curriculum becomes increasingly advanced and, not surprisingly, greater percentages of students fall behind, which typically results in some differentiation in instruction for different groups of students. Especially, taking into account some type of tailored curriculum and instruction

Exhibit 8.19: Instruction Limited by Students Lacking Prerequisite Knowledge or Skills

TIMSS 2011 4th Grade Science

Reported by Teachers

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Lacking Prerequisite Knowledge or Skills					
	Not At All		Some		A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan	64 (3.6)	497 (6.0)	30 (3.6)	484 (10.4)	5 (1.8)	540 (14.4)
Japan	53 (4.1)	561 (2.6)	44 (4.1)	556 (2.7)	3 (1.3)	551 (2.1)
Norway	46 (5.1)	496 (3.0)	53 (5.1)	493 (3.6)	1 (0.6)	~ ~
Russian Federation	44 (3.7)	555 (4.8)	44 (3.2)	553 (5.3)	12 (2.6)	538 (6.8)
Slovak Republic	42 (3.4)	550 (3.2)	52 (3.3)	522 (5.5)	6 (1.2)	492 (17.5)
Denmark	41 (3.5)	540 (3.1)	55 (3.5)	524 (3.4)	4 (1.2)	499 (26.8)
Finland	41 (3.5)	577 (2.6)	57 (3.4)	565 (3.4)	2 (0.6)	~ ~
Belgium (Flemish)	41 (3.3)	515 (2.8)	50 (3.4)	507 (2.8)	8 (1.8)	486 (8.8)
Georgia	39 (3.7)	461 (5.9)	59 (3.7)	452 (5.4)	2 (1.0)	~ ~
Sweden r	39 (4.6)	544 (5.0)	54 (4.6)	532 (4.2)	7 (1.7)	508 (10.1)
Chinese Taipei	38 (4.2)	558 (3.6)	58 (4.4)	550 (2.8)	4 (1.4)	510 (7.9)
Ireland	37 (3.7)	534 (4.0)	55 (4.0)	512 (4.7)	8 (1.9)	463 (7.5)
Azerbaijan	36 (3.8)	460 (10.0)	62 (3.9)	431 (6.9)	2 (1.0)	~ ~
Hong Kong SAR	35 (4.7)	547 (6.0)	58 (4.9)	536 (3.3)	7 (2.4)	458 (35.4)
Croatia	35 (3.2)	517 (3.1)	61 (3.4)	516 (2.6)	4 (1.6)	511 (9.9)
Slovenia	32 (4.0)	534 (4.0)	57 (3.7)	516 (3.5)	11 (2.3)	501 (3.9)
Netherlands r	32 (4.1)	543 (4.0)	62 (4.3)	526 (3.2)	6 (2.3)	508 (9.2)
Australia r	31 (3.5)	542 (6.7)	59 (4.4)	513 (4.1)	10 (2.4)	482 (7.8)
Czech Republic	31 (3.7)	546 (3.8)	65 (3.4)	535 (3.1)	4 (1.4)	490 (25.3)
Austria	30 (3.0)	546 (3.3)	55 (2.6)	532 (3.2)	14 (2.6)	497 (5.1)
Korea, Rep. of	29 (4.0)	587 (4.0)	56 (4.3)	588 (2.4)	14 (3.0)	577 (4.6)
Singapore	28 (2.6)	620 (5.3)	60 (3.2)	580 (4.1)	12 (1.7)	509 (9.9)
Spain	28 (3.7)	517 (4.8)	62 (3.7)	507 (3.1)	10 (2.2)	468 (9.5)
Romania	28 (3.5)	533 (8.8)	67 (3.5)	499 (7.1)	5 (1.4)	417 (46.6)
Qatar	28 (5.0)	414 (11.2)	62 (4.9)	388 (7.6)	11 (2.1)	380 (15.1)
Hungary	28 (3.2)	557 (6.6)	63 (3.5)	531 (5.0)	9 (2.1)	483 (13.4)
Bahrain	26 (4.8)	458 (8.9)	66 (4.9)	448 (4.5)	8 (2.0)	437 (10.6)
England	26 (3.4)	560 (5.8)	62 (4.2)	525 (4.6)	13 (3.0)	493 (9.2)
Armenia	26 (3.3)	422 (7.0)	70 (3.4)	414 (4.5)	4 (1.7)	412 (21.0)
Italy	25 (3.1)	519 (5.5)	54 (3.6)	527 (4.5)	21 (3.2)	528 (5.1)
Northern Ireland r	25 (3.6)	530 (7.1)	69 (3.8)	514 (3.4)	6 (2.1)	500 (9.6)
Serbia	24 (3.4)	528 (4.6)	70 (3.6)	514 (3.9)	6 (2.5)	491 (13.3)
Portugal	24 (3.5)	535 (6.9)	65 (3.9)	520 (4.7)	10 (2.1)	503 (8.4)
Malta	24 (0.1)	451 (2.5)	66 (0.1)	448 (2.2)	10 (0.1)	429 (4.6)
New Zealand	23 (3.2)	515 (4.8)	65 (3.1)	497 (2.7)	12 (1.6)	464 (8.5)
United Arab Emirates	23 (2.1)	456 (7.1)	66 (2.6)	426 (3.6)	12 (1.5)	407 (7.3)
Oman	23 (2.1)	384 (7.0)	52 (2.6)	381 (5.5)	25 (2.7)	366 (6.9)
Germany	22 (3.0)	546 (4.8)	68 (3.2)	529 (3.1)	11 (2.1)	488 (9.9)
Poland	20 (2.9)	510 (6.5)	71 (3.4)	505 (2.6)	10 (2.0)	490 (7.8)
Saudi Arabia	18 (3.0)	452 (11.5)	64 (3.5)	430 (7.4)	17 (3.4)	397 (13.5)
Kuwait	17 (3.2)	370 (11.9)	72 (4.0)	346 (5.9)	12 (2.7)	328 (12.9)
United States r	16 (2.0)	566 (5.1)	65 (2.6)	548 (2.5)	19 (2.0)	517 (4.8)
Lithuania	16 (2.0)	529 (5.9)	74 (2.7)	513 (2.8)	10 (2.1)	500 (5.8)
Iran, Islamic Rep. of	16 (2.6)	495 (8.8)	64 (3.7)	453 (5.2)	20 (2.9)	419 (10.4)
Chile	15 (3.1)	500 (9.2)	65 (3.9)	481 (4.1)	20 (3.2)	467 (9.2)
Yemen	14 (3.3)	215 (14.4)	68 (4.2)	207 (8.7)	18 (3.2)	201 (17.0)
Thailand	12 (2.3)	520 (13.9)	70 (3.8)	472 (5.8)	18 (3.4)	443 (15.6)
Tunisia	11 (2.0)	358 (13.6)	58 (3.8)	353 (7.6)	31 (3.7)	330 (9.1)
Morocco	7 (1.7)	282 (18.2)	55 (3.8)	270 (6.8)	38 (4.3)	252 (9.9)
Turkey	6 (1.7)	502 (12.0)	60 (3.5)	474 (6.1)	34 (3.4)	436 (7.4)
International Avg.	28 (0.5)	501 (1.1)	60 (0.5)	485 (0.7)	11 (0.3)	460 (2.1)

( ) 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 2011

Exhibit 8.19: Instruction Limited by Students Lacking Prerequisite Knowledge or Skills (Continued)

Country		Students in Classrooms Where Teachers Report Instruction Is Limited by Students Lacking Prerequisite Knowledge or Skills					
		Not At All		Some		A Lot	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Sixth Grade Participants							
Honduras		20 (3.7)	456 (17.9)	68 (4.1)	422 (6.9)	12 (2.8)	444 (12.6)
Yemen		16 (3.3)	348 (15.7)	67 (4.6)	348 (8.1)	17 (3.6)	325 (18.0)
Botswana		8 (2.4)	456 (31.5)	57 (4.2)	387 (7.7)	35 (3.8)	328 (8.7)
Benchmarking Participants							
Dubai, UAE	r	38 (3.4)	493 (7.2)	54 (3.5)	456 (6.6)	7 (0.9)	423 (13.6)
Quebec, Canada		29 (4.3)	530 (4.7)	57 (4.8)	513 (3.4)	13 (2.8)	502 (4.8)
Alberta, Canada	r	21 (4.2)	547 (7.4)	65 (4.8)	544 (3.1)	14 (3.1)	522 (9.4)
Ontario, Canada		19 (2.7)	542 (6.3)	64 (3.6)	530 (3.5)	18 (3.0)	506 (5.7)
Abu Dhabi, UAE		17 (3.4)	435 (16.3)	69 (4.3)	410 (6.1)	14 (3.2)	406 (14.1)
Florida, US	s	11 (3.2)	581 (14.6)	62 (5.8)	546 (4.7)	27 (5.4)	520 (7.2)
North Carolina, US		7 (2.4)	556 (19.7)	61 (5.0)	541 (4.8)	32 (4.9)	526 (7.8)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.20: Instruction Limited by Students Lacking Prerequisite Knowledge or Skills

Reported by Teachers

Country		Students in Classrooms Where Teachers Report Instruction Is Limited by Students Lacking Prerequisite Knowledge or Skills					
		Not At All		Some		A Lot	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan		54 (2.6)	496 (5.5)	40 (2.7)	482 (5.6)	6 (1.4)	503 (12.1)
Japan		44 (4.5)	571 (3.1)	51 (4.6)	548 (3.3)	6 (2.1)	541 (6.0)
Russian Federation		41 (2.3)	560 (3.8)	44 (2.7)	535 (4.0)	15 (1.4)	519 (6.0)
Sweden	r	33 (3.4)	529 (3.4)	59 (3.6)	506 (3.3)	7 (1.9)	470 (10.3)
Australia	s	32 (3.7)	560 (9.7)	58 (3.5)	516 (5.9)	10 (2.0)	481 (14.4)
Korea, Rep. of		31 (3.6)	558 (3.8)	54 (3.9)	561 (2.7)	15 (2.9)	562 (4.8)
England	r	29 (3.2)	562 (8.0)	62 (3.2)	526 (6.4)	9 (1.7)	482 (18.8)
Macedonia, Rep. of		29 (2.4)	390 (8.3)	60 (2.3)	424 (6.1)	11 (1.6)	380 (14.4)
Malaysia		27 (3.8)	473 (10.2)	55 (4.1)	432 (6.3)	18 (3.1)	336 (13.3)
Finland		27 (2.6)	569 (3.5)	63 (2.6)	550 (2.3)	10 (1.7)	522 (6.6)
New Zealand		27 (2.9)	547 (6.8)	55 (2.9)	504 (5.3)	19 (2.4)	480 (11.9)
Singapore		26 (2.3)	624 (8.7)	66 (2.6)	584 (4.8)	7 (1.3)	533 (20.1)
United Arab Emirates		23 (2.1)	479 (6.5)	64 (2.6)	459 (3.1)	13 (1.8)	447 (9.4)
Israel		21 (2.7)	548 (9.7)	53 (3.8)	523 (4.8)	25 (3.3)	482 (9.0)
Hong Kong SAR		21 (3.5)	558 (7.6)	70 (4.4)	532 (4.5)	9 (2.6)	505 (19.1)
Norway		21 (3.7)	501 (4.4)	72 (4.0)	492 (3.2)	8 (2.1)	485 (12.3)
Slovenia		19 (1.6)	549 (3.4)	67 (1.9)	543 (2.9)	14 (1.5)	534 (5.3)
Hungary		19 (2.0)	543 (5.6)	68 (2.1)	526 (2.9)	12 (1.6)	474 (7.1)
Lebanon		18 (2.6)	421 (12.2)	65 (3.3)	408 (6.0)	17 (2.5)	379 (11.3)
Ukraine		18 (2.3)	513 (6.1)	47 (2.9)	506 (4.5)	34 (2.9)	489 (5.0)
Romania		18 (1.8)	477 (6.8)	68 (2.1)	465 (3.6)	14 (1.6)	445 (7.6)
Qatar		18 (2.1)	451 (13.0)	62 (4.5)	420 (8.0)	20 (3.9)	384 (15.3)
Bahrain		18 (2.6)	476 (10.1)	64 (2.6)	454 (2.8)	18 (2.6)	428 (8.4)
Chile		17 (2.8)	482 (8.3)	57 (4.4)	463 (4.2)	26 (3.8)	443 (5.4)
Armenia		16 (2.1)	453 (8.2)	77 (2.0)	437 (3.6)	7 (1.6)	419 (8.4)
Italy		15 (2.9)	520 (6.9)	59 (3.6)	505 (3.0)	26 (3.5)	483 (6.9)
United States	s	15 (2.1)	556 (9.3)	67 (2.7)	532 (4.0)	18 (2.0)	500 (6.7)
Chinese Taipei		15 (2.9)	585 (7.6)	64 (4.0)	565 (3.5)	21 (3.4)	543 (4.6)
Lithuania		14 (1.4)	531 (5.0)	68 (1.7)	516 (2.5)	18 (1.5)	497 (5.1)
Indonesia		13 (3.6)	402 (19.7)	67 (4.1)	403 (4.8)	20 (3.2)	414 (6.7)
Morocco		13 (1.7)	397 (6.0)	41 (2.4)	382 (2.9)	46 (2.1)	367 (3.5)
Saudi Arabia		13 (2.9)	440 (11.7)	65 (3.7)	438 (4.5)	22 (3.6)	430 (8.1)
Oman		12 (1.6)	438 (10.1)	59 (3.4)	419 (5.1)	30 (3.2)	413 (7.6)
Thailand		11 (2.4)	475 (16.2)	71 (3.5)	454 (4.8)	19 (2.9)	427 (8.8)
Tunisia		10 (2.5)	454 (12.5)	64 (3.4)	439 (3.0)	25 (3.4)	431 (4.3)
Syrian Arab Republic		10 (2.2)	441 (10.7)	64 (3.4)	427 (4.4)	26 (3.4)	417 (8.5)
Palestinian Nat'l Auth.		9 (2.5)	465 (12.9)	52 (4.0)	423 (4.9)	39 (4.3)	407 (5.8)
Iran, Islamic Rep. of		9 (2.1)	512 (16.9)	60 (3.5)	477 (4.6)	31 (3.5)	458 (6.5)
Georgia		8 (1.1)	444 (5.9)	74 (2.4)	418 (3.3)	18 (2.3)	418 (5.3)
Jordan		6 (1.7)	448 (17.9)	55 (4.0)	459 (4.8)	39 (3.8)	435 (7.6)
Ghana		5 (1.6)	302 (24.2)	78 (3.4)	313 (6.4)	17 (3.0)	279 (9.2)
Turkey		3 (1.3)	551 (54.4)	51 (3.5)	498 (4.9)	46 (3.3)	462 (4.6)
International Avg.		20 (0.4)	496 (2.0)	61 (0.5)	478 (0.7)	19 (0.4)	455 (1.5)

( ) 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 less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.20: Instruction Limited by Students Lacking Prerequisite Knowledge or Skills (Continued)

Country		Students in Classrooms Where Teachers Report Instruction Is Limited by Students Lacking Prerequisite Knowledge or Skills					
		Not At All		Some		A Lot	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Ninth Grade Participants							
Honduras		20 (3.7)	379 (10.3)	51 (4.6)	366 (4.9)	29 (4.5)	369 (10.5)
Botswana		15 (3.2)	438 (10.5)	42 (4.3)	408 (5.9)	43 (4.4)	388 (4.9)
South Africa		9 (2.4)	340 (21.0)	59 (3.9)	334 (5.8)	33 (3.9)	317 (6.8)
Benchmarking Participants							
Quebec, Canada		29 (3.7)	539 (5.7)	53 (4.1)	514 (4.1)	18 (3.4)	511 (7.8)
Dubai, UAE	r	26 (2.7)	511 (7.5)	62 (4.5)	470 (5.2)	12 (3.9)	467 (15.1)
Ontario, Canada		23 (3.2)	536 (5.5)	64 (3.8)	519 (3.4)	13 (2.5)	500 (7.3)
Minnesota, US	r	22 (5.0)	568 (11.8)	64 (4.6)	556 (6.0)	14 (3.8)	518 (27.8)
Alberta, Canada		22 (3.6)	562 (5.5)	67 (3.9)	543 (2.7)	11 (2.7)	533 (6.7)
Massachusetts, US	s	22 (6.3)	599 (14.0)	67 (7.3)	563 (10.1)	11 (4.6)	510 (31.8)
Abu Dhabi, UAE		20 (3.6)	478 (12.2)	64 (4.0)	461 (4.9)	15 (2.9)	438 (9.8)
Alabama, US	s	17 (5.3)	498 (15.9)	65 (6.5)	482 (10.0)	18 (6.2)	481 (13.1)
Colorado, US	s	17 (4.9)	552 (12.4)	69 (6.2)	554 (6.7)	13 (4.0)	492 (14.3)
Indiana, US	s	16 (5.9)	542 (12.3)	69 (6.9)	536 (6.6)	15 (3.8)	495 (12.3)
Connecticut, US	s	15 (3.8)	563 (13.6)	55 (6.4)	548 (8.5)	30 (6.6)	498 (15.5)
California, US	s	13 (3.4)	553 (19.5)	68 (4.6)	507 (8.4)	19 (3.5)	468 (16.7)
North Carolina, US	s	2 (1.7)	~ ~	68 (7.8)	545 (12.4)	30 (7.5)	491 (15.7)
Florida, US		x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

for groups of students, it is distressing that, according to their teachers, relatively few students at the eighth grade are receiving the full instructional benefit that could be provided.

Eighth grade students in classes where instruction was not limited had higher average science achievement than did their counterparts in classes where instruction was limited to some extent (496 vs. 478). Also consistent with teachers' reports, average science achievement was substantially lower (455) for eighth grade students in classrooms where instruction was limited "a lot" because students lacked the prerequisite knowledge or skills. This pattern also was evidenced at the ninth grade and for the benchmarking participants.

Instruction Limited by Students Suffering from Lack of Nutrition or Sleep

The importance of a healthy breakfast is widely advertised, including the benefit of doing better in school. Unfortunately, some children in many countries around the world suffer from hunger, and a growing body of research, mostly in developing countries, is providing evidence that malnutrition has a negative impact on educational achievement. Similarly, a number of studies in a variety of countries have shown sleep duration and quality to be related to academic functioning at school. For example, a Dutch researcher found that chronic sleep reduction can affect school achievement directly and indirectly via motivation and engagement (Meijer, 2008).

Exhibit 8.21 presents teachers' reports at the fourth grade about the degree to which their science instruction was limited by students' lack of nutrition or not having enough sleep. On average, internationally, 71 percent of the fourth grade students were in classrooms where instruction was "not at all" limited because students were lacking in basic nutrition. These fourth grade students had higher average science achievement than their peers in classrooms where instruction was limited "some" or "a lot" due to lack of basic nutrition (493 vs. 467). It is of considerable concern that 29 percent of the fourth grade students, on average, were reported to be suffering from lack of basic nutrition; and this percentage is much higher in some countries, including those that participated at the sixth grade.

Teachers reported that 54 percent of the fourth grade students, on average, were in classrooms where instruction was "not at all" limited by students suffering from not enough sleep. However, it is unfortunate that 46 percent,

on average, were in classrooms where instruction was limited "some" or "a lot" by students suffering from lack of sleep. The achievement gap for sleep deprivation was somewhat less than that related to lack of nutrition, but the fourth grade students suffering from some amount of sleep deprivation did have lower average science achievement than their more alert counterparts (by 11 points on average). Again, there was considerable variation across countries in teachers' reports about the percentages of fourth grade students suffering from not enough sleep. According to their teachers, in a number of TIMSS 2011 countries and benchmarking participants, the majority of students were at least somewhat sleep deprived.

Exhibit 8.22 presents the eighth grade teachers' reports about the degree to which their instruction was limited by students' lack of nutrition or not having enough sleep. On average, internationally, 64 percent of the eighth grade students were in classrooms where instruction was "not at all" limited because students were lacking in basic nutrition. These eighth grade students had higher average science achievement than their peers in classrooms where instruction was limited "some" or "a lot" due to lack of basic nutrition (485 vs. 461). More than one-third (36%) of the eighth grade students, on average, were reported to be suffering from lack of basic nutrition; and this percentage was much higher in some countries, including those that participated at the ninth grade.

Teachers reported that 42 percent of the eighth grade students, on average, were in classrooms where instruction was "not at all" limited by students suffering from not enough sleep. However, again, it is a matter of considerable concern that the majority of eighth grade students (58%), on average, were in classrooms where instruction was limited "some" or "a lot" by students suffering from lack of sleep. Similar to the results at fourth grade, the achievement gap for sleep deprivation was somewhat less than that related to lack of nutrition, but the eighth grade students suffering from some amount of sleep deprivation did have lower average science achievement than their counterparts (by 11 points). Again, there was considerable variation across countries in teachers' reports about the percentages of eighth grade students suffering from not enough sleep. According to their teachers, however, in a number of TIMSS 2011 countries and benchmarking participants, as much as two-thirds of students were at least somewhat sleep deprived.

Exhibit 8.21: Instruction Limited by Students Suffering from Lack of Nutrition or Sleep

TIMSS 2011 4th Grade Science

Reported by Teachers

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Lack of Basic Nutrition				Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Not Enough Sleep			
	Not At All		Some or A Lot		Not At All		Some or A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	33 (3.9)	427 (7.0)	67 (3.9)	412 (4.7)	52 (4.6)	422 (5.8)	48 (4.6)	409 (5.5)
Australia r	73 (3.0)	531 (3.4)	27 (3.0)	488 (6.6)	r 36 (3.7)	536 (4.8)	64 (3.7)	509 (5.2)
Austria	– –	– –	– –	– –	42 (3.4)	540 (3.3)	58 (3.4)	524 (3.6)
Azerbaijan	60 (3.5)	448 (7.8)	40 (3.5)	431 (8.6)	82 (2.9)	443 (6.4)	18 (2.9)	427 (9.6)
Bahrain	61 (4.5)	452 (5.6)	39 (4.5)	446 (5.4)	47 (4.9)	445 (4.7)	53 (4.9)	453 (5.5)
Belgium (Flemish)	95 (1.5)	511 (2.1)	5 (1.5)	474 (8.7)	62 (3.6)	514 (2.5)	38 (3.6)	500 (3.4)
Chile	58 (3.5)	496 (3.7)	42 (3.5)	460 (5.1)	37 (4.3)	499 (5.6)	63 (4.3)	470 (4.5)
Chinese Taipei	76 (3.8)	556 (2.6)	24 (3.8)	537 (4.8)	63 (4.1)	552 (2.7)	37 (4.1)	551 (3.5)
Croatia	83 (2.8)	517 (2.2)	17 (2.8)	512 (6.3)	44 (3.5)	513 (3.2)	56 (3.5)	519 (2.6)
Czech Republic	99 (0.9)	536 (2.5)	1 (0.9)	~ ~	67 (3.8)	539 (3.1)	33 (3.8)	531 (4.3)
Denmark	83 (2.8)	533 (3.1)	17 (2.8)	520 (6.1)	53 (3.9)	534 (3.4)	47 (3.9)	525 (4.2)
England	79 (3.0)	537 (4.4)	21 (3.0)	505 (5.0)	36 (4.3)	545 (6.1)	64 (4.3)	521 (4.4)
Finland	91 (2.2)	572 (2.5)	9 (2.2)	550 (6.6)	39 (4.0)	576 (3.8)	61 (4.0)	566 (2.6)
Georgia	46 (4.1)	469 (4.6)	54 (4.1)	444 (5.8)	64 (4.3)	455 (4.2)	36 (4.3)	455 (7.0)
Germany	85 (2.7)	533 (2.9)	15 (2.7)	503 (7.0)	52 (3.3)	539 (3.0)	48 (3.3)	517 (4.3)
Hong Kong SAR	89 (2.4)	537 (4.4)	11 (2.4)	517 (8.0)	56 (4.7)	541 (4.6)	44 (4.7)	527 (8.2)
Hungary	72 (2.9)	542 (3.9)	28 (2.9)	510 (7.9)	48 (3.4)	544 (4.7)	52 (3.4)	523 (5.6)
Iran, Islamic Rep. of	30 (3.6)	483 (6.9)	70 (3.6)	440 (4.7)	41 (3.6)	457 (5.9)	59 (3.6)	450 (5.2)
Ireland	79 (3.0)	522 (3.9)	21 (3.0)	495 (6.8)	38 (3.6)	530 (5.2)	62 (3.6)	508 (4.3)
Italy	72 (3.5)	526 (3.1)	28 (3.5)	528 (6.0)	52 (4.4)	526 (3.7)	48 (4.4)	526 (4.5)
Japan	99 (0.6)	559 (1.9)	1 (0.0)	~ ~	77 (3.3)	559 (2.1)	23 (3.3)	556 (3.5)
Kazakhstan	81 (3.2)	495 (6.0)	19 (3.2)	496 (12.4)	88 (2.9)	491 (5.5)	12 (2.9)	523 (14.1)
Korea, Rep. of	82 (3.4)	588 (2.3)	18 (3.4)	580 (2.9)	73 (3.5)	587 (2.6)	27 (3.5)	585 (3.1)
Kuwait	64 (4.1)	354 (6.4)	36 (4.1)	337 (8.2)	36 (3.8)	359 (8.6)	64 (3.8)	341 (6.1)
Lithuania	82 (3.0)	516 (3.0)	18 (3.0)	504 (5.8)	54 (3.3)	519 (3.7)	46 (3.3)	510 (3.1)
Malta	89 (0.1)	449 (1.9)	11 (0.1)	426 (3.7)	79 (0.1)	447 (1.9)	21 (0.1)	443 (3.3)
Morocco	21 (3.0)	292 (12.7)	79 (3.0)	255 (6.0)	40 (3.7)	267 (8.3)	60 (3.7)	261 (6.6)
Netherlands r	91 (2.6)	532 (2.7)	9 (2.6)	512 (8.3)	r 54 (4.3)	537 (2.8)	46 (4.3)	522 (3.4)
New Zealand	63 (2.7)	516 (2.6)	37 (2.7)	468 (4.0)	30 (2.9)	517 (3.9)	70 (2.9)	489 (3.0)
Northern Ireland r	80 (3.1)	524 (3.4)	20 (3.1)	489 (5.7)	r 39 (4.7)	532 (3.9)	61 (4.7)	507 (4.3)
Norway	74 (4.5)	497 (2.7)	26 (4.5)	488 (4.7)	53 (4.4)	496 (3.1)	47 (4.4)	493 (3.4)
Oman	46 (3.0)	392 (6.3)	54 (3.0)	366 (4.8)	49 (3.0)	388 (6.0)	51 (3.0)	368 (4.4)
Poland	88 (2.2)	505 (2.8)	12 (2.2)	500 (5.2)	62 (3.1)	506 (3.2)	38 (3.1)	504 (3.7)
Portugal	86 (2.8)	523 (4.1)	14 (2.8)	517 (10.4)	67 (4.0)	524 (5.4)	33 (4.0)	517 (6.0)
Qatar	60 (3.2)	415 (7.5)	40 (3.2)	363 (9.9)	40 (4.5)	402 (8.7)	60 (4.5)	390 (7.4)
Romania	50 (3.6)	528 (6.6)	50 (3.6)	481 (9.2)	62 (3.8)	509 (5.9)	38 (3.8)	498 (10.9)
Russian Federation	82 (2.5)	557 (3.7)	18 (2.5)	527 (5.9)	72 (2.7)	555 (3.9)	28 (2.7)	543 (5.8)
Saudi Arabia	47 (4.1)	438 (7.1)	53 (4.1)	422 (8.6)	32 (3.5)	431 (7.9)	68 (3.5)	426 (7.4)
Serbia	84 (2.8)	516 (3.1)	16 (2.8)	519 (8.8)	52 (4.0)	516 (3.9)	48 (4.0)	518 (3.9)
Singapore	84 (1.8)	591 (3.4)	16 (1.8)	538 (9.3)	64 (2.4)	593 (4.2)	36 (2.4)	566 (6.4)
Slovak Republic	97 (0.9)	533 (3.8)	3 (0.9)	499 (21.3)	80 (2.7)	536 (3.6)	20 (2.7)	515 (10.8)
Slovenia	88 (2.0)	522 (2.8)	12 (2.0)	505 (5.8)	48 (4.5)	524 (3.6)	52 (4.5)	516 (3.5)
Spain	89 (2.3)	508 (3.0)	11 (2.3)	490 (7.0)	62 (3.9)	512 (3.7)	38 (3.9)	496 (4.0)
Sweden r	97 (1.2)	535 (3.3)	3 (1.2)	518 (15.9)	r 60 (4.1)	541 (3.6)	40 (4.1)	524 (5.5)
Thailand	70 (4.1)	483 (5.8)	30 (4.1)	449 (11.1)	68 (4.2)	478 (6.1)	32 (4.2)	462 (10.8)
Tunisia	49 (4.0)	359 (7.4)	51 (4.0)	333 (6.6)	69 (3.6)	345 (6.5)	31 (3.6)	348 (8.9)
Turkey	26 (2.8)	483 (9.1)	74 (2.8)	455 (5.4)	35 (3.0)	465 (5.7)	65 (3.0)	461 (5.8)
United Arab Emirates	67 (2.3)	441 (3.8)	33 (2.3)	409 (4.8)	47 (2.3)	447 (4.3)	53 (2.3)	416 (3.9)
United States r	61 (2.2)	554 (2.5)	39 (2.2)	531 (3.2)	r 27 (2.1)	559 (3.5)	73 (2.1)	539 (2.6)
Yemen	13 (3.2)	212 (21.4)	87 (3.2)	206 (8.2)	55 (4.4)	221 (8.9)	45 (4.4)	189 (9.8)
International Avg.	71 (0.4)	493 (0.8)	29 (0.4)	467 (1.1)	54 (0.5)	492 (0.7)	46 (0.5)	481 (0.9)

( ) 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.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.21: Instruction Limited by Students Suffering from Lack of Nutrition or Sleep (Continued)

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Lack of Basic Nutrition					Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Not Enough Sleep				
	Not At All		Some or A Lot			Not At All		Some or A Lot		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement		Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Sixth Grade Participants										
Botswana	60 (3.9)	393 (8.9)	40 (3.9)	340 (7.3)		41 (4.3)	388 (9.1)	59 (4.3)	360 (8.5)	
Honduras	28 (4.0)	466 (11.0)	72 (4.0)	420 (6.8)		64 (4.3)	439 (6.9)	36 (4.3)	420 (10.7)	
Yemen	22 (4.0)	365 (14.6)	78 (4.0)	340 (8.5)		55 (4.5)	360 (9.6)	45 (4.5)	326 (9.7)	
Benchmarking Participants										
Alberta, Canada	r 60 (4.7)	550 (3.4)	40 (4.7)	528 (4.3)		r 29 (4.5)	559 (5.4)	71 (4.5)	535 (2.9)	
Ontario, Canada	63 (3.8)	536 (3.3)	37 (3.8)	514 (4.4)		26 (3.5)	540 (6.0)	74 (3.5)	523 (3.1)	
Quebec, Canada	74 (3.8)	522 (3.1)	26 (3.8)	502 (4.7)		38 (3.8)	526 (3.9)	62 (3.8)	511 (2.9)	
Abu Dhabi, UAE	61 (4.2)	420 (7.0)	39 (4.2)	405 (7.4)		44 (4.6)	421 (9.1)	56 (4.6)	408 (6.7)	
Dubai, UAE	r 86 (1.9)	478 (3.8)	14 (1.9)	406 (9.2)		r 65 (2.7)	483 (3.9)	35 (2.7)	439 (6.9)	
Florida, US	s 63 (4.6)	549 (5.8)	37 (4.6)	534 (6.7)		s 27 (4.2)	556 (8.4)	73 (4.2)	539 (4.6)	
North Carolina, US	65 (5.5)	543 (4.7)	35 (5.5)	527 (8.2)		19 (3.0)	539 (8.1)	81 (3.0)	537 (5.3)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.22: Instruction Limited by Students Suffering from Lack of Nutrition or Sleep

Reported by Teachers

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Lack of Basic Nutrition				Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Not Enough Sleep			
	Not At All		Some or A Lot		Not At All		Some or A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	38 (2.5)	446 (4.6)	62 (2.5)	433 (4.0)	53 (2.6)	441 (4.2)	47 (2.6)	434 (4.5)
Australia	s 76 (2.8)	540 (6.1)	24 (2.8)	484 (8.9)	s 37 (3.6)	535 (6.4)	63 (3.6)	522 (7.6)
Bahrain	53 (3.4)	469 (4.6)	47 (3.4)	436 (4.4)	31 (2.8)	473 (6.2)	69 (2.8)	445 (2.6)
Chile	55 (4.4)	476 (4.0)	45 (4.4)	444 (4.1)	26 (3.1)	484 (5.7)	74 (3.1)	453 (3.2)
Chinese Taipei	83 (3.0)	565 (2.5)	17 (3.0)	557 (8.3)	23 (3.6)	555 (6.8)	77 (3.6)	566 (2.8)
England	r 75 (2.4)	538 (5.4)	25 (2.4)	513 (11.4)	r 37 (3.4)	549 (5.4)	63 (3.4)	522 (7.7)
Finland	90 (1.2)	553 (2.5)	10 (1.2)	545 (4.9)	18 (1.9)	560 (3.2)	82 (1.9)	550 (2.7)
Georgia	39 (2.8)	430 (3.6)	61 (2.8)	414 (4.0)	47 (3.1)	420 (4.0)	53 (3.1)	421 (4.3)
Ghana	34 (4.3)	333 (11.9)	66 (4.3)	293 (6.5)	26 (3.4)	309 (8.5)	74 (3.4)	305 (7.1)
Hong Kong SAR	86 (3.3)	539 (4.2)	14 (3.3)	520 (10.7)	17 (3.2)	549 (14.7)	83 (3.2)	532 (3.5)
Hungary	82 (2.0)	531 (3.0)	18 (2.0)	488 (6.4)	43 (2.4)	531 (3.5)	57 (2.4)	517 (4.0)
Indonesia	70 (3.5)	404 (5.8)	30 (3.5)	407 (7.2)	47 (4.5)	403 (7.9)	53 (4.5)	407 (5.5)
Iran, Islamic Rep. of	30 (3.3)	499 (8.0)	70 (3.3)	464 (4.1)	35 (3.6)	487 (6.3)	65 (3.6)	468 (4.9)
Israel	82 (2.5)	527 (4.5)	18 (2.5)	478 (10.5)	47 (3.8)	535 (5.9)	53 (3.8)	503 (5.6)
Italy	90 (2.4)	504 (2.5)	10 (2.4)	491 (11.3)	68 (3.9)	502 (3.3)	32 (3.9)	501 (4.8)
Japan	99 (0.9)	558 (2.4)	1 (0.9)	~ ~	65 (3.6)	558 (2.7)	35 (3.6)	557 (4.1)
Jordan	30 (3.4)	451 (10.1)	70 (3.4)	448 (4.8)	42 (4.2)	451 (8.1)	58 (4.2)	448 (4.8)
Kazakhstan	81 (2.5)	494 (4.3)	19 (2.5)	478 (7.2)	85 (2.1)	490 (4.3)	15 (2.1)	494 (8.8)
Korea, Rep. of	73 (3.4)	559 (2.3)	27 (3.4)	562 (3.6)	28 (3.0)	560 (4.0)	72 (3.0)	559 (2.1)
Lebanon	65 (3.3)	402 (6.1)	35 (3.3)	413 (7.6)	36 (3.5)	402 (7.5)	64 (3.5)	407 (6.2)
Lithuania	80 (1.6)	517 (2.7)	20 (1.6)	504 (3.8)	60 (1.9)	516 (2.7)	40 (1.9)	512 (3.4)
Macedonia, Rep. of	76 (2.1)	420 (5.9)	24 (2.1)	379 (9.7)	r 51 (2.5)	411 (6.8)	49 (2.5)	408 (6.5)
Malaysia	74 (3.3)	442 (6.3)	26 (3.3)	379 (12.3)	59 (4.1)	448 (6.8)	41 (4.1)	394 (8.9)
Morocco	30 (2.4)	394 (3.8)	70 (2.4)	370 (2.6)	38 (2.4)	379 (3.2)	62 (2.4)	375 (2.6)
New Zealand	71 (3.0)	529 (5.3)	29 (3.0)	469 (6.9)	37 (3.8)	531 (6.5)	63 (3.8)	500 (5.5)
Norway	58 (3.7)	497 (3.1)	42 (3.7)	489 (4.5)	33 (3.8)	502 (3.8)	67 (3.8)	489 (3.2)
Oman	38 (3.4)	424 (5.4)	62 (3.4)	417 (4.1)	47 (3.4)	424 (5.9)	53 (3.4)	416 (4.6)
Palestinian Nat'l Auth.	24 (3.5)	436 (8.0)	76 (3.5)	416 (3.5)	27 (2.9)	415 (8.1)	73 (2.9)	423 (3.6)
Qatar	52 (4.3)	439 (8.9)	48 (4.3)	395 (5.9)	34 (4.1)	452 (14.1)	66 (4.1)	401 (5.8)
Romania	60 (2.9)	470 (4.6)	40 (2.9)	457 (4.4)	55 (2.4)	465 (4.8)	45 (2.4)	464 (3.8)
Russian Federation	82 (1.7)	547 (3.3)	18 (1.7)	522 (5.1)	67 (2.6)	547 (3.3)	33 (2.6)	533 (4.3)
Saudi Arabia	39 (4.2)	436 (7.7)	61 (4.2)	437 (4.2)	23 (3.4)	439 (7.9)	77 (3.4)	436 (4.8)
Singapore	89 (1.9)	596 (4.2)	11 (1.9)	538 (22.6)	30 (2.7)	611 (8.3)	70 (2.7)	582 (5.4)
Slovenia	86 (1.5)	543 (2.7)	14 (1.5)	544 (4.4)	47 (2.3)	543 (2.7)	53 (2.3)	543 (3.5)
Sweden	r 93 (1.7)	513 (2.9)	7 (1.7)	490 (9.9)	r 43 (3.5)	517 (3.9)	57 (3.5)	507 (3.9)
Syrian Arab Republic	44 (3.8)	428 (6.2)	56 (3.8)	425 (5.3)	48 (3.8)	429 (6.0)	52 (3.8)	424 (5.4)
Thailand	73 (3.2)	451 (5.2)	27 (3.2)	450 (6.5)	51 (4.4)	451 (6.4)	49 (4.4)	451 (5.2)
Tunisia	56 (3.7)	446 (3.4)	44 (3.7)	429 (3.1)	44 (3.5)	439 (3.6)	56 (3.5)	439 (4.0)
Turkey	38 (3.3)	501 (7.9)	62 (3.3)	472 (3.8)	30 (3.2)	492 (9.6)	70 (3.2)	479 (3.8)
Ukraine	81 (2.6)	504 (3.9)	19 (2.6)	489 (5.1)	78 (2.7)	502 (3.9)	22 (2.7)	496 (5.0)
United Arab Emirates	61 (2.5)	475 (3.5)	39 (2.5)	442 (3.9)	40 (2.6)	477 (4.4)	60 (2.6)	452 (3.0)
United States	s 60 (2.4)	538 (4.2)	40 (2.4)	519 (5.0)	s 15 (1.8)	534 (7.7)	85 (1.8)	529 (3.6)
International Avg.	64 (0.5)	485 (0.8)	36 (0.5)	461 (1.2)	42 (0.5)	484 (1.0)	58 (0.5)	473 (0.8)

( ) 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 less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.22: Instruction Limited by Students Suffering from Lack of Nutrition or Sleep (Continued)

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Lack of Basic Nutrition				Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Not Enough Sleep			
	Not At All		Some or A Lot		Not At All		Some or A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Ninth Grade Participants								
Botswana	64 (4.1)	410 (4.7)	36 (4.1)	392 (5.8)	40 (4.0)	409 (6.9)	60 (4.0)	400 (4.5)
Honduras	25 (4.2)	392 (11.5)	75 (4.2)	362 (4.1)	34 (4.6)	367 (9.5)	66 (4.6)	371 (4.9)
South Africa	38 (3.0)	351 (8.7)	62 (3.0)	316 (5.4)	31 (3.4)	330 (8.5)	69 (3.4)	329 (5.4)
Benchmarking Participants								
Alberta, Canada	57 (4.8)	554 (3.3)	43 (4.8)	536 (3.3)	16 (3.3)	562 (6.3)	84 (3.3)	543 (2.6)
Ontario, Canada	64 (3.9)	528 (3.8)	36 (3.9)	509 (3.6)	23 (3.6)	533 (5.7)	77 (3.6)	517 (3.2)
Quebec, Canada	72 (3.7)	529 (3.6)	28 (3.7)	500 (5.5)	40 (4.3)	529 (5.7)	60 (4.3)	515 (3.4)
Abu Dhabi, UAE	60 (4.0)	469 (6.3)	40 (4.0)	452 (4.7)	39 (4.2)	469 (8.1)	61 (4.2)	456 (4.7)
Dubai, UAE	r 64 (4.5)	506 (4.7)	36 (4.5)	434 (9.9)	r 47 (4.6)	503 (5.3)	53 (4.6)	461 (6.0)
Alabama, US	s 81 (6.8)	489 (9.1)	19 (6.8)	468 (11.3)	s 13 (3.7)	526 (10.0)	87 (3.7)	479 (7.6)
California, US	s 52 (6.0)	519 (7.8)	48 (6.0)	491 (11.6)	s 23 (5.6)	519 (11.3)	77 (5.6)	500 (9.1)
Colorado, US	s 65 (7.8)	553 (7.4)	35 (7.8)	532 (13.1)	s 19 (4.9)	548 (8.4)	81 (4.9)	545 (7.5)
Connecticut, US	s 63 (6.2)	546 (9.6)	37 (6.2)	520 (10.0)	s 24 (5.5)	544 (14.3)	76 (5.5)	533 (8.1)
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x
Indiana, US	s 56 (6.9)	536 (7.1)	44 (6.9)	525 (8.2)	s 14 (4.3)	525 (14.7)	86 (4.3)	532 (5.1)
Massachusetts, US	s 68 (5.8)	582 (7.2)	32 (5.8)	528 (13.0)	s 16 (5.9)	583 (17.5)	84 (5.9)	567 (8.3)
Minnesota, US	r 57 (5.0)	561 (6.4)	43 (5.0)	543 (9.8)	r 15 (5.1)	550 (6.6)	85 (5.1)	553 (6.7)
North Carolina, US	s 58 (8.1)	534 (13.6)	42 (8.1)	520 (15.9)	s 14 (4.1)	533 (17.1)	86 (4.1)	527 (11.6)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.23: Instruction Limited by Disruptive or Uninterested Students

TIMSS 2011 4th Grade Science

Reported by Teachers

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Disruptive Students				Students in Classrooms Where Teachers Report Instruction Is Limited by Uninterested Students			
	Some or Not At All		A Lot		Some or Not At All		A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	95 (1.6)	417 (4.2)	5 (1.6)	406 (12.6)	88 (2.8)	417 (4.5)	12 (2.8)	408 (8.1)
Australia	r 86 (2.7)	523 (3.8)	14 (2.7)	497 (6.2)	r 94 (1.7)	521 (3.6)	6 (1.7)	494 (11.7)
Austria	90 (2.2)	533 (3.1)	10 (2.2)	518 (7.3)	93 (2.2)	533 (2.7)	7 (2.2)	513 (8.4)
Azerbaijan	99 (0.7)	440 (5.6)	1 (0.7)	~ ~	96 (1.2)	441 (5.5)	4 (1.2)	408 (19.2)
Bahrain	77 (4.0)	451 (4.0)	23 (4.0)	441 (8.7)	80 (3.5)	456 (4.0)	20 (3.5)	425 (9.3)
Belgium (Flemish)	92 (2.1)	510 (2.1)	8 (2.1)	492 (8.2)	97 (1.3)	510 (2.0)	3 (1.3)	473 (13.2)
Chile	72 (3.8)	489 (2.9)	28 (3.8)	462 (6.5)	82 (3.4)	483 (3.2)	18 (3.4)	470 (8.5)
Chinese Taipei	96 (1.6)	551 (2.3)	4 (1.6)	557 (13.6)	97 (1.4)	552 (2.3)	3 (1.4)	540 (20.2)
Croatia	93 (1.9)	516 (2.2)	7 (1.9)	520 (6.2)	95 (1.4)	517 (2.0)	5 (1.4)	504 (6.6)
Czech Republic	88 (2.6)	538 (2.6)	12 (2.6)	527 (10.2)	95 (1.4)	539 (2.3)	5 (1.4)	500 (19.3)
Denmark	88 (1.9)	530 (2.7)	12 (1.9)	529 (10.7)	93 (1.5)	530 (2.6)	7 (1.5)	532 (17.0)
England	94 (1.9)	532 (3.6)	6 (1.9)	494 (10.2)	96 (1.7)	532 (3.5)	4 (1.7)	491 (9.6)
Finland	90 (2.3)	571 (2.6)	10 (2.3)	562 (5.2)	98 (0.7)	571 (2.5)	2 (0.7)	~ ~
Georgia	97 (1.2)	456 (3.9)	3 (1.2)	423 (23.5)	95 (1.7)	455 (4.0)	5 (1.7)	444 (15.2)
Germany	89 (2.0)	532 (3.0)	11 (2.0)	503 (7.6)	97 (1.3)	529 (2.9)	3 (1.3)	517 (10.3)
Hong Kong SAR	89 (2.8)	537 (3.7)	11 (2.8)	513 (16.9)	96 (1.5)	535 (4.2)	4 (1.5)	522 (9.6)
Hungary	91 (2.1)	535 (4.1)	9 (2.1)	519 (8.1)	93 (1.8)	535 (3.9)	7 (1.8)	507 (16.2)
Iran, Islamic Rep. of	88 (2.4)	455 (4.0)	12 (2.4)	440 (14.2)	81 (3.2)	460 (4.4)	19 (3.2)	422 (10.1)
Ireland	90 (2.5)	518 (3.4)	10 (2.5)	502 (9.8)	96 (1.6)	517 (3.4)	4 (1.6)	509 (8.1)
Italy	76 (3.3)	527 (3.3)	24 (3.3)	521 (7.3)	87 (2.6)	527 (2.9)	13 (2.6)	516 (9.4)
Japan	94 (2.0)	558 (2.0)	6 (2.0)	563 (7.4)	97 (1.3)	559 (2.0)	3 (1.3)	561 (8.8)
Kazakhstan	99 (0.7)	495 (5.1)	1 (0.7)	~ ~	97 (1.4)	495 (5.2)	3 (1.4)	498 (20.9)
Korea, Rep. of	62 (3.7)	587 (2.6)	38 (3.7)	585 (3.0)	81 (3.5)	587 (2.4)	19 (3.5)	585 (4.0)
Kuwait	77 (3.5)	352 (5.4)	23 (3.5)	333 (10.7)	79 (3.2)	353 (5.6)	21 (3.2)	327 (10.9)
Lithuania	81 (2.3)	514 (2.7)	19 (2.3)	517 (6.1)	85 (2.4)	516 (2.7)	15 (2.4)	508 (7.4)
Malta	83 (0.1)	449 (2.0)	17 (0.1)	438 (3.5)	91 (0.1)	448 (2.1)	9 (0.1)	432 (4.7)
Morocco	86 (3.6)	265 (5.3)	14 (3.6)	248 (13.2)	70 (4.0)	273 (6.1)	30 (4.0)	241 (7.5)
Netherlands	r 90 (2.8)	531 (2.6)	10 (2.8)	527 (5.1)	r 98 (0.8)	530 (2.5)	2 (0.8)	~ ~
New Zealand	89 (1.5)	502 (2.5)	11 (1.5)	455 (5.7)	97 (0.9)	499 (2.4)	3 (0.9)	455 (15.5)
Northern Ireland	r 95 (2.0)	519 (2.9)	5 (2.0)	485 (23.3)	r 98 (1.2)	517 (3.1)	2 (1.2)	~ ~
Norway	91 (2.8)	496 (2.5)	9 (2.8)	481 (8.3)	98 (1.1)	494 (2.5)	2 (1.1)	~ ~
Oman	78 (2.7)	384 (4.7)	22 (2.7)	358 (6.3)	74 (2.8)	379 (4.1)	26 (2.8)	373 (9.1)
Poland	85 (2.6)	505 (2.8)	15 (2.6)	506 (6.5)	93 (1.7)	505 (2.6)	7 (1.7)	497 (9.8)
Portugal	88 (2.4)	522 (4.4)	12 (2.4)	519 (10.5)	85 (2.9)	522 (4.6)	15 (2.9)	519 (8.7)
Qatar	80 (3.1)	410 (4.9)	20 (3.1)	330 (11.5)	76 (3.2)	408 (5.2)	24 (3.2)	353 (11.8)
Romania	98 (0.8)	504 (6.1)	2 (0.8)	~ ~	93 (2.0)	508 (6.2)	7 (2.0)	458 (23.1)
Russian Federation	94 (1.8)	552 (3.7)	6 (1.8)	550 (10.7)	95 (1.8)	553 (3.6)	5 (1.8)	534 (7.9)
Saudi Arabia	86 (3.0)	431 (6.0)	14 (3.0)	415 (17.2)	81 (3.7)	434 (5.6)	19 (3.7)	409 (14.3)
Serbia	90 (2.2)	516 (3.1)	10 (2.2)	520 (6.2)	87 (2.6)	516 (3.2)	13 (2.6)	519 (8.9)
Singapore	91 (1.9)	585 (3.4)	9 (1.9)	566 (15.9)	92 (1.4)	587 (3.3)	8 (1.4)	531 (16.8)
Slovak Republic	96 (1.0)	532 (4.0)	4 (1.0)	512 (14.3)	94 (1.6)	534 (3.4)	6 (1.6)	497 (18.5)
Slovenia	66 (3.6)	524 (3.2)	34 (3.6)	514 (3.7)	84 (2.4)	521 (3.0)	16 (2.4)	514 (4.2)
Spain	87 (2.6)	511 (2.9)	13 (2.6)	475 (9.2)	83 (3.0)	512 (2.8)	17 (3.0)	475 (7.0)
Sweden	r 94 (1.8)	537 (3.1)	6 (1.8)	506 (11.2)	r 97 (1.4)	534 (3.2)	3 (1.4)	533 (14.0)
Thailand	94 (2.4)	475 (6.3)	6 (2.4)	438 (21.8)	89 (3.0)	479 (4.9)	11 (3.0)	419 (22.2)
Tunisia	79 (3.5)	347 (6.1)	21 (3.5)	340 (10.4)	77 (3.5)	352 (6.2)	23 (3.5)	324 (11.5)
Turkey	84 (2.4)	463 (5.1)	16 (2.4)	461 (8.6)	67 (3.1)	475 (4.5)	33 (3.1)	436 (9.3)
United Arab Emirates	86 (1.7)	436 (2.7)	14 (1.7)	401 (8.8)	88 (1.6)	436 (2.8)	12 (1.6)	395 (8.4)
United States	r 86 (1.6)	548 (2.2)	14 (1.6)	524 (6.5)	r 91 (1.1)	547 (2.3)	9 (1.1)	515 (6.7)
Yemen	85 (3.2)	206 (8.1)	15 (3.2)	211 (15.5)	79 (3.7)	208 (7.9)	21 (3.7)	203 (14.9)
International Avg.	87 (0.3)	488 (0.6)	13 (0.3)	472 (1.6)	89 (0.3)	489 (0.6)	11 (0.3)	463 (1.9)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) 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.

TIMSS & PIRLS International Study Center
Lynch School of Education, Boston College

Exhibit 8.23: Instruction Limited by Disruptive or Uninterested Students (Continued)

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Disruptive Students				Students in Classrooms Where Teachers Report Instruction Is Limited by Uninterested Students			
	Some or Not At All		A Lot		Some or Not At All		A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Sixth Grade Participants								
Botswana	90 (2.5)	375 (6.8)	10 (2.5)	344 (19.7)	82 (3.3)	382 (7.1)	18 (3.3)	327 (10.5)
Honduras	95 (1.3)	432 (6.3)	5 (1.3)	437 (11.8)	89 (2.6)	432 (6.7)	11 (2.6)	430 (11.2)
Yemen	87 (2.8)	344 (7.7)	13 (2.8)	349 (17.3)	81 (3.4)	348 (7.2)	19 (3.4)	329 (17.2)
Benchmarking Participants								
Alberta, Canada r	85 (3.1)	545 (3.0)	15 (3.1)	524 (4.5)	r 95 (1.8)	543 (2.9)	5 (1.8)	513 (8.4)
Ontario, Canada	81 (2.6)	528 (3.4)	19 (2.6)	529 (4.7)	93 (2.1)	530 (3.1)	7 (2.1)	501 (6.6)
Quebec, Canada	78 (4.1)	518 (3.2)	22 (4.1)	509 (4.6)	91 (2.5)	517 (2.9)	9 (2.5)	506 (5.7)
Abu Dhabi, UAE	84 (3.5)	419 (5.3)	16 (3.5)	390 (12.4)	87 (3.0)	418 (5.7)	13 (3.0)	389 (8.9)
Dubai, UAE r	94 (1.1)	473 (3.5)	6 (1.1)	406 (10.7)	r 95 (0.8)	475 (3.1)	5 (0.8)	364 (14.8)
Florida, US s	87 (3.9)	547 (4.1)	13 (3.9)	515 (14.4)	s 88 (2.6)	546 (3.9)	12 (2.6)	522 (15.5)
North Carolina, US	83 (4.7)	542 (4.5)	17 (4.7)	516 (11.8)	85 (3.2)	538 (5.1)	15 (3.2)	531 (10.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.24: Instruction Limited by Disruptive or Uninterested Students

TIMSS 2011 8th Grade Science

Reported by Teachers

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Disruptive Students					Students in Classrooms Where Teachers Report Instruction Is Limited by Uninterested Students				
	Some or Not At All		A Lot			Some or Not At All		A Lot		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement		Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	91 (1.6)	439 (3.5)	9 (1.6)	426 (7.3)		84 (1.8)	440 (3.4)	16 (1.8)	424 (5.2)	
Australia	s 87 (2.4)	533 (6.2)	13 (2.4)	488 (10.5)		s 91 (1.9)	531 (5.9)	9 (1.9)	480 (13.1)	
Bahrain	79 (2.8)	459 (3.0)	21 (2.8)	433 (6.5)		73 (3.5)	465 (3.5)	27 (3.5)	423 (6.1)	
Chile	63 (3.8)	470 (3.5)	37 (3.8)	444 (5.2)		62 (3.9)	468 (3.6)	38 (3.9)	448 (5.1)	
Chinese Taipei	81 (3.3)	568 (2.8)	19 (3.3)	547 (5.9)		65 (4.2)	572 (3.6)	35 (4.2)	549 (4.0)	
England	r 83 (2.7)	538 (5.9)	17 (2.7)	506 (11.1)		r 90 (2.0)	534 (5.7)	10 (2.0)	511 (10.9)	
Finland	86 (2.3)	554 (2.5)	14 (2.3)	537 (4.0)		89 (1.7)	554 (2.4)	11 (1.7)	536 (5.9)	
Georgia	91 (1.5)	419 (3.2)	9 (1.5)	434 (6.3)		86 (1.8)	420 (3.1)	14 (1.8)	419 (6.1)	
Ghana	91 (2.4)	310 (5.5)	9 (2.4)	274 (17.7)		94 (2.0)	309 (5.6)	6 (2.0)	261 (24.9)	
Hong Kong SAR	95 (1.7)	537 (3.3)	5 (1.7)	486 (34.9)		84 (3.1)	542 (3.5)	16 (3.1)	497 (14.4)	
Hungary	88 (1.4)	526 (3.0)	12 (1.4)	502 (6.5)		87 (1.7)	526 (3.0)	13 (1.7)	498 (7.2)	
Indonesia	97 (1.2)	404 (4.5)	3 (1.2)	450 (15.9)		91 (2.0)	403 (4.7)	9 (2.0)	429 (8.9)	
Iran, Islamic Rep. of	91 (1.8)	476 (4.3)	9 (1.8)	457 (11.6)		73 (2.8)	483 (4.1)	27 (2.8)	453 (7.2)	
Israel	65 (3.9)	532 (4.8)	35 (3.9)	492 (7.8)		72 (3.6)	529 (4.5)	28 (3.6)	489 (9.1)	
Italy	80 (3.2)	506 (2.8)	20 (3.2)	487 (9.0)		69 (3.7)	509 (2.9)	31 (3.7)	487 (5.9)	
Japan	97 (1.3)	558 (2.5)	3 (1.3)	542 (12.2)		97 (1.4)	558 (2.5)	3 (1.4)	533 (7.4)	
Jordan	70 (3.8)	459 (4.8)	30 (3.8)	425 (7.8)		64 (3.4)	460 (5.2)	36 (3.4)	429 (7.6)	
Kazakhstan	98 (0.7)	491 (4.2)	2 (0.7)	~ ~		97 (0.8)	491 (4.2)	3 (0.8)	499 (20.0)	
Korea, Rep. of	63 (3.7)	561 (2.7)	37 (3.7)	558 (3.1)		74 (3.4)	561 (2.4)	26 (3.4)	557 (3.0)	
Lebanon	84 (2.2)	407 (5.0)	16 (2.2)	403 (12.3)		84 (2.6)	408 (5.2)	16 (2.6)	394 (12.0)	
Lithuania	74 (1.8)	519 (2.8)	26 (1.8)	503 (3.4)		77 (1.7)	519 (2.5)	23 (1.7)	498 (4.8)	
Macedonia, Rep. of	91 (1.3)	412 (5.6)	9 (1.3)	387 (12.6)		85 (1.6)	414 (5.6)	15 (1.6)	387 (11.0)	
Malaysia	97 (1.3)	424 (6.4)	3 (1.3)	458 (30.1)		86 (2.6)	437 (6.2)	14 (2.6)	358 (14.9)	
Morocco	73 (2.4)	376 (2.7)	27 (2.4)	377 (4.1)		53 (2.1)	384 (3.0)	47 (2.1)	368 (3.4)	
New Zealand	82 (2.6)	519 (4.7)	18 (2.6)	476 (8.6)		86 (2.5)	518 (5.0)	14 (2.5)	474 (9.6)	
Norway	94 (1.8)	495 (2.6)	6 (1.8)	471 (16.8)		97 (2.0)	495 (2.6)	3 (2.0)	449 (41.0)	
Oman	82 (2.5)	424 (4.2)	18 (2.5)	398 (7.8)		62 (3.1)	431 (4.4)	38 (3.1)	401 (6.3)	
Palestinian Nat'l Auth.	67 (3.8)	424 (4.4)	33 (3.8)	413 (5.8)		59 (3.8)	423 (4.9)	41 (3.8)	417 (4.8)	
Qatar	85 (2.2)	426 (4.4)	15 (2.2)	372 (10.7)		79 (2.7)	430 (4.3)	21 (2.7)	375 (8.2)	
Romania	92 (1.2)	466 (3.6)	8 (1.2)	455 (6.1)		86 (1.9)	468 (3.7)	14 (1.9)	446 (6.5)	
Russian Federation	87 (1.3)	546 (3.6)	13 (1.3)	520 (4.9)		87 (1.6)	547 (3.5)	13 (1.6)	516 (5.9)	
Saudi Arabia	83 (3.0)	438 (4.5)	17 (3.0)	431 (6.9)		81 (3.2)	441 (4.5)	19 (3.2)	416 (7.7)	
Singapore	89 (1.9)	596 (4.5)	11 (1.9)	543 (13.8)		88 (1.9)	596 (4.4)	12 (1.9)	545 (12.2)	
Slovenia	71 (2.1)	544 (2.7)	29 (2.1)	539 (4.1)		76 (2.1)	545 (2.6)	24 (2.1)	537 (4.3)	
Sweden	r 88 (2.2)	515 (2.8)	12 (2.2)	481 (8.5)		r 92 (1.9)	513 (3.0)	8 (1.9)	486 (6.5)	
Syrian Arab Republic	76 (3.5)	428 (4.8)	24 (3.5)	421 (8.2)		67 (3.5)	433 (5.0)	33 (3.5)	412 (6.1)	
Thailand	95 (1.8)	450 (4.1)	5 (1.8)	459 (12.5)		87 (2.7)	453 (4.3)	13 (2.7)	430 (10.4)	
Tunisia	74 (3.3)	439 (2.8)	26 (3.3)	437 (5.2)		74 (3.7)	442 (3.0)	26 (3.7)	429 (3.9)	
Turkey	69 (3.3)	491 (4.7)	31 (3.3)	467 (4.9)		57 (3.5)	496 (5.3)	43 (3.5)	466 (4.5)	
Ukraine	86 (2.4)	504 (3.9)	14 (2.4)	484 (7.6)		65 (3.1)	509 (4.5)	35 (3.1)	486 (4.8)	
United Arab Emirates	84 (1.9)	464 (2.6)	16 (1.9)	450 (6.9)		80 (2.3)	468 (2.7)	20 (2.3)	438 (7.3)	
United States	s 83 (1.8)	534 (3.6)	17 (1.8)	509 (7.9)		s 82 (2.2)	534 (3.7)	18 (2.2)	515 (6.8)	
International Avg.	83 (0.4)	481 (0.6)	17 (0.4)	462 (1.8)		79 (0.4)	482 (0.6)	21 (0.4)	456 (1.7)	

( ) 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 less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.24: Instruction Limited by Disruptive or Uninterested Students (Continued)

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Disruptive Students					Students in Classrooms Where Teachers Report Instruction Is Limited by Uninterested Students				
	Some or Not At All		A Lot			Some or Not At All		A Lot		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement		Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Ninth Grade Participants										
Botswana	67 (3.7)	406 (4.5)	33 (3.7)	400 (6.5)		46 (3.9)	421 (5.6)	54 (3.9)	390 (5.0)	
Honduras	81 (3.9)	372 (4.9)	19 (3.9)	360 (10.1)		71 (3.9)	370 (5.2)	29 (3.9)	368 (7.7)	
South Africa	78 (3.3)	328 (4.4)	22 (3.3)	338 (10.7)		73 (3.5)	327 (4.5)	27 (3.5)	335 (8.6)	
Benchmarking Participants										
Alberta, Canada	85 (2.7)	547 (2.7)	15 (2.7)	541 (5.6)		91 (2.2)	548 (2.5)	9 (2.2)	530 (8.3)	
Ontario, Canada	85 (2.8)	523 (2.9)	15 (2.8)	510 (7.3)		89 (2.6)	523 (2.8)	11 (2.6)	504 (7.7)	
Quebec, Canada	71 (3.5)	528 (3.4)	29 (3.5)	502 (6.1)		80 (3.1)	524 (3.3)	20 (3.1)	507 (7.4)	
Abu Dhabi, UAE	79 (3.7)	466 (5.2)	21 (3.7)	443 (6.2)		74 (3.8)	466 (5.3)	26 (3.8)	446 (6.3)	
Dubai, UAE	r 85 (4.0)	488 (3.6)	15 (4.0)	441 (17.1)	r	84 (4.0)	490 (3.6)	16 (4.0)	431 (18.4)	
Alabama, US	s 79 (6.1)	490 (8.9)	21 (6.1)	468 (12.4)	s	66 (8.2)	496 (8.5)	34 (8.2)	465 (11.2)	
California, US	s 76 (4.6)	513 (7.4)	24 (4.6)	479 (14.1)	s	78 (4.7)	511 (8.1)	22 (4.7)	484 (10.7)	
Colorado, US	s 88 (4.0)	549 (5.8)	12 (4.0)	520 (19.4)	s	84 (5.8)	547 (6.7)	16 (5.8)	534 (15.4)	
Connecticut, US	s 79 (5.2)	549 (7.8)	21 (5.2)	486 (15.4)	s	82 (4.9)	543 (8.3)	18 (4.9)	503 (17.9)	
Florida, US	x x	x x	x x	x x		x x	x x	x x	x x	
Indiana, US	s 85 (4.4)	535 (5.2)	15 (4.4)	509 (14.8)	s	83 (4.2)	531 (5.2)	17 (4.2)	531 (14.4)	
Massachusetts, US	s 89 (4.0)	570 (8.8)	11 (4.0)	525 (33.2)	s	93 (3.3)	576 (6.4)	7 (3.3)	488 (37.0)	
Minnesota, US	r 87 (4.6)	558 (5.8)	13 (4.6)	524 (34.2)	r	92 (2.5)	556 (5.9)	8 (2.5)	527 (10.2)	
North Carolina, US	s 76 (6.4)	536 (11.4)	24 (6.4)	502 (20.0)	s	74 (6.8)	534 (12.7)	26 (6.8)	512 (17.9)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Instruction Limited by Disruptive or Uninterested Students

The importance of classroom management and maintaining a positive and productive classroom environment is widely recognized as central to high-quality teaching (Bill & Melinda Gates Foundation, 2010). Yet, even the most experienced and effective teachers can encounter discipline problems.

Exhibit 8.23 presents teachers' reports about the extent to which their fourth grade classroom instruction in science was limited by disruptive or uninterested students. As good news, internationally, on average, teachers reported their instruction was rarely limited by either disruptive or bored students, with 87 to 89 percent of the fourth grade students in classrooms with some or no problems. However, the 11 to 13 percent of students in classrooms with a lot of student behavior problems did have lower average science achievement (from 16–26 points). Across the fourth grade, sixth grade, and benchmarking participants there was some variation in teachers' reports about disruptive and uninterested students. In general, however, teachers reported that their fourth grade students around the world appear relatively well behaved and attentive during their science lessons.

Exhibit 8.24 presents teachers' reports about the extent to which their eighth grade classroom instruction in science was limited by disruptive or uninterested students. Internationally, on average, teachers reported their instruction was limited "some or not at all" by disruptive students for 83 percent of the students and by bored students for 79 percent of the students. Although most of the eighth grade students were in science classrooms with attentive students, the 17 to 21 percent of students in classrooms with "a lot" of student behavior problems had lower average science achievement (from 19–26 points). Across the eighth grade, ninth grade, and benchmarking participants there was some variation in teachers' reports. Compared to the fourth grade, however, boredom appears to be an emerging problem in science classes at the eighth grade. It is difficult to know whether students are bored because they cannot do the science, or whether they just find science boring.

Classroom Resources and Activities for Teaching Science

Resources Teachers Use for Teaching Science

Exhibit 8.25 contains teachers' reports about the classroom materials used for teaching science at the fourth grade. On average, internationally, textbooks were used most often as the basis for science instruction, for 70 percent of the fourth grade students, and workbooks or worksheets were used the next most often, for 41 percent of the students. Science equipment and materials were used as the basis of instruction for 36 percent of the fourth grade students, and relying on computer software was relatively rare, used for only 11 percent of the students, on average. Teachers reported that all of the materials TIMSS asked about were used to some extent as supplementary resources for science instruction at the fourth grade, with science equipment and materials the most popular, used with 60 percent of the students, followed by workbooks or worksheets used with 56 percent of the students, on average. Teachers reported using computer software as a supplementary resource for 53 percent of the fourth grade students, on average.

As shown in Exhibit 8.26, textbooks also were the most frequent basis of science instruction at the eighth grade, used with 74 percent of the students internationally, on average. However, in contrast to the fourth grade, science equipment and materials were the next most frequently reported basis for instruction, used with 43 percent of the eighth grade students. Workbooks or worksheets were less frequently used than at the fourth grade (35% of students on average) but still heavily used in some countries. Computer software was more frequently reported as a basis for instruction than at the fourth grade, but was not used with many students—only 16 percent, on average. All of the following materials except textbooks were popular as supplementary instructional resources at the eighth grade: workbooks or worksheets, with 60 percent of students; science equipment and materials, with 54 percent; and computer software, with 61 percent.

Exhibit 8.25: Resources Teachers Use for Teaching Science

TIMSS 2011 4th Grade Science

Reported by Teachers

Country	Percent of Students Whose Teachers Use							
	Textbooks		Workbooks or Worksheets		Science Equipment and Materials		Computer Software for Science Instruction	
	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement
Armenia	r 97 (1.0)	2 (0.8)	r 6 (1.7)	58 (4.1)	r 8 (2.6)	73 (3.3)	r 3 (1.3)	41 (4.5)
Australia	r 12 (2.4)	34 (3.6)	r 16 (3.2)	76 (3.7)	r 53 (4.4)	46 (4.4)	r 7 (2.3)	59 (4.4)
Austria	46 (3.3)	45 (3.2)	33 (2.9)	66 (2.9)	17 (2.4)	81 (2.4)	2 (0.7)	52 (3.7)
Azerbaijan	95 (1.7)	5 (1.6)	34 (3.8)	65 (3.9)	17 (3.0)	78 (3.3)	7 (2.0)	33 (3.6)
Bahrain	82 (4.7)	18 (4.7)	51 (4.5)	48 (4.6)	59 (4.3)	39 (4.4)	28 (3.2)	64 (3.7)
Belgium (Flemish)	37 (3.9)	40 (4.0)	74 (3.6)	26 (3.7)	23 (3.4)	76 (3.4)	5 (1.8)	70 (3.6)
Chile	r 32 (4.2)	68 (4.1)	r 37 (4.1)	58 (4.4)	r 16 (3.2)	62 (4.5)	r 6 (2.2)	60 (4.6)
Chinese Taipei	96 (1.7)	4 (1.7)	44 (4.1)	56 (4.1)	48 (4.2)	52 (4.2)	28 (3.8)	69 (3.7)
Croatia	94 (1.3)	6 (1.3)	29 (3.4)	71 (3.4)	12 (2.4)	88 (2.4)	4 (1.0)	42 (3.3)
Czech Republic	81 (3.3)	17 (3.2)	45 (3.8)	52 (3.8)	24 (3.8)	75 (3.9)	4 (1.6)	63 (3.9)
Denmark	s 43 (4.2)	51 (4.2)	s 24 (3.8)	65 (4.1)	s 39 (3.7)	60 (3.7)	s 9 (2.7)	79 (3.5)
England	r 4 (1.0)	45 (5.0)	r 4 (1.6)	82 (3.5)	r 62 (4.9)	38 (4.9)	r 15 (3.5)	74 (3.6)
Finland	94 (1.8)	6 (1.5)	40 (3.0)	54 (3.3)	7 (1.9)	90 (2.4)	1 (0.6)	61 (3.1)
Georgia	99 (0.5)	0 (0.4)	54 (4.1)	46 (4.1)	4 (1.5)	77 (3.2)	2 (0.9)	45 (4.1)
Germany	28 (2.9)	48 (3.5)	58 (3.5)	41 (3.5)	23 (2.9)	75 (2.9)	1 (0.0)	40 (3.2)
Hong Kong SAR	95 (1.6)	3 (1.6)	46 (4.7)	54 (4.6)	19 (3.3)	80 (3.5)	36 (4.2)	59 (4.4)
Hungary	89 (2.6)	11 (2.6)	70 (3.3)	28 (3.4)	30 (3.4)	69 (3.5)	5 (1.5)	37 (3.6)
Iran, Islamic Rep. of	94 (1.9)	6 (1.9)	15 (3.3)	79 (3.5)	42 (3.5)	57 (3.5)	2 (0.6)	22 (3.8)
Ireland	38 (3.6)	50 (3.7)	12 (2.3)	85 (2.6)	55 (3.8)	45 (3.8)	8 (2.1)	63 (3.3)
Italy	70 (3.6)	28 (3.5)	23 (3.3)	76 (3.2)	9 (2.0)	74 (3.2)	3 (1.3)	35 (3.6)
Japan	82 (3.3)	17 (3.2)	17 (3.2)	76 (3.6)	62 (4.0)	38 (4.0)	2 (1.1)	52 (4.2)
Kazakhstan	87 (3.2)	11 (2.9)	13 (2.8)	86 (2.9)	21 (3.2)	75 (3.6)	10 (2.8)	72 (3.6)
Korea, Rep. of	96 (1.7)	3 (1.6)	86 (2.9)	13 (3.0)	50 (4.0)	50 (4.1)	36 (3.8)	55 (3.7)
Kuwait	93 (2.0)	5 (1.8)	77 (3.7)	23 (3.7)	91 (2.3)	9 (2.3)	28 (3.8)	66 (3.9)
Lithuania	92 (1.7)	8 (1.7)	70 (3.6)	30 (3.5)	12 (2.2)	84 (2.3)	10 (1.8)	67 (2.9)
Malta	34 (0.1)	18 (0.1)	34 (0.1)	58 (0.1)	54 (0.1)	39 (0.1)	28 (0.1)	54 (0.1)
Morocco	r 91 (2.1)	8 (1.9)	r 68 (3.4)	28 (3.4)	r 59 (5.0)	28 (4.4)	r 7 (2.0)	12 (2.6)
Netherlands	r 74 (4.2)	13 (3.0)	r 72 (4.4)	26 (4.3)	r 4 (1.8)	78 (5.0)	r 3 (1.0)	31 (5.5)
New Zealand	5 (1.4)	43 (3.0)	9 (1.8)	81 (2.4)	46 (3.3)	50 (3.1)	13 (2.2)	61 (3.4)
Northern Ireland	r 9 (2.4)	52 (4.6)	r 16 (3.0)	82 (3.2)	r 33 (4.8)	66 (4.8)	r 11 (2.8)	69 (4.1)
Norway	83 (3.7)	15 (3.5)	39 (5.2)	61 (5.2)	13 (2.7)	82 (3.3)	12 (3.1)	59 (5.0)
Oman	58 (3.1)	40 (3.0)	46 (3.1)	54 (3.1)	42 (2.9)	56 (2.9)	6 (1.2)	75 (2.7)
Poland	69 (3.8)	26 (3.5)	58 (3.8)	42 (3.9)	12 (2.6)	70 (3.2)	3 (1.3)	49 (4.1)
Portugal	62 (5.0)	38 (5.0)	34 (4.0)	64 (4.1)	35 (4.9)	60 (4.8)	4 (1.2)	64 (4.5)
Qatar	75 (2.9)	20 (3.1)	57 (2.9)	42 (3.1)	62 (3.2)	38 (3.2)	44 (4.7)	41 (5.1)
Romania	94 (1.7)	6 (1.7)	36 (4.1)	64 (4.2)	26 (3.1)	72 (3.0)	5 (1.8)	47 (3.8)
Russian Federation	94 (1.7)	6 (1.7)	48 (4.2)	51 (4.1)	9 (1.9)	88 (2.2)	3 (1.2)	56 (2.9)
Saudi Arabia	96 (1.6)	4 (1.5)	52 (4.0)	47 (3.9)	72 (3.9)	24 (3.7)	36 (4.0)	47 (4.5)
Serbia	77 (2.9)	23 (2.9)	16 (3.1)	82 (3.2)	15 (2.7)	79 (3.2)	3 (1.0)	20 (3.1)
Singapore	68 (2.7)	27 (2.5)	69 (2.6)	31 (2.6)	60 (2.5)	40 (2.5)	19 (2.0)	78 (2.3)
Slovak Republic	92 (1.8)	8 (1.8)	39 (3.0)	59 (3.2)	16 (2.4)	83 (2.5)	5 (1.5)	66 (3.0)
Slovenia	89 (2.4)	10 (2.2)	50 (3.8)	48 (3.9)	45 (3.8)	55 (3.8)	4 (1.3)	72 (3.4)
Spain	87 (2.5)	12 (2.5)	34 (3.7)	64 (3.7)	5 (1.9)	82 (3.2)	4 (1.8)	64 (3.2)
Sweden	r 36 (4.4)	55 (4.3)	r 19 (3.8)	68 (4.7)	r 44 (4.7)	53 (4.8)	r 3 (1.4)	30 (4.4)
Thailand	69 (4.4)	31 (4.4)	47 (4.5)	52 (4.5)	50 (4.4)	48 (4.5)	12 (3.2)	59 (4.3)
Tunisia	44 (5.0)	55 (4.9)	66 (3.8)	33 (3.6)	91 (2.5)	7 (2.1)	10 (2.3)	30 (4.4)
Turkey	93 (1.5)	6 (1.4)	43 (3.0)	56 (3.1)	33 (3.3)	65 (3.4)	19 (2.8)	56 (3.1)
United Arab Emirates	75 (2.0)	18 (2.1)	53 (2.4)	46 (2.4)	64 (2.0)	35 (2.0)	31 (2.1)	53 (2.3)
United States	r 46 (2.6)	40 (2.6)	r 23 (2.0)	71 (1.9)	r 46 (2.7)	53 (2.7)	r 8 (1.3)	56 (2.6)
Yemen	89 (2.7)	11 (2.7)	47 (4.7)	50 (4.7)	43 (4.8)	37 (4.5)	2 (1.2)	9 (2.1)
International Avg.	70 (0.4)	22 (0.4)	41 (0.5)	56 (0.5)	36 (0.5)	60 (0.5)	11 (0.3)	53 (0.5)

( ) 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.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.25: Resources Teachers Use for Teaching Science (Continued)

Country	Percent of Students Whose Teachers Use							
	Textbooks		Workbooks or Worksheets		Science Equipment and Materials		Computer Software for Science Instruction	
	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement
Sixth Grade Participants								
Botswana	r 67 (4.7)	33 (4.7)	r 17 (3.8)	43 (4.9)	r 48 (4.7)	46 (4.9)	r 2 (1.1)	8 (2.4)
Honduras	93 (2.2)	6 (2.0)	35 (4.0)	61 (4.3)	14 (3.3)	48 (3.9)	3 (1.4)	24 (4.3)
Yemen	81 (3.7)	19 (3.7)	59 (3.5)	36 (3.6)	40 (4.4)	40 (3.9)	1 (0.6)	7 (1.8)
Benchmarking Participants								
Alberta, Canada	r 2 (1.1)	22 (3.1)	r 23 (3.1)	70 (3.6)	r 72 (3.3)	28 (3.3)	r 7 (2.0)	80 (3.6)
Ontario, Canada	r 33 (3.7)	54 (3.5)	r 28 (3.4)	69 (3.4)	r 36 (3.8)	61 (3.8)	r 7 (1.7)	51 (3.9)
Quebec, Canada	23 (3.7)	40 (4.5)	42 (4.3)	52 (4.5)	31 (4.0)	66 (4.2)	2 (1.2)	26 (3.4)
Abu Dhabi, UAE	70 (3.6)	16 (3.4)	63 (3.8)	36 (3.8)	68 (3.6)	31 (3.6)	34 (4.0)	52 (4.4)
Dubai, UAE	r 57 (3.7)	36 (3.8)	r 28 (1.8)	71 (1.9)	r 56 (2.6)	44 (2.6)	r 25 (2.4)	61 (2.3)
Florida, US	s 64 (5.5)	34 (5.3)	s 24 (4.8)	68 (5.4)	s 32 (6.3)	62 (6.1)	s 24 (5.6)	53 (5.5)
North Carolina, US	r 26 (6.2)	45 (6.2)	r 8 (3.5)	79 (5.2)	r 62 (7.4)	34 (6.9)	r 14 (4.3)	62 (6.2)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.26: Resources Teachers Use for Teaching Science

TIMSS 2011 Science 8th Grade

Reported by Teachers

Country	Percent of Students Whose Teachers Use							
	Textbooks		Workbooks or Worksheets		Science Equipment and Materials		Computer Software for Science Instruction	
	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement
Armenia	96 (0.8)	4 (0.8)	29 (2.3)	67 (2.5)	16 (1.8)	78 (2.0)	5 (0.9)	75 (2.2)
Australia	s 45 (3.5)	51 (3.3)	s 34 (2.9)	65 (2.9)	s 47 (4.3)	53 (4.3)	s 12 (2.3)	77 (2.7)
Bahrain	86 (2.3)	14 (2.3)	49 (3.1)	51 (3.1)	47 (2.9)	50 (3.1)	28 (2.8)	70 (3.0)
Chile	44 (4.3)	56 (4.3)	28 (3.4)	62 (4.0)	25 (3.4)	65 (4.1)	13 (2.7)	67 (3.9)
Chinese Taipei	92 (1.9)	7 (1.7)	31 (4.1)	66 (4.0)	13 (2.4)	86 (2.5)	9 (2.1)	69 (3.6)
England	r 8 (1.9)	78 (2.7)	r 21 (3.0)	76 (3.2)	r 62 (3.7)	37 (3.7)	r 29 (3.2)	67 (3.2)
Finland	78 (2.0)	22 (2.0)	26 (2.0)	67 (2.3)	38 (2.1)	62 (2.2)	3 (0.6)	64 (2.1)
Georgia	96 (0.9)	4 (0.9)	55 (2.7)	44 (2.8)	15 (1.7)	77 (1.5)	3 (0.8)	66 (2.6)
Ghana	60 (3.3)	39 (3.4)	18 (3.1)	60 (3.6)	34 (3.8)	50 (3.9)	1 (0.7)	16 (3.3)
Hong Kong SAR	87 (3.4)	12 (3.2)	42 (4.2)	58 (4.2)	56 (4.2)	44 (4.2)	32 (4.4)	62 (4.8)
Hungary	87 (1.4)	13 (1.4)	47 (2.2)	43 (2.2)	44 (2.2)	55 (2.1)	7 (1.0)	55 (2.5)
Indonesia	97 (1.2)	3 (1.2)	22 (3.7)	78 (3.7)	52 (4.1)	47 (4.0)	4 (1.5)	59 (4.0)
Iran, Islamic Rep. of	93 (1.9)	7 (1.9)	7 (1.6)	76 (2.6)	37 (3.9)	60 (3.7)	7 (1.7)	34 (3.3)
Israel	75 (2.9)	20 (2.5)	63 (3.9)	35 (3.8)	68 (3.6)	29 (3.3)	27 (3.3)	53 (3.7)
Italy	79 (3.1)	20 (3.1)	20 (2.9)	75 (3.1)	10 (2.3)	73 (3.6)	4 (1.5)	47 (3.9)
Japan	71 (3.9)	29 (3.9)	30 (4.1)	69 (4.0)	65 (4.2)	35 (4.2)	3 (1.5)	49 (4.1)
Jordan	92 (2.1)	8 (2.1)	36 (3.6)	63 (3.6)	42 (3.2)	55 (3.3)	11 (2.3)	66 (3.4)
Kazakhstan	80 (2.0)	19 (2.0)	17 (1.6)	80 (1.7)	37 (2.4)	62 (2.4)	24 (2.2)	73 (2.2)
Korea, Rep. of	88 (2.5)	12 (2.5)	34 (3.8)	59 (4.1)	41 (3.8)	57 (3.8)	50 (3.8)	46 (3.9)
Lebanon	73 (3.0)	26 (3.0)	56 (3.5)	41 (3.5)	46 (3.6)	49 (3.6)	13 (2.2)	47 (3.2)
Lithuania	92 (1.4)	8 (1.4)	40 (1.9)	52 (2.2)	23 (1.6)	73 (1.9)	13 (1.5)	74 (1.7)
Macedonia, Rep. of	r 82 (2.1)	17 (2.0)	r 16 (1.8)	65 (2.7)	r 26 (2.1)	69 (2.2)	r 20 (2.0)	67 (2.3)
Malaysia	83 (2.5)	16 (2.3)	39 (3.8)	61 (3.8)	40 (3.4)	59 (3.4)	33 (3.8)	59 (3.8)
Morocco	35 (2.2)	64 (2.2)	50 (2.2)	43 (2.3)	81 (2.0)	15 (2.0)	14 (1.6)	46 (2.5)
New Zealand	16 (2.9)	77 (2.9)	23 (3.3)	74 (3.5)	48 (3.9)	52 (3.9)	14 (2.8)	70 (3.5)
Norway	92 (2.5)	8 (2.4)	25 (3.8)	73 (4.0)	33 (4.1)	66 (4.1)	4 (1.7)	79 (3.5)
Oman	67 (3.1)	33 (3.1)	33 (3.3)	65 (3.3)	43 (3.3)	57 (3.4)	11 (1.8)	77 (2.6)
Palestinian Nat'l Auth.	89 (2.5)	11 (2.5)	35 (3.8)	65 (3.8)	59 (3.9)	40 (3.9)	8 (2.4)	70 (3.4)
Qatar	59 (3.2)	39 (3.0)	61 (3.2)	37 (3.0)	60 (3.3)	38 (3.1)	45 (4.2)	47 (4.6)
Romania	85 (1.8)	15 (1.8)	53 (2.4)	45 (2.4)	50 (2.5)	47 (2.4)	16 (1.8)	63 (2.5)
Russian Federation	82 (1.4)	18 (1.4)	18 (1.4)	73 (1.6)	31 (1.6)	67 (1.7)	13 (0.9)	75 (1.5)
Saudi Arabia	91 (2.5)	7 (2.0)	46 (4.3)	50 (4.1)	65 (4.0)	30 (3.8)	42 (4.2)	45 (4.5)
Singapore	52 (2.3)	39 (2.5)	66 (2.7)	34 (2.7)	32 (2.8)	67 (2.8)	23 (2.4)	69 (2.4)
Slovenia	84 (1.5)	15 (1.6)	38 (2.2)	55 (2.3)	26 (1.8)	69 (1.8)	20 (2.0)	74 (2.0)
Sweden	r 76 (3.0)	23 (3.0)	r 14 (2.5)	77 (3.0)	r 63 (3.3)	37 (3.3)	r 1 (0.6)	47 (3.8)
Syrian Arab Republic	88 (2.4)	12 (2.3)	39 (4.2)	54 (4.1)	r 59 (3.3)	39 (3.1)	21 (3.5)	35 (4.1)
Thailand	72 (3.4)	27 (3.5)	47 (4.2)	53 (4.2)	37 (3.9)	63 (3.9)	10 (2.7)	74 (3.9)
Tunisia	54 (3.6)	44 (3.6)	53 (3.8)	44 (3.7)	83 (2.6)	13 (2.4)	7 (2.0)	45 (3.8)
Turkey	89 (2.0)	11 (2.0)	44 (3.3)	56 (3.3)	35 (3.2)	62 (3.4)	17 (2.8)	72 (3.1)
Ukraine	85 (1.8)	15 (1.8)	17 (1.7)	80 (1.8)	29 (2.4)	67 (2.5)	4 (0.9)	65 (3.2)
United Arab Emirates	80 (1.7)	17 (1.7)	51 (2.1)	47 (2.1)	58 (2.4)	41 (2.4)	30 (2.3)	59 (2.4)
United States	s 36 (3.2)	60 (3.1)	s 12 (2.1)	82 (2.3)	s 48 (3.0)	52 (3.0)	s 19 (2.3)	67 (2.4)
International Avg.	74 (0.4)	24 (0.4)	35 (0.5)	60 (0.5)	43 (0.5)	54 (0.5)	16 (0.4)	61 (0.5)

( ) 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 less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.26: Resources Teachers Use for Teaching Science (Continued)

Country	Percent of Students Whose Teachers Use							
	Textbooks		Workbooks or Worksheets		Science Equipment and Materials		Computer Software for Science Instruction	
	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement
Ninth Grade Participants								
Botswana	43 (4.5)	57 (4.4)	34 (4.0)	46 (4.1)	73 (4.0)	25 (3.9)	1 (1.0)	35 (4.2)
Honduras	68 (4.1)	28 (3.8)	29 (4.4)	60 (5.2)	25 (4.5)	65 (5.1)	1 (0.6)	22 (3.3)
South Africa	66 (3.6)	28 (3.2)	39 (3.8)	52 (3.7)	20 (3.0)	69 (3.6)	3 (1.0)	17 (2.9)
Benchmarking Participants								
Alberta, Canada	47 (3.9)	50 (3.9)	20 (3.0)	75 (3.4)	41 (3.8)	58 (3.9)	24 (3.4)	60 (3.7)
Ontario, Canada	r 54 (4.2)	44 (4.1)	r 15 (3.0)	78 (3.3)	r 34 (3.5)	66 (3.5)	r 5 (1.9)	69 (4.1)
Quebec, Canada	41 (4.4)	55 (4.6)	44 (4.3)	53 (4.4)	46 (4.2)	53 (4.2)	6 (1.9)	40 (4.1)
Abu Dhabi, UAE	70 (3.5)	26 (3.7)	58 (3.5)	39 (3.6)	59 (3.6)	39 (3.7)	31 (3.9)	57 (4.4)
Dubai, UAE	r 74 (2.4)	21 (2.3)	r 35 (2.4)	63 (2.4)	r 53 (4.6)	47 (4.6)	r 34 (4.6)	61 (4.6)
Alabama, US	s 34 (6.2)	62 (6.4)	s 7 (3.1)	90 (3.2)	s 50 (7.9)	50 (7.9)	s 17 (5.1)	77 (6.1)
California, US	s 53 (5.8)	46 (5.8)	s 22 (4.0)	73 (4.6)	s 36 (5.4)	64 (5.4)	s 18 (4.2)	65 (4.9)
Colorado, US	s 30 (7.4)	64 (6.5)	s 6 (3.4)	89 (4.1)	s 63 (6.7)	37 (6.7)	s 7 (3.1)	82 (3.6)
Connecticut, US	s 24 (4.9)	72 (5.1)	s 13 (4.1)	85 (4.5)	s 52 (6.3)	47 (6.4)	s 20 (5.6)	65 (6.0)
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x
Indiana, US	s 37 (6.3)	60 (6.1)	s 14 (5.2)	82 (6.3)	s 40 (5.7)	60 (5.7)	s 8 (3.0)	77 (5.5)
Massachusetts, US	s 39 (7.8)	57 (7.6)	s 13 (4.6)	85 (4.8)	s 62 (7.2)	38 (7.2)	s 11 (3.6)	69 (6.6)
Minnesota, US	r 34 (6.5)	63 (7.1)	r 19 (5.7)	76 (5.9)	r 60 (6.5)	40 (6.5)	r 21 (5.7)	71 (6.7)
North Carolina, US	s 34 (8.0)	60 (8.4)	s 21 (7.3)	74 (7.5)	s 38 (6.9)	62 (6.9)	s 22 (5.1)	68 (7.3)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Teacher Emphasis on Science Investigation

As noted in the TIMSS 2011 Science Assessment Framework, one of the ways in which students have been encouraged to build upon their knowledge and understanding of science is through the process of scientific inquiry, and, as documented in the *TIMSS 2011 Encyclopedia*, the contemporary science curricula of many countries place considerable emphasis on engaging students in this process. For example, the most recent recommendations for effective instructional practices of the US National Research Council include an emphasis on inquiry activities (National Research Council, 2011). A recent meta-analysis across 138 studies indicated that using some level of inquiry-based instruction had a positive relationship with student understanding and retention of science content. In particular, instruction emphasizing active thinking and drawing conclusions from data or providing hands-on experience with scientific phenomena were associated with increased likelihood of scientific understanding (Minner, Levy, & Century, 2009).

Previous TIMSS studies have presented teachers' reports about the frequency with which they engaged in a range of inquiry-related activities. TIMSS 2011 takes this approach further, using IRT scales to summarize teacher reports at the fourth and eighth grades. The Emphasize Science Investigation scale at the fourth grade is based on teacher reports of how often, in teaching science, teachers ask students to engage in the following six activities:

- Observe natural phenomena such as the weather or a plant growing and describe what they see;
- Watch me (the teacher) demonstrate an experiment or investigation;
- Design or plan experiments or investigations;
- Conduct experiments or investigations;
- Give explanations about something they are studying; and
- Relate what they are learning in science to their daily lives.

Exhibit 8.27 presents the results for the fourth grade assessment. Students were categorized according to their teachers' responses, with **About Half the Lessons or More** corresponding to teachers who used all six activities in "about half the lessons," on average. All other students had teachers who emphasized science investigation in **Less than Half the Lessons**. As shown in the exhibit, teachers of science at the fourth grade vary widely across countries in their use of inquiry activities, with the percentage of students taught by teachers emphasizing science investigation in **About Half the Lessons or More** ranging from 4 percent in Norway to 80 to 86 percent in Iran and Tunisia. On average across the fourth grade countries, 40 percent of students were taught by teachers emphasizing science investigation in half tof he lessons or more, and 60 percent had teachers emphasizing investigation less frequently. This pattern was similar among the sixth grade and benchmarking participants. There was no relationship between emphasis on science investigation and average science achievement.

Exhibit 8.28 presents the results for the eighth grade on the Emphasize Science Investigation scale, which includes the six instructional activities from the fourth grade scale and one additional activity more suited to eighth grade students: "Use scientific formulas and laws to solve routine problems." Compared to the fourth grade, there was greater use of investigation in science instruction, with almost half of the students (48%) taught by teachers emphasizing investigation in **About Half the Lessons or More**. Although on average across countries, science achievement was somewhat higher among students whose teachers more frequently emphasize inquiry activities (479 vs. 474), both the frequency of inquiry activity use and its relationship with science achievement varied considerably across the eighth grade, ninth grade, and benchmarking participants.

Exhibit 8.27: Teachers Emphasize Science Investigation

Reported by Teachers

Students were scored according to their teachers' responses to how often they used each of six instructional activities on the *Emphasize Science Investigation* scale. Students with teachers who emphasized science investigation in **About Half the Lessons or More** had a score on the scale of at least 10.7, which corresponds to their teachers using all six activities in "about half the lessons," on average. All other students had teachers who emphasized science investigation in **Less than Half the Lessons**.

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	
Tunisia	86 (2.8)	349 (5.9)	14 (2.8)	323 (11.2)	12.1 (0.17)
Iran, Islamic Rep. of	80 (2.6)	452 (4.7)	20 (2.6)	455 (8.9)	11.9 (0.13)
United Arab Emirates	75 (2.0)	426 (3.2)	25 (2.0)	442 (6.1)	11.5 (0.10)
Oman	75 (3.1)	384 (4.3)	25 (3.1)	361 (8.3)	11.4 (0.10)
Thailand	74 (4.2)	482 (5.4)	26 (4.2)	441 (13.6)	11.3 (0.17)
Bahrain	74 (4.2)	454 (4.5)	26 (4.2)	436 (9.3)	11.3 (0.19)
Kuwait	73 (3.6)	349 (5.9)	27 (3.6)	341 (8.1)	11.2 (0.14)
Saudi Arabia	70 (4.0)	434 (5.7)	30 (4.0)	419 (11.5)	11.2 (0.17)
Romania	65 (3.6)	508 (6.4)	35 (3.6)	497 (10.1)	11.0 (0.13)
Qatar	63 (3.6)	394 (8.0)	37 (3.6)	391 (11.3)	10.9 (0.12)
Korea, Rep. of	58 (4.8)	588 (2.7)	42 (4.8)	585 (2.9)	10.7 (0.16)
Morocco r	57 (4.8)	265 (7.2)	43 (4.8)	256 (7.7)	10.8 (0.21)
Turkey	55 (3.6)	472 (5.6)	45 (3.6)	451 (7.4)	10.6 (0.15)
Chinese Taipei	54 (3.9)	557 (2.9)	46 (3.9)	546 (3.3)	10.4 (0.17)
Japan	51 (4.2)	558 (2.3)	49 (4.2)	559 (3.0)	10.4 (0.16)
Azerbaijan	51 (4.0)	434 (7.2)	49 (4.0)	442 (9.3)	10.4 (0.10)
Singapore	50 (2.6)	585 (4.6)	50 (2.6)	582 (4.9)	10.4 (0.11)
Italy	49 (3.2)	523 (4.1)	51 (3.2)	528 (3.5)	10.5 (0.11)
Kazakhstan	47 (3.9)	498 (6.9)	53 (3.9)	493 (7.6)	10.4 (0.11)
Chile r	45 (4.2)	478 (5.2)	55 (4.2)	484 (4.4)	10.4 (0.15)
Serbia	45 (3.8)	518 (3.8)	55 (3.8)	514 (4.7)	10.5 (0.12)
Ireland	43 (3.6)	519 (4.5)	57 (3.6)	513 (4.4)	10.0 (0.13)
Georgia	43 (3.7)	455 (5.7)	57 (3.7)	455 (5.2)	10.2 (0.08)
United States r	41 (2.9)	548 (3.3)	59 (2.9)	541 (3.2)	9.9 (0.10)
England r	41 (4.7)	535 (7.5)	59 (4.7)	524 (4.4)	10.0 (0.15)
Armenia r	36 (4.5)	409 (6.5)	64 (4.5)	420 (5.1)	10.0 (0.13)
Portugal	34 (4.1)	525 (7.2)	66 (4.1)	520 (4.1)	9.8 (0.22)
Australia r	34 (4.0)	535 (5.9)	66 (4.0)	511 (4.7)	9.1 (0.21)
Slovenia	33 (3.2)	517 (3.5)	67 (3.2)	522 (3.6)	9.8 (0.11)
Yemen	32 (4.6)	210 (10.2)	68 (4.6)	206 (9.2)	9.6 (0.17)
Russian Federation	32 (3.3)	554 (5.1)	68 (3.3)	551 (4.4)	10.0 (0.09)
Slovak Republic	29 (3.3)	534 (6.6)	71 (3.3)	530 (4.1)	9.8 (0.10)
Lithuania	27 (3.4)	518 (5.2)	73 (3.4)	513 (2.9)	9.9 (0.10)
Denmark s	26 (4.0)	536 (4.9)	74 (4.0)	527 (3.8)	9.1 (0.15)
Malta	25 (0.1)	446 (3.3)	75 (0.1)	447 (1.9)	9.5 (0.00)
Sweden r	24 (4.1)	535 (6.3)	76 (4.1)	535 (3.7)	9.0 (0.19)
Spain	23 (3.5)	512 (6.0)	77 (3.5)	504 (3.4)	9.8 (0.10)
Hungary	22 (3.1)	527 (7.9)	78 (3.1)	535 (4.3)	9.5 (0.12)
Croatia	21 (2.7)	513 (4.7)	79 (2.7)	517 (2.3)	9.9 (0.08)
Czech Republic	20 (3.3)	538 (4.7)	80 (3.3)	536 (2.9)	9.4 (0.10)
New Zealand	20 (2.4)	498 (6.5)	80 (2.4)	499 (2.4)	8.6 (0.13)
Finland	13 (2.3)	580 (4.9)	87 (2.3)	570 (2.7)	9.1 (0.10)
Northern Ireland r	13 (3.1)	510 (12.2)	87 (3.1)	518 (4.0)	8.0 (0.16)
Germany	12 (2.5)	520 (7.2)	88 (2.5)	531 (2.9)	8.8 (0.11)
Hong Kong SAR	12 (3.0)	536 (9.3)	88 (3.0)	535 (4.4)	8.7 (0.12)
Poland	11 (2.3)	494 (9.1)	89 (2.3)	506 (2.5)	8.7 (0.13)
Austria	8 (1.8)	534 (8.1)	92 (1.8)	531 (3.0)	8.2 (0.10)
Belgium (Flemish)	7 (1.6)	518 (8.9)	93 (1.6)	508 (2.0)	8.6 (0.10)
Netherlands r	5 (2.2)	542 (9.2)	95 (2.2)	530 (2.4)	8.3 (0.14)
Norway	4 (1.6)	493 (9.2)	96 (1.6)	494 (2.5)	7.5 (0.15)
International Avg.	40 (0.5)	488 (0.9)	60 (0.5)	484 (0.9)	

Centerpoint of scale set at 10.

( ) 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.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.27: Teachers Emphasize Science Investigation (Continued)

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	
Sixth Grade Participants						
Botswana		48 (4.6)	377 (10.8)	52 (4.6)	371 (7.8)	10.6 (0.19)
Honduras		45 (4.4)	442 (7.4)	55 (4.4)	421 (9.9)	10.4 (0.14)
Yemen		29 (4.3)	354 (12.0)	71 (4.3)	341 (8.8)	9.7 (0.15)
Benchmarking Participants						
Abu Dhabi, UAE		78 (3.9)	413 (5.2)	22 (3.9)	415 (14.2)	11.6 (0.17)
Dubai, UAE	r	73 (2.0)	454 (4.2)	27 (2.0)	494 (6.6)	11.4 (0.10)
Alberta, Canada	r	48 (4.5)	545 (4.4)	52 (4.5)	539 (4.4)	10.0 (0.14)
North Carolina, US	r	44 (6.2)	534 (7.0)	56 (6.2)	537 (5.4)	9.9 (0.23)
Florida, US	s	42 (5.6)	546 (7.1)	58 (5.6)	542 (5.7)	10.0 (0.24)
Quebec, Canada		36 (4.6)	522 (3.8)	64 (4.6)	513 (3.0)	9.7 (0.18)
Ontario, Canada		32 (3.7)	527 (5.2)	68 (3.7)	527 (3.4)	9.4 (0.12)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

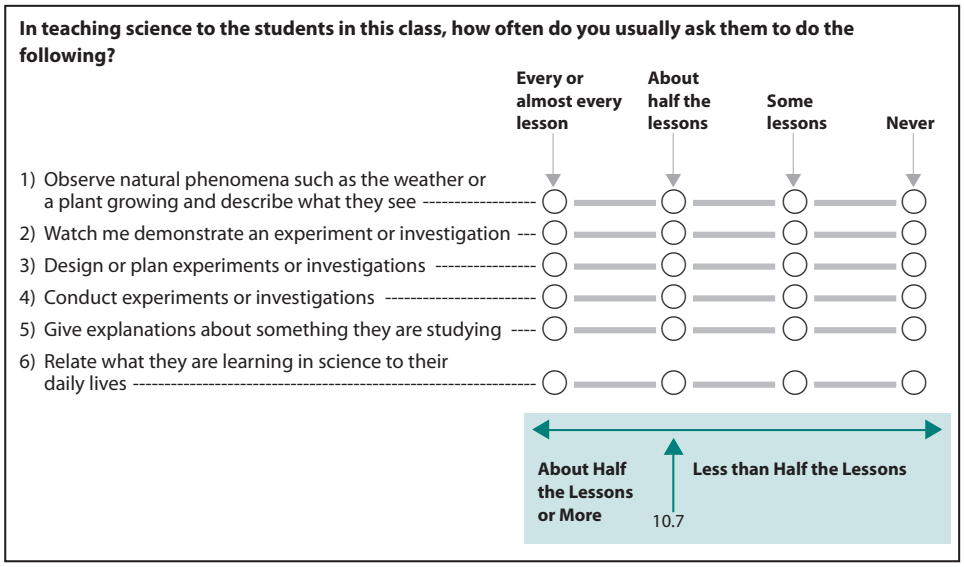


Exhibit 8.28: Teachers Emphasize Science Investigation

Reported by Teachers

Students were scored according to their teachers' responses to how often they used each of seven instructional activities on the *Emphasize Science Investigation* scale. Students with teachers who emphasized science investigation in **About Half the Lessons or More** had a score on the scale of at least 10.2, which corresponds to their teachers using all seven activities in "about half the lessons," on average. All other students had teachers who emphasized science investigation in **Less than Half the Lessons**.

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	
Jordan	82 (2.9)	453 (4.9)	18 (2.9)	436 (10.5)	11.3 (0.14)
Tunisia	74 (3.6)	440 (3.0)	26 (3.6)	433 (4.6)	11.1 (0.16)
Palestinian Nat'l Auth.	72 (3.7)	429 (4.2)	28 (3.7)	403 (6.4)	11.3 (0.18)
Oman	71 (3.2)	425 (4.3)	29 (3.2)	406 (9.5)	11.0 (0.12)
Lebanon	70 (2.5)	405 (5.6)	30 (2.5)	405 (7.6)	11.0 (0.12)
Qatar	69 (3.3)	423 (6.4)	31 (3.3)	410 (13.5)	10.9 (0.18)
Saudi Arabia	67 (3.7)	438 (4.8)	33 (3.7)	434 (6.0)	10.7 (0.16)
Thailand	67 (4.2)	449 (5.0)	33 (4.2)	453 (9.0)	10.7 (0.16)
Ghana	67 (4.2)	310 (7.2)	33 (4.2)	299 (8.9)	11.1 (0.22)
Romania	65 (2.2)	466 (3.9)	35 (2.2)	462 (4.8)	10.8 (0.10)
Iran, Islamic Rep. of	65 (3.3)	479 (4.8)	35 (3.3)	465 (6.3)	10.7 (0.11)
Morocco	64 (2.3)	380 (2.8)	36 (2.3)	370 (3.4)	10.8 (0.08)
United Arab Emirates	62 (2.5)	458 (3.3)	38 (2.5)	468 (4.7)	10.7 (0.12)
Syrian Arab Republic	59 (3.7)	424 (5.0)	41 (3.7)	430 (5.9)	10.3 (0.12)
Turkey	59 (3.6)	482 (5.4)	41 (3.6)	483 (5.9)	10.5 (0.13)
Kazakhstan	58 (2.4)	492 (5.3)	42 (2.4)	489 (5.1)	10.5 (0.09)
Indonesia	54 (3.6)	405 (7.0)	46 (3.6)	406 (5.3)	10.3 (0.12)
Malaysia	53 (3.8)	433 (7.4)	47 (3.8)	417 (9.6)	10.2 (0.14)
Bahrain	52 (2.7)	462 (3.6)	48 (2.7)	444 (3.1)	10.4 (0.09)
Ukraine	52 (2.7)	503 (3.8)	48 (2.7)	498 (4.1)	10.1 (0.07)
Macedonia, Rep. of r	51 (2.2)	419 (6.2)	49 (2.2)	407 (6.5)	10.3 (0.11)
United States s	47 (2.4)	537 (5.2)	53 (2.4)	524 (4.2)	9.7 (0.10)
Chile	47 (4.1)	462 (3.8)	53 (4.1)	459 (4.4)	10.0 (0.14)
Georgia	47 (2.2)	420 (3.8)	53 (2.2)	420 (3.3)	10.1 (0.08)
Israel	38 (3.4)	505 (7.4)	62 (3.4)	526 (5.4)	9.5 (0.15)
Russian Federation	38 (2.1)	548 (3.1)	62 (2.1)	539 (3.7)	9.7 (0.07)
England r	37 (2.9)	544 (9.1)	63 (2.9)	525 (6.4)	9.4 (0.12)
Armenia	36 (2.4)	443 (4.8)	64 (2.4)	435 (3.6)	9.7 (0.06)
Hong Kong SAR	36 (4.0)	553 (6.1)	64 (4.0)	526 (5.1)	9.4 (0.16)
Korea, Rep. of	35 (3.8)	565 (3.3)	65 (3.8)	557 (2.4)	9.6 (0.10)
New Zealand	35 (3.6)	510 (7.1)	65 (3.6)	513 (6.3)	9.3 (0.11)
Australia s	34 (3.2)	523 (10.6)	66 (3.2)	528 (6.0)	9.2 (0.14)
Finland	32 (2.0)	558 (2.9)	68 (2.0)	549 (2.6)	9.3 (0.09)
Japan	32 (4.3)	559 (4.2)	68 (4.3)	557 (3.0)	9.3 (0.16)
Italy	29 (3.1)	502 (4.7)	71 (3.1)	502 (3.4)	9.4 (0.11)
Singapore	29 (2.7)	595 (9.2)	71 (2.7)	588 (5.2)	9.1 (0.09)
Hungary	28 (2.1)	523 (3.7)	72 (2.1)	522 (3.3)	9.2 (0.07)
Sweden r	26 (3.3)	508 (6.6)	74 (3.3)	512 (3.0)	8.8 (0.13)
Lithuania	24 (1.7)	512 (4.1)	76 (1.7)	515 (2.7)	9.3 (0.05)
Chinese Taipei	21 (3.4)	552 (6.4)	79 (3.4)	567 (2.8)	8.6 (0.17)
Slovenia	20 (1.4)	545 (3.1)	80 (1.4)	542 (2.9)	8.7 (0.06)
Norway	5 (1.9)	468 (18.1)	95 (1.9)	495 (2.5)	7.5 (0.16)
International Avg.	48 (0.5)	479 (0.9)	52 (0.5)	474 (0.9)	

Centerpoint of scale set at 10.

( ) 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 less than 50% of students.

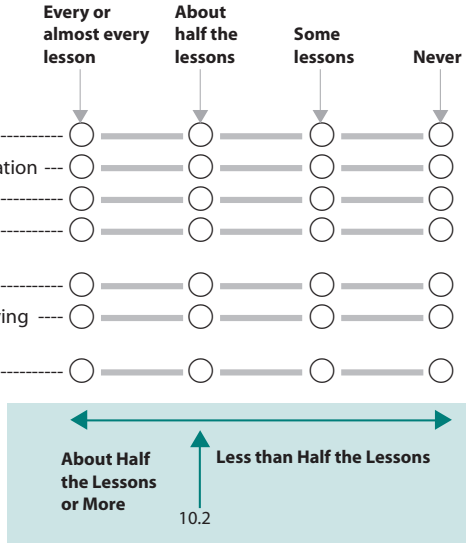
SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.28: Teachers Emphasize Science Investigation (Continued)

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	
Ninth Grade Participants						
Honduras		53 (4.5)	375 (6.9)	47 (4.5)	363 (6.0)	10.3 (0.17)
Botswana		52 (4.3)	405 (5.6)	48 (4.3)	403 (5.7)	10.3 (0.17)
South Africa		38 (3.8)	316 (7.9)	62 (3.8)	339 (6.2)	9.8 (0.16)
Benchmarking Participants						
Abu Dhabi, UAE		62 (4.2)	459 (5.4)	38 (4.2)	465 (7.0)	10.4 (0.17)
Alabama, US	s	61 (6.4)	483 (10.8)	39 (6.4)	488 (9.5)	10.5 (0.30)
Dubai, UAE	r	60 (5.1)	474 (5.5)	40 (5.1)	490 (6.9)	10.8 (0.27)
Colorado, US	s	55 (5.5)	546 (8.7)	45 (5.5)	541 (9.0)	9.9 (0.19)
North Carolina, US	s	47 (8.1)	516 (17.3)	53 (8.1)	536 (13.3)	9.6 (0.23)
Indiana, US	s	43 (6.5)	531 (6.7)	57 (6.5)	532 (5.7)	9.6 (0.19)
California, US	s	40 (6.1)	508 (11.1)	60 (6.1)	503 (8.3)	9.3 (0.25)
Connecticut, US	s	38 (5.8)	540 (11.5)	62 (5.8)	535 (9.0)	9.5 (0.22)
Minnesota, US	r	37 (7.2)	558 (16.4)	63 (7.2)	550 (5.1)	9.4 (0.22)
Massachusetts, US	s	34 (6.2)	588 (11.6)	66 (6.2)	552 (8.2)	8.9 (0.30)
Alberta, Canada		29 (3.8)	548 (4.3)	71 (3.8)	545 (2.7)	9.2 (0.13)
Quebec, Canada		27 (3.4)	518 (5.4)	73 (3.4)	521 (3.6)	9.2 (0.12)
Ontario, Canada	r	22 (3.6)	520 (5.3)	78 (3.6)	521 (3.4)	8.8 (0.12)
Florida, US		x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

In teaching science to the students in this class, how often do you usually ask them to do the following?



Computer Activities During Science Lessons

According to the *TIMSS 2011 Encyclopedia*, countries are investing in technology as a way to enhance teaching and learning. Availability of computers and other technology in the science classroom can facilitate successful implementation of the curriculum. For example, as described in the Contextual Framework chapter of the *TIMSS 2011 Assessment Frameworks*, computers and the Internet provide students ways to explore concepts in-depth, trigger enthusiasm and motivation for learning, enable students to learn at their own pace, and provide students with access to vast information sources.

Besides giving students access to the Internet, computers can serve a number of other educational purposes. While initially limited to learning drills and practice, they are now used in a variety of ways including tutorials, simulations, games, and applications. New software enables students to pose their own problems and explore and discover mathematics and scientific properties on their own. Computer software for modeling and visualization of ideas can open a whole new world to students and help them connect these ideas to their language and symbol systems. A recent study summarizing 25 meta-analyses determined that computer use in the classroom has a significant positive effect on achievement at all grade levels and in all subjects (Tamim, Bernard, Borokhovski, Abrami, & Schmidt, 2011).

Exhibit 8.29 contains teachers' reports about the prevalence and types of computer-based activities used as part of science instruction at fourth grade. The range of computer availability across countries was very large, from 7 percent of the students in Iran to 85 percent in New Zealand. Internationally, on average, less than half (47%) of the fourth grade students had computers available during their science lessons. Average science achievement was equivalent between those fourth grade students with computers available and those without computers available.

Teachers reported that 24 to 25 percent of the fourth grade students, on average, were asked to use a computer at least monthly to do scientific procedures or experiments or to study natural phenomena through simulations. Somewhat larger percentages were asked to use a computer at least monthly to look up ideas and information (41%) and to practice skills and procedures (31%). The range in computer availability across the benchmarking participants reflected the fourth grade results across countries. However, the students participating at the sixth grade had less access to computers for science instruction than did the fourth grade TIMSS students, on average.

At the eighth grade, reports about computer availability and use were similar to those at the fourth grade (see Exhibit 8.30). Internationally, on average, less than half (46%) of the eighth grade students had computers available during their science lessons, ranging from 12 percent in Ghana to 84 percent in Kazakhstan. Students with computers available during their lessons had slightly higher science achievement than students without computers available. Approximately one-third (28–39%) of the eighth grade students, on average, were asked to do the following on at least a monthly basis: look up ideas and information, do scientific procedures or experiments, study natural phenomena through simulations, process and analyze data, and practice skills and procedures. As would be anticipated, computer use in science lessons varied considerably across countries at the eighth grade, as well as for the benchmarking participants. Countries participating at the ninth grade had less computer availability, including South Africa, Botswana, and Honduras.

Exhibit 8.29: Computer Activities During Science Lessons

Reported by Teachers

Country	Computers Available for Science Lessons			Percent of Students Whose Teachers Have Them Use Computers At Least Monthly			
	Percent of Students	Average Achievement					
	Yes	Yes	No	To Look Up Ideas and Information	To Do Scientific Procedures or Experiments	To Study Natural Phenomena Through Simulations	To Practice Skills and Procedures
New Zealand	85 (2.3)	497 (2.8)	505 (5.5)	79 (2.5)	42 (3.3)	47 (2.9)	40 (3.3)
Belgium (Flemish)	84 (2.9)	510 (2.1)	502 (6.4)	78 (3.3)	21 (3.3)	26 (3.4)	56 (3.8)
Denmark	r 81 (2.6)	530 (3.3)	526 (7.5)	s 71 (3.4)	s 25 (3.7)	s 37 (4.5)	s 45 (3.9)
Northern Ireland	r 78 (3.5)	519 (3.6)	511 (6.3)	r 73 (3.9)	r 47 (4.0)	r 42 (4.3)	r 53 (4.4)
Australia	r 77 (3.4)	520 (4.5)	519 (6.0)	r 72 (3.8)	r 42 (3.4)	s 48 (4.2)	r 38 (3.5)
Malta	74 (0.1)	438 (2.2)	471 (2.7)	65 (0.1)	50 (0.1)	39 (0.1)	59 (0.1)
Japan	74 (3.7)	558 (2.2)	562 (3.5)	40 (4.2)	15 (3.1)	35 (4.3)	18 (3.1)
England	74 (4.3)	531 (3.8)	519 (9.3)	68 (5.0)	40 (4.8)	51 (5.1)	43 (4.8)
Austria	73 (3.4)	533 (2.8)	527 (6.0)	60 (3.5)	20 (2.6)	20 (2.8)	32 (3.3)
Norway	72 (3.9)	494 (2.9)	495 (3.4)	61 (4.6)	22 (3.9)	22 (3.6)	38 (4.4)
Sweden	r 68 (4.7)	538 (3.2)	528 (6.5)	r 49 (4.6)	r 11 (3.1)	r 10 (2.5)	r 21 (3.5)
Kazakhstan	67 (3.6)	484 (6.3)	513 (9.6)	62 (3.7)	58 (3.5)	52 (3.7)	64 (3.5)
Finland	66 (3.1)	572 (2.9)	570 (3.2)	59 (3.7)	17 (2.7)	15 (2.2)	42 (3.5)
United States	r 65 (2.6)	544 (2.8)	544 (3.7)	r 51 (2.5)	r 31 (2.1)	r 34 (2.0)	r 34 (2.3)
Netherlands	r 64 (4.7)	527 (3.3)	534 (3.9)	r 58 (5.0)	r 13 (3.4)	r 16 (3.4)	r 27 (4.5)
Chinese Taipei	63 (4.1)	553 (3.0)	549 (3.9)	53 (4.1)	44 (4.0)	46 (4.1)	46 (4.2)
Singapore	62 (2.5)	579 (4.3)	590 (6.0)	56 (2.8)	44 (2.8)	39 (3.0)	49 (2.9)
Ireland	62 (3.6)	518 (4.5)	513 (5.0)	55 (3.9)	29 (3.5)	35 (3.4)	30 (3.5)
Hong Kong SAR	61 (4.3)	531 (5.1)	541 (5.7)	49 (4.2)	43 (3.9)	39 (4.3)	43 (4.0)
Germany	61 (3.5)	533 (3.4)	523 (4.0)	54 (3.2)	14 (2.4)	15 (2.4)	23 (2.9)
Chile	r 59 (4.3)	485 (4.2)	475 (5.3)	r 51 (4.0)	r 33 (3.4)	r 37 (4.0)	r 42 (3.8)
Czech Republic	53 (4.0)	537 (3.8)	536 (2.9)	45 (4.1)	22 (3.4)	16 (3.0)	37 (4.2)
Qatar	51 (3.6)	382 (8.4)	406 (9.1)	50 (3.7)	45 (3.6)	45 (3.4)	47 (3.3)
Lithuania	49 (3.8)	517 (4.4)	512 (3.2)	45 (4.1)	30 (3.3)	21 (2.8)	41 (3.8)
Portugal	47 (5.3)	528 (7.6)	516 (4.2)	46 (5.3)	29 (3.9)	30 (4.2)	39 (4.3)
Slovak Republic	45 (3.2)	537 (4.0)	527 (5.9)	42 (3.2)	17 (2.3)	24 (2.7)	43 (3.2)
Slovenia	41 (3.7)	523 (3.4)	518 (3.4)	37 (3.6)	12 (2.1)	20 (2.7)	21 (3.0)
Azerbaijan	41 (3.6)	446 (8.3)	434 (7.7)	30 (3.7)	24 (3.7)	28 (3.7)	30 (3.7)
United Arab Emirates	40 (2.7)	427 (4.7)	429 (3.8)	36 (2.5)	33 (2.5)	33 (2.6)	33 (2.4)
Spain	40 (3.8)	510 (4.7)	502 (3.4)	33 (3.5)	21 (3.2)	20 (3.3)	29 (3.5)
Bahrain	37 (4.1)	454 (6.1)	447 (4.8)	36 (4.1)	32 (4.1)	32 (3.9)	35 (4.0)
Turkey	36 (3.4)	491 (4.8)	447 (5.9)	35 (3.4)	34 (3.3)	28 (3.4)	35 (3.3)
Hungary	36 (3.5)	523 (6.2)	539 (4.5)	34 (3.5)	14 (2.5)	15 (2.6)	27 (3.2)
Korea, Rep. of	35 (3.6)	589 (3.5)	586 (2.3)	25 (3.3)	20 (3.0)	23 (3.4)	23 (3.3)
Kuwait	34 (4.0)	347 (7.6)	347 (6.3)	31 (4.1)	28 (3.9)	29 (4.1)	30 (4.0)
Russian Federation	33 (3.7)	556 (6.6)	550 (3.8)	28 (2.8)	20 (2.5)	19 (2.4)	31 (3.5)
Italy	31 (3.2)	528 (4.0)	525 (3.5)	28 (3.1)	21 (2.8)	18 (2.7)	23 (2.9)
Thailand	29 (4.0)	469 (9.3)	472 (7.4)	26 (3.9)	20 (3.5)	24 (3.7)	23 (3.7)
Romania	28 (3.5)	509 (11.2)	502 (6.7)	23 (3.5)	21 (3.2)	21 (3.3)	23 (3.5)
Georgia	25 (2.9)	464 (8.0)	452 (4.6)	23 (2.9)	13 (2.5)	15 (2.7)	22 (2.9)
Saudi Arabia	24 (3.3)	421 (10.0)	432 (6.9)	21 (3.2)	15 (3.0)	15 (2.6)	18 (3.2)
Poland	19 (3.1)	496 (5.4)	507 (2.9)	16 (2.8)	7 (2.0)	11 (2.5)	13 (2.8)
Oman	18 (2.1)	390 (9.4)	375 (4.8)	15 (1.9)	11 (1.6)	12 (1.9)	12 (1.7)
Armenia	r 18 (3.2)	418 (7.0)	416 (4.9)	r 13 (2.6)	r 11 (2.5)	r 10 (2.4)	r 13 (2.7)
Tunisia	16 (3.1)	317 (12.0)	350 (5.6)	14 (3.0)	12 (2.8)	11 (2.5)	14 (3.0)
Yemen	15 (3.1)	196 (22.0)	212 (7.7)	8 (2.7)	7 (2.7)	8 (2.8)	7 (2.7)
Croatia	15 (2.3)	514 (4.9)	516 (2.3)	13 (2.2)	7 (1.5)	5 (1.4)	12 (2.3)
Serbia	13 (2.6)	511 (8.9)	516 (3.4)	10 (2.1)	7 (1.5)	7 (1.6)	8 (1.9)
Morocco	r 9 (2.2)	285 (12.5)	257 (5.5)	r 5 (1.6)	r 4 (1.3)	r 4 (1.0)	r 7 (1.8)
Iran, Islamic Rep. of	7 (1.8)	512 (17.5)	448 (4.2)	5 (1.5)	6 (1.6)	4 (1.3)	5 (1.5)
International Avg.	47 (0.5)	488 (1.0)	486 (0.8)	41 (0.5)	24 (0.4)	25 (0.4)	31 (0.5)

( ) 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.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.29: Computer Activities During Science Lessons (Continued)

Country	Computers Available for Science Lessons			Percent of Students Whose Teachers Have Them Use Computers At Least Monthly			
	Percent of Students	Average Achievement					
	Yes	Yes	No	To Look Up Ideas and Information	To Do Scientific Procedures or Experiments	To Study Natural Phenomena Through Simulations	To Practice Skills and Procedures
Sixth Grade Participants							
Yemen	13 (3.2)	368 (15.3)	342 (8.0)	5 (2.1)	5 (2.0)	5 (2.0)	4 (1.8)
Botswana	6 (1.6)	416 (34.0)	371 (6.2)	3 (0.7)	3 (0.7)	3 (0.7)	3 (0.7)
Honduras	6 (1.4)	447 (7.0)	431 (6.6)	5 (1.5)	5 (1.5)	4 (1.7)	5 (1.5)
Benchmarking Participants							
Florida, US	s 79 (4.5)	541 (4.5)	552 (12.5)	s 66 (5.3)	s 49 (4.8)	s 50 (5.4)	s 50 (5.8)
North Carolina, US	r 79 (5.9)	537 (5.7)	534 (11.0)	r 75 (6.1)	r 50 (6.6)	r 50 (7.7)	r 38 (6.5)
Alberta, Canada	r 75 (4.1)	544 (3.5)	535 (4.6)	r 69 (4.3)	r 43 (4.6)	r 48 (4.8)	r 49 (4.4)
Ontario, Canada	52 (3.8)	531 (3.9)	522 (4.2)	r 48 (3.9)	r 25 (3.4)	r 25 (3.1)	r 29 (3.6)
Quebec, Canada	50 (4.0)	522 (3.6)	511 (3.4)	47 (3.9)	25 (3.3)	23 (3.0)	28 (3.8)
Dubai, UAE	r 47 (3.9)	465 (7.2)	465 (7.3)	r 43 (3.9)	r 36 (4.0)	r 38 (3.9)	r 38 (3.9)
Abu Dhabi, UAE	39 (4.4)	411 (9.3)	414 (7.0)	38 (4.4)	36 (4.5)	34 (4.4)	36 (4.3)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.30: Computer Activities During Science Lessons

TIMSS 2011 Science 8th Grade

Reported by Teachers

Country	Computers Available for Science Lessons			Percent of Students Whose Teachers Have Them Use Computers At Least Monthly				
	Percent of Students	Average Achievement						
	Yes	Yes	No	To Look Up Ideas and Information	To Do Scientific Procedures or Experiments	To Study Natural Phenomena Through Simulations	To Process and Analyze Data	To Practice Skills and Procedures
Kazakhstan	84 (2.3)	489 (4.4)	500 (8.5)	81 (2.3)	77 (2.6)	73 (2.9)	79 (2.5)	82 (2.4)
Norway	77 (3.6)	495 (2.9)	490 (5.3)	72 (3.9)	35 (4.0)	42 (4.4)	34 (4.1)	54 (4.4)
Macedonia, Rep. of	r 71 (2.8)	411 (5.9)	409 (9.8)	r 66 (3.0)	r 59 (3.0)	r 61 (3.0)	r 63 (3.0)	r 64 (3.0)
Australia	s 71 (2.8)	522 (6.2)	536 (9.2)	s 66 (3.6)	s 40 (4.5)	s 44 (3.8)	s 49 (3.9)	s 47 (4.5)
Chile	70 (3.5)	460 (3.5)	463 (5.2)	60 (3.9)	43 (3.7)	42 (3.7)	54 (4.0)	48 (3.7)
Korea, Rep. of	68 (3.5)	562 (2.4)	556 (3.6)	52 (3.4)	51 (3.4)	49 (3.7)	45 (3.2)	48 (3.6)
United States	s 67 (2.7)	536 (4.1)	516 (5.8)	s 59 (2.7)	s 39 (2.6)	s 44 (2.4)	s 46 (2.4)	s 43 (2.6)
England	r 63 (3.3)	529 (7.6)	538 (5.7)	r 57 (3.1)	r 25 (2.5)	r 37 (2.9)	r 41 (3.2)	r 31 (3.5)
Finland	59 (2.5)	552 (2.8)	553 (2.7)	49 (2.7)	18 (2.2)	20 (2.3)	31 (2.4)	36 (2.5)
Sweden	r 57 (3.8)	514 (3.4)	509 (4.4)	r 53 (3.7)	r 14 (3.0)	r 17 (2.8)	r 30 (3.7)	r 23 (3.5)
Romania	57 (3.0)	468 (4.5)	460 (4.6)	52 (3.1)	43 (2.9)	43 (2.9)	42 (2.9)	51 (3.1)
Singapore	56 (2.5)	584 (6.2)	598 (6.3)	42 (2.5)	27 (2.5)	31 (2.7)	26 (2.4)	31 (2.6)
Lithuania	55 (2.3)	511 (3.2)	518 (3.1)	49 (2.4)	33 (2.2)	28 (2.0)	41 (2.4)	44 (2.4)
Russian Federation	52 (2.7)	546 (4.2)	539 (3.7)	45 (2.6)	26 (2.2)	27 (2.3)	34 (2.6)	47 (2.6)
Georgia	52 (3.1)	420 (4.9)	419 (3.9)	50 (3.3)	41 (3.1)	41 (3.1)	45 (3.3)	47 (3.1)
Japan	50 (4.3)	559 (3.6)	557 (3.4)	15 (3.1)	2 (1.2)	13 (2.8)	8 (2.4)	4 (1.5)
Ukraine	50 (3.7)	503 (4.8)	498 (4.1)	43 (3.8)	21 (2.7)	20 (2.9)	24 (3.0)	37 (3.5)
Jordan	49 (3.5)	457 (5.8)	441 (6.0)	48 (3.6)	44 (3.6)	42 (3.8)	39 (3.6)	46 (3.5)
Hungary	48 (2.6)	515 (4.6)	528 (4.0)	45 (2.4)	25 (2.0)	29 (2.2)	30 (2.3)	36 (2.4)
Armenia	48 (3.2)	447 (4.4)	430 (4.3)	r 44 (3.3)	r 34 (3.1)	r 29 (2.8)	r 39 (3.0)	r 43 (3.2)
Qatar	48 (3.0)	426 (10.4)	409 (6.4)	47 (2.6)	43 (2.5)	44 (2.9)	40 (2.9)	46 (2.7)
Slovenia	47 (2.4)	543 (2.8)	543 (3.2)	40 (2.3)	21 (1.9)	30 (2.2)	29 (2.2)	31 (2.3)
Israel	46 (4.2)	530 (6.2)	508 (6.2)	39 (4.1)	24 (3.5)	28 (3.7)	27 (3.7)	34 (3.8)
United Arab Emirates	42 (2.3)	462 (3.8)	461 (3.5)	41 (2.3)	r 37 (2.3)	36 (2.5)	r 36 (2.4)	r 38 (2.2)
Turkey	40 (3.5)	499 (6.9)	473 (3.9)	38 (3.4)	35 (3.2)	36 (3.6)	31 (3.2)	33 (3.4)
Chinese Taipei	40 (4.3)	557 (4.9)	568 (3.1)	24 (3.5)	24 (3.6)	21 (3.5)	18 (3.2)	23 (3.6)
Palestinian Nat'l Auth.	40 (3.7)	432 (6.2)	412 (4.1)	38 (3.8)	34 (3.6)	33 (3.8)	28 (3.6)	34 (3.7)
New Zealand	39 (4.1)	499 (6.5)	519 (6.4)	37 (4.0)	13 (2.5)	25 (3.7)	21 (3.2)	23 (3.4)
Bahrain	38 (3.1)	466 (4.8)	446 (3.1)	34 (3.2)	33 (3.4)	32 (3.1)	30 (3.1)	35 (3.1)
Italy	36 (3.2)	509 (5.0)	497 (3.2)	30 (3.0)	13 (2.5)	14 (2.4)	20 (2.9)	18 (2.6)
Hong Kong SAR	34 (4.1)	526 (8.1)	540 (4.6)	24 (4.0)	23 (3.9)	19 (3.7)	22 (3.8)	19 (3.9)
Syrian Arab Republic	r 33 (4.3)	420 (7.6)	427 (4.9)	r 28 (4.1)	r 28 (3.9)	r 28 (4.1)	r 28 (4.1)	r 26 (4.0)
Saudi Arabia	31 (3.9)	446 (8.4)	433 (4.3)	30 (3.9)	29 (3.8)	29 (3.9)	27 (3.8)	30 (3.9)
Indonesia	31 (4.1)	390 (9.5)	411 (4.5)	21 (3.5)	19 (3.5)	19 (3.7)	19 (3.5)	17 (3.3)
Thailand	31 (4.1)	455 (7.9)	449 (5.3)	28 (3.8)	23 (3.6)	25 (3.7)	26 (3.7)	24 (3.4)
Iran, Islamic Rep. of	31 (3.3)	500 (8.7)	462 (4.0)	21 (3.4)	23 (3.4)	18 (2.9)	17 (3.0)	19 (2.9)
Oman	21 (2.7)	440 (7.7)	414 (4.0)	21 (2.7)	13 (2.1)	16 (2.3)	15 (2.4)	17 (2.5)
Morocco	19 (1.7)	397 (5.7)	372 (2.4)	15 (1.6)	13 (1.6)	15 (1.5)	12 (1.5)	13 (1.5)
Tunisia	19 (3.2)	449 (8.0)	436 (2.7)	11 (2.7)	6 (2.0)	10 (2.5)	11 (2.5)	11 (2.4)
Malaysia	17 (3.3)	447 (13.1)	421 (6.8)	17 (3.2)	15 (3.0)	17 (3.2)	15 (3.0)	14 (2.9)
Lebanon	14 (1.8)	421 (12.1)	402 (4.8)	10 (1.8)	9 (1.8)	9 (1.6)	9 (1.7)	10 (1.8)
Ghana	12 (2.8)	308 (14.8)	307 (6.0)	5 (1.5)	4 (1.4)	4 (1.3)	4 (1.4)	5 (1.5)
International Avg.	46 (0.5)	481 (1.0)	475 (0.8)	39 (0.5)	28 (0.5)	30 (0.5)	31 (0.5)	33 (0.5)

( ) 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 less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.30: Computer Activities During Science Lessons (Continued)

Country	Computers Available for Science Lessons			Percent of Students Whose Teachers Have Them Use Computers At Least Monthly				
	Percent of Students	Average Achievement						
	Yes	Yes	No	To Look Up Ideas and Information	To Do Scientific Procedures or Experiments	To Study Natural Phenomena Through Simulations	To Process and Analyze Data	To Practice Skills and Procedures
Ninth Grade Participants								
South Africa	17 (2.6)	325 (13.3)	330 (4.4)	7 (1.6)	7 (1.7)	7 (1.7)	7 (1.7)	7 (1.8)
Botswana	13 (3.0)	407 (8.6)	402 (4.1)	9 (2.4)	5 (1.6)	5 (1.8)	5 (2.1)	6 (2.1)
Honduras	9 (3.0)	378 (17.4)	368 (4.5)	8 (2.9)	3 (1.2)	3 (1.2)	3 (1.3)	7 (2.9)
Benchmarking Participants								
Alberta, Canada	79 (3.3)	545 (2.8)	549 (4.6)	73 (3.7)	55 (4.3)	55 (4.1)	55 (4.1)	55 (3.9)
Indiana, US	s 68 (5.7)	531 (5.7)	533 (8.8)	s 60 (5.3)	s 32 (6.0)	s 40 (6.0)	s 41 (5.3)	s 41 (6.3)
Minnesota, US	r 64 (6.9)	553 (8.8)	553 (7.5)	r 57 (7.0)	r 40 (7.7)	r 53 (7.1)	r 44 (7.3)	r 43 (7.8)
Colorado, US	s 62 (6.6)	547 (8.7)	545 (9.3)	s 52 (7.1)	s 41 (6.0)	s 41 (6.3)	s 46 (6.6)	s 43 (7.7)
North Carolina, US	s 61 (7.4)	537 (11.8)	516 (17.4)	s 61 (7.4)	s 44 (7.1)	s 40 (7.3)	s 54 (7.1)	s 47 (7.2)
Massachusetts, US	s 59 (8.2)	573 (12.3)	547 (12.0)	s 47 (9.6)	s 27 (7.5)	s 37 (8.1)	s 37 (8.4)	s 31 (7.2)
California, US	s 58 (5.7)	505 (11.2)	505 (5.6)	x x	x x	x x	x x	x x
Ontario, Canada	r 56 (4.2)	520 (3.7)	522 (4.6)	r 53 (4.3)	r 36 (4.2)	r 32 (4.0)	r 36 (4.2)	r 33 (4.0)
Connecticut, US	s 56 (6.9)	533 (9.2)	541 (13.4)	s 47 (7.3)	s 31 (5.4)	s 37 (6.8)	s 35 (6.2)	s 34 (6.3)
Dubai, UAE	r 52 (2.6)	493 (4.8)	465 (5.0)	r 52 (2.6)	r 41 (4.6)	r 45 (2.6)	r 46 (3.5)	r 47 (2.8)
Quebec, Canada	47 (4.2)	526 (4.7)	515 (4.0)	38 (4.2)	18 (2.9)	21 (3.2)	24 (3.7)	24 (3.9)
Alabama, US	s 42 (7.2)	490 (16.1)	481 (5.2)	s 34 (7.4)	s 24 (6.3)	s 24 (7.1)	s 22 (6.5)	s 28 (7.7)
Abu Dhabi, UAE	38 (4.5)	453 (6.9)	466 (6.0)	35 (4.3)	32 (4.2)	31 (4.5)	r 30 (4.3)	33 (4.2)
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Science Homework

Homework is a way to extend instruction and assess student progress. TIMSS has consistently shown that the amount of homework assigned for mathematics and science varies both within and across countries. In some situations, homework is assigned typically to students who need it the most to keep up to their classmates. In other situations, students receive homework for practice or as an enrichment exercise. Because of the different approaches and policies associated with assigning homework, it generally shows mixed results in relation to average student achievement.

The eighth grade students in TIMSS were asked how often their teacher gives homework in science (or biology, chemistry, physics, and earth science for separate science countries) and how much time they usually spend on it when it is given. Weekly time on science homework was estimated by multiplying the frequency of assignment by the amount of time spent. Exhibit 8.31 presents the results, with countries ordered by the percentage of students reporting they spent 3 hours or more per week. However, spending as much time as this on science homework was relatively rare. Among countries teaching science as general or integrated subject, the range was from a high of 11 percent of students in Malaysia to 1 percent in England and Korea and to zero in Japan. It should be mentioned that although students in several of the high-performing East Asian countries report relatively small amounts of homework, many of them attend special tutoring schools.

On average, internationally, only 5 percent of the eighth grade students reported doing as much as 3 hours of science homework per week, and these students had the lowest average science achievement. The majority of students (67%) reported doing 45 minutes or less of weekly science homework, and a further 29 percent reported doing more than 45 minutes but less than 3 hours—these students had the highest average science achievement. Both Botswana and South Africa at the ninth grade had relatively high percentages of students reporting 3 hours of science homework per week, although the percentages for benchmarking participants were more comparable to the international averages at eighth grade.

For each of the four science subjects, eighth grade students in separate science countries reported about the same amount of homework as students in general or integrated science countries reported for science overall. This means, of course, that the total time spent on science homework by students in separate science countries is a lot more than in general or integrated science

Exhibit 8.31: Weekly Time Students Spend on Science Homework

Reported by Students

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

Weekly Time Students Spend on General/Integrated Science Homework

General/Integrated Science	3 Hours or More		More than 45 Minutes but Less than 3 Hours		45 Minutes or Less	
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Malaysia	11 (0.6)	417 (6.3)	52 (1.1)	437 (6.1)	37 (1.3)	420 (8.2)
Thailand	10 (0.6)	449 (5.7)	52 (1.1)	455 (4.4)	38 (1.1)	450 (4.2)
Ghana	9 (0.6)	293 (6.4)	38 (1.3)	323 (6.0)	53 (1.3)	306 (6.0)
Jordan	8 (0.5)	447 (6.6)	32 (0.9)	464 (3.8)	61 (1.1)	456 (3.8)
Turkey	8 (0.5)	466 (5.1)	39 (1.0)	487 (3.5)	54 (1.1)	487 (4.3)
Palestinian Nat'l Auth.	7 (0.7)	388 (9.4)	31 (1.3)	424 (4.1)	62 (1.6)	427 (3.5)
Bahrain	6 (0.6)	415 (9.9)	25 (1.0)	465 (4.8)	69 (1.0)	457 (2.5)
Iran, Islamic Rep. of	6 (0.5)	471 (10.5)	30 (0.9)	476 (5.1)	64 (1.1)	474 (3.9)
Chinese Taipei	6 (0.6)	565 (7.4)	39 (1.3)	580 (2.9)	55 (1.5)	555 (2.6)
Singapore	6 (0.4)	609 (6.2)	49 (0.9)	603 (3.7)	46 (1.0)	576 (5.7)
Italy	5 (0.5)	478 (7.6)	35 (1.3)	502 (3.5)	60 (1.5)	504 (3.1)
Tunisia	4 (0.4)	416 (6.2)	20 (0.7)	428 (3.3)	76 (0.9)	445 (2.6)
Qatar	4 (0.4)	398 (11.1)	28 (1.0)	445 (6.7)	68 (1.1)	414 (3.4)
Oman	4 (0.4)	373 (10.3)	17 (0.7)	411 (5.2)	79 (0.9)	432 (3.0)
United Arab Emirates	4 (0.2)	443 (6.6)	25 (0.7)	479 (3.2)	71 (0.7)	464 (2.6)
Israel	4 (0.4)	499 (10.7)	23 (1.1)	511 (5.2)	74 (1.4)	522 (4.4)
Chile	4 (0.4)	446 (7.3)	29 (1.0)	456 (2.8)	68 (1.1)	466 (2.9)
United States	3 (0.3)	518 (6.3)	24 (0.8)	533 (4.0)	73 (0.9)	525 (2.6)
Saudi Arabia	3 (0.4)	401 (13.6)	14 (0.9)	425 (4.8)	83 (1.1)	441 (3.8)
Norway	3 (0.3)	465 (11.0)	36 (1.5)	494 (3.4)	62 (1.6)	498 (3.0)
New Zealand	2 (0.5)	~ ~	19 (1.6)	533 (5.9)	79 (1.7)	512 (4.7)
Hong Kong SAR	2 (0.3)	~ ~	24 (1.3)	540 (3.9)	74 (1.4)	536 (3.7)
Australia	2 (0.2)	~ ~	17 (1.0)	535 (6.8)	81 (1.1)	519 (4.8)
England	1 (0.2)	~ ~	26 (1.4)	555 (5.4)	73 (1.5)	528 (5.3)
Korea, Rep. of	1 (0.2)	~ ~	8 (1.0)	541 (4.8)	91 (1.2)	563 (2.1)
Japan	0 (0.1)	~ ~	10 (1.2)	553 (6.1)	90 (1.3)	559 (2.6)
International Avg.	5 (0.1)	448 (1.9)	29 (0.2)	487 (0.9)	67 (0.2)	482 (0.8)
Ninth Grade Participants						
South Africa	13 (0.7)	308 (7.3)	39 (0.7)	346 (4.3)	48 (0.8)	338 (3.9)
Botswana	10 (0.7)	364 (5.0)	35 (0.9)	412 (3.9)	55 (1.1)	415 (3.9)
Honduras	– –	– –	– –	– –	– –	– –
Benchmarking Participants						
Massachusetts, US	8 (1.5)	559 (10.3)	41 (2.3)	574 (6.0)	51 (2.6)	563 (5.5)
Connecticut, US	5 (1.0)	516 (12.1)	34 (2.6)	539 (6.4)	61 (3.0)	536 (5.2)
California, US	5 (0.8)	492 (10.9)	32 (1.7)	511 (4.6)	64 (2.0)	496 (5.8)
Dubai, UAE	4 (0.4)	462 (8.4)	33 (0.7)	502 (4.0)	63 (0.8)	481 (2.5)
Abu Dhabi, UAE	4 (0.4)	439 (11.7)	22 (1.3)	471 (6.7)	74 (1.4)	462 (4.5)
North Carolina, US	4 (0.6)	524 (9.4)	23 (2.0)	541 (11.1)	73 (2.3)	531 (6.2)
Alberta, Canada	3 (0.5)	540 (6.6)	28 (1.4)	544 (3.9)	69 (1.7)	549 (2.3)
Indiana, US	3 (1.0)	537 (17.7)	22 (1.8)	530 (7.3)	75 (2.3)	536 (4.2)
Minnesota, US	3 (0.6)	526 (12.8)	29 (2.0)	556 (7.2)	68 (2.5)	556 (4.4)
Florida, US	3 (0.5)	557 (12.9)	23 (1.9)	552 (9.1)	74 (2.1)	527 (7.4)
Alabama, US	2 (0.3)	~ ~	14 (1.4)	490 (11.3)	84 (1.5)	489 (5.9)
Colorado, US	2 (0.4)	~ ~	16 (1.3)	534 (8.5)	82 (1.6)	546 (4.8)
Ontario, Canada r	2 (0.2)	~ ~	24 (1.6)	524 (4.2)	75 (1.7)	521 (2.7)
Quebec, Canada	1 (0.3)	~ ~	13 (1.0)	519 (5.3)	86 (1.1)	522 (2.4)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.
A dash (–) indicates comparable data are 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.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.31: Weekly Time Students Spend on Science Homework (Continued)

A. How often does your teacher give you homework in <science/biology/chemistry/physics/earth science>?

1) Every day
2) 3 or 4 times a week
3) 1 or 2 times a week
4) Less than once a week
5) Never

B. When your teacher gives you <science/biology/chemistry/physics/earth science> homework, about how many minutes do you usually spend on your homework?

1) My teacher never gives me homework
2) 1-15 minutes
3) 16-30 minutes
4) 31-60 minutes
5) 61-90 minutes
6) More than 90 minutes

The weekly time spent on <science> homework was calculated by multiplying how often students were given homework weekly by the minutes they spent on that homework.

The values for Part A were: Every day = 5; 3 or 4 times a week = 3.5; 1 or 2 times a week = 1.5; Less than once a week = 0.5; and Never = 0.

The values for Part B were: My teacher never gives me homework = 0; 1-15 minutes = 8; 16-30 minutes = 23; 31-60 minutes = 45; 61-90 minutes = 75; and More than 90 minutes = 105.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Separate Science Panels

Weekly Time Students Spend on Biology Homework

Biology		3 Hours or More		More than 45 Minutes but Less than 3 Hours		45 Minutes or Less	
Country		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan		17 (0.9)	482 (7.0)	41 (1.1)	490 (4.7)	42 (1.4)	498 (4.7)
Russian Federation		8 (0.6)	518 (5.9)	35 (0.9)	540 (3.6)	57 (1.0)	549 (3.2)
Georgia		7 (0.7)	424 (7.2)	25 (1.3)	437 (4.1)	68 (1.7)	432 (3.0)
Syrian Arab Republic		7 (0.5)	410 (5.8)	27 (0.8)	427 (4.0)	66 (1.0)	435 (4.1)
Ukraine		7 (0.7)	489 (6.3)	35 (1.4)	498 (4.5)	58 (1.7)	507 (3.6)
Armenia		7 (0.5)	437 (7.9)	30 (1.0)	440 (4.8)	63 (1.1)	444 (3.4)
Indonesia		5 (0.5)	409 (6.2)	35 (1.0)	416 (5.4)	61 (1.0)	408 (4.9)
Morocco	r	4 (0.3)	367 (6.0)	24 (0.6)	383 (3.3)	72 (0.8)	384 (2.6)
Lebanon		4 (0.5)	360 (8.2)	20 (1.2)	396 (6.4)	76 (1.3)	414 (5.4)
Lithuania		4 (0.3)	486 (8.8)	17 (1.0)	502 (4.2)	79 (1.2)	520 (2.6)
Hungary		3 (0.4)	496 (9.0)	17 (0.8)	509 (4.7)	79 (1.1)	531 (2.8)
Macedonia, Rep. of	r	2 (0.3)	~ ~	15 (1.0)	382 (6.6)	82 (1.1)	424 (5.2)
Romania		2 (0.3)	~ ~	12 (0.8)	447 (5.7)	86 (0.9)	474 (3.5)
Sweden	r	2 (0.2)	~ ~	16 (0.9)	508 (4.4)	82 (0.9)	518 (2.5)
Slovenia		1 (0.2)	~ ~	8 (0.8)	524 (7.1)	91 (0.9)	548 (2.6)
Finland		1 (0.2)	~ ~	11 (0.8)	541 (4.8)	88 (0.8)	556 (2.6)

Exhibit 8.31: Weekly Time Students Spend on Science Homework (Continued)

Weekly Time Students Spend on Chemistry Homework

Chemistry	3 Hours or More		More than 45 Minutes but Less than 3 Hours		45 Minutes or Less	
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan	30 (1.1)	486 (5.6)	48 (1.0)	499 (4.3)	22 (1.0)	484 (5.9)
Russian Federation	15 (0.7)	528 (4.4)	47 (0.9)	545 (3.6)	38 (1.1)	548 (3.5)
Ukraine	12 (0.8)	484 (5.6)	40 (1.2)	503 (4.0)	48 (1.4)	508 (3.9)
Armenia	12 (0.7)	432 (4.6)	36 (1.0)	443 (3.9)	53 (1.3)	444 (3.6)
Syrian Arab Republic	8 (0.6)	420 (6.0)	33 (0.9)	432 (4.0)	59 (1.1)	432 (4.5)
Lithuania	7 (0.6)	497 (6.4)	28 (1.1)	513 (3.6)	65 (1.5)	519 (2.7)
Romania	6 (0.7)	450 (11.1)	22 (1.1)	475 (5.5)	72 (1.6)	471 (3.5)
Macedonia, Rep. of r	5 (0.5)	371 (11.4)	23 (1.2)	409 (7.3)	72 (1.5)	424 (5.3)
Morocco r	5 (0.3)	363 (5.6)	25 (0.7)	383 (3.3)	70 (0.7)	385 (2.7)
Hungary	4 (0.4)	495 (7.9)	19 (1.0)	513 (5.0)	77 (1.3)	530 (3.0)
Lebanon	4 (0.4)	381 (11.0)	22 (1.2)	390 (6.4)	74 (1.4)	415 (5.3)
Indonesia r	3 (0.3)	388 (9.0)	24 (1.1)	410 (6.0)	73 (1.2)	413 (3.9)
Slovenia	3 (0.5)	499 (10.1)	13 (0.9)	527 (4.6)	85 (1.3)	549 (2.8)
Finland	2 (0.2)	~ ~	15 (0.8)	545 (3.4)	83 (0.9)	556 (2.6)
Sweden r	2 (0.2)	~ ~	17 (1.0)	509 (3.8)	82 (1.0)	519 (2.6)
Georgia	– –	– –	– –	– –	– –	– –
International Avg.	8 (0.2)	446 (2.2)	27 (0.3)	473 (1.2)	65 (0.3)	480 (1.0)

Weekly Time Students Spend on Physics Homework

Physics	3 Hours or More		More than 45 Minutes but Less than 3 Hours		45 Minutes or Less	
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan	26 (1.1)	485 (6.2)	45 (1.2)	497 (4.7)	29 (1.1)	491 (4.9)
Russian Federation	13 (0.9)	530 (7.0)	42 (1.1)	546 (3.1)	45 (1.3)	545 (4.0)
Georgia	13 (0.7)	437 (4.9)	36 (1.1)	440 (3.2)	51 (1.4)	426 (3.1)
Ukraine	12 (0.8)	498 (7.6)	41 (1.2)	503 (4.0)	48 (1.6)	505 (3.7)
Armenia	11 (0.6)	434 (5.5)	36 (0.8)	446 (3.9)	53 (1.0)	442 (3.5)
Syrian Arab Republic	9 (0.6)	419 (5.0)	29 (0.8)	431 (4.6)	62 (1.0)	433 (4.5)
Lithuania	7 (0.6)	498 (6.7)	26 (1.0)	513 (3.9)	66 (1.5)	519 (2.7)
Macedonia, Rep. of	7 (0.7)	370 (11.4)	23 (1.1)	411 (6.9)	70 (1.4)	423 (5.2)
Morocco	7 (0.3)	364 (5.9)	26 (0.7)	383 (3.6)	67 (0.7)	383 (2.5)
Slovenia	6 (0.8)	523 (6.8)	23 (1.0)	533 (4.3)	71 (1.4)	550 (2.9)
Indonesia	6 (0.5)	403 (6.2)	40 (1.2)	420 (4.4)	54 (1.3)	404 (5.6)
Romania	6 (0.5)	445 (9.0)	21 (1.2)	468 (6.2)	74 (1.5)	472 (3.5)
Lebanon	4 (0.5)	371 (9.6)	25 (1.1)	400 (6.4)	71 (1.2)	413 (5.3)
Hungary	4 (0.4)	488 (6.8)	17 (1.0)	512 (4.5)	80 (1.2)	530 (2.9)
Finland	2 (0.2)	~ ~	14 (0.9)	548 (3.9)	84 (0.9)	557 (2.5)
Sweden r	2 (0.2)	~ ~	17 (0.9)	511 (4.1)	81 (1.0)	519 (2.6)
International Avg.	8 (0.2)	448 (1.9)	29 (0.3)	473 (1.1)	63 (0.3)	476 (1.0)

Weekly Time Students Spend on Earth Science Homework

Earth Science	3 Hours or More		More than 45 Minutes but Less than 3 Hours		45 Minutes or Less	
Country	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan	17 (0.9)	477 (6.0)	39 (1.0)	491 (4.8)	43 (1.1)	499 (4.7)
Georgia r	8 (1.3)	432 (6.7)	25 (1.0)	437 (4.5)	67 (1.5)	435 (3.2)
Armenia	8 (0.6)	438 (6.5)	29 (1.0)	438 (4.7)	64 (1.3)	445 (3.2)
Russian Federation	7 (0.6)	520 (6.3)	32 (0.9)	539 (3.8)	60 (1.1)	549 (3.3)
Syrian Arab Republic r	7 (0.6)	404 (6.1)	24 (0.9)	423 (4.6)	68 (1.1)	436 (4.3)
Ukraine	7 (0.5)	485 (7.4)	33 (1.3)	499 (4.9)	60 (1.4)	509 (3.4)
Lithuania	6 (0.5)	491 (6.7)	25 (1.1)	509 (3.4)	69 (1.4)	520 (2.8)
Indonesia r	4 (0.5)	401 (6.4)	30 (1.0)	414 (4.9)	65 (1.2)	409 (5.3)
Morocco r	4 (0.3)	363 (6.5)	25 (0.7)	378 (2.6)	71 (0.8)	386 (2.8)
Hungary	3 (0.4)	500 (7.4)	16 (0.8)	512 (4.6)	81 (1.0)	529 (3.0)
Romania	3 (0.3)	433 (10.2)	13 (0.9)	462 (6.0)	84 (1.0)	473 (3.4)
Macedonia, Rep. of r	3 (0.4)	369 (14.8)	12 (0.8)	390 (8.6)	85 (0.8)	422 (5.1)
Sweden r	2 (0.3)	~ ~	16 (0.9)	506 (4.4)	82 (1.0)	519 (2.5)
Slovenia	2 (0.2)	~ ~	7 (0.5)	519 (5.5)	91 (0.7)	548 (2.7)
Finland	1 (0.2)	~ ~	11 (0.8)	541 (4.3)	88 (0.8)	556 (2.5)
Lebanon	– –	– –	– –	– –	– –	– –
International Avg.	6 (0.1)	443 (2.3)	23 (0.2)	470 (1.3)	72 (0.3)	482 (0.9)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

countries. However, there was an inverse relationship between time spent on homework and average science achievement in the separate science countries, with average achievement highest among students spending 45 minutes or less on each subject.

Science Classroom Assessment

Teachers have a number of informal and formal ways to evaluate student learning. Informal assessments during instruction help teachers identify the needs of particular individuals, gauge the pace of instruction, and signal the need to adapt or reteach. Formal tests typically are used to make important decisions about the students, such as grades or marks.

Exhibit 8.32 presents teachers' reports about how often they give eighth grade students science tests or examinations. Internationally, on average, the eighth grade students were tested fairly regularly in science—35 percent at least every two weeks, and 41 percent about monthly. Just 24 percent were tested less often, approximately a few times a year.

The exhibit also contains teachers' reports about the types of questions they included in their tests and examinations. Most frequently, the test questions involved application of knowledge and understanding, which were used always or almost always for 78 percent of the students, on average, across the countries, and at least sometimes for 22 percent of the students. The test questions in science often also required students to provide explanations or justifications for their answers—almost always for 54 percent of students and sometimes for 42 percent, with only 3 percent almost never. Questions involving developing hypotheses and designing scientific investigations were used less frequently—always or almost always for 21 percent of the students, on average, sometimes for 62 percent of the students, and rarely for 17 percent of the students. However, across the eighth grade, ninth grade, and benchmarking participants, there was considerable variation in testing practices.

Exhibit 8.32: Classroom Assessment

Reported by Teachers

Country	Percentage of Students Whose Teachers Give Science Tests or Examinations			Percentage of Students Whose Teachers Give Test Questions								
				Involving Application of Knowledge and Understanding			Involving Developing Hypotheses and Designing Scientific Investigations			Requiring Explanations or Justifications		
	Every 2 Weeks or More	About Once a Month	A Few Times a Year or Less	Always or Almost Always	Sometimes	Never or Almost Never	Always or Almost Always	Sometimes	Never or Almost Never	Always or Almost Always	Sometimes	Never or Almost Never
Armenia	20 (1.8)	47 (2.6)	33 (2.8)	72 (2.3)	27 (2.2)	1 (0.6)	5 (1.2)	57 (2.9)	38 (2.7)	59 (2.6)	39 (2.4)	2 (0.8)
Australia s	9 (2.1)	47 (3.9)	44 (4.3)	s 83 (2.3)	17 (2.4)	0 (0.2)	s 30 (3.0)	56 (4.4)	14 (3.4)	s 59 (3.6)	40 (3.8)	1 (0.8)
Bahrain	79 (2.3)	17 (2.2)	4 (0.8)	79 (2.4)	21 (2.4)	0 (0.0)	20 (1.5)	66 (2.3)	14 (2.4)	75 (2.4)	24 (2.3)	1 (0.8)
Chile	34 (4.2)	65 (4.2)	1 (0.8)	84 (2.5)	16 (2.5)	0 (0.0)	26 (3.6)	59 (4.0)	15 (2.8)	60 (4.2)	37 (4.1)	3 (1.4)
Chinese Taipei	98 (1.1)	2 (0.9)	1 (0.6)	83 (3.1)	17 (3.1)	0 (0.0)	28 (3.8)	61 (3.7)	12 (2.7)	25 (3.8)	59 (3.6)	16 (3.3)
England r	13 (2.5)	50 (4.1)	36 (3.8)	r 78 (3.1)	22 (3.0)	1 (0.6)	r 38 (3.2)	55 (2.8)	7 (1.4)	r 58 (3.1)	41 (3.1)	1 (0.6)
Finland	1 (0.5)	21 (1.8)	78 (1.9)	84 (2.1)	16 (2.1)	0 (0.2)	4 (1.1)	42 (2.0)	54 (2.0)	81 (1.8)	18 (1.7)	1 (0.3)
Georgia	19 (2.4)	57 (2.5)	24 (2.1)	84 (2.2)	16 (2.2)	0 (0.2)	11 (1.4)	77 (1.9)	12 (1.6)	63 (2.4)	37 (2.4)	0 (0.0)
Ghana	73 (3.8)	27 (3.8)	0 (0.0)	70 (3.7)	29 (3.8)	1 (0.0)	33 (4.0)	61 (4.2)	5 (1.9)	63 (4.1)	36 (4.1)	1 (0.7)
Hong Kong SAR	20 (3.6)	39 (4.7)	41 (4.9)	57 (4.1)	43 (4.1)	0 (0.0)	14 (3.3)	77 (4.0)	8 (2.3)	37 (4.7)	58 (5.0)	4 (1.9)
Hungary	42 (2.2)	53 (2.2)	5 (0.8)	82 (1.6)	18 (1.6)	0 (0.1)	2 (0.6)	46 (2.2)	51 (2.2)	31 (2.0)	58 (2.3)	11 (1.8)
Indonesia	64 (3.7)	34 (3.7)	3 (1.0)	73 (3.5)	27 (3.5)	0 (0.0)	16 (3.3)	72 (3.7)	12 (2.4)	38 (4.4)	57 (4.5)	5 (1.6)
Iran, Islamic Rep. of	55 (3.3)	32 (3.1)	13 (2.4)	62 (2.8)	37 (2.7)	1 (0.8)	18 (2.8)	69 (3.3)	13 (1.9)	46 (3.8)	47 (3.8)	6 (2.1)
Israel	7 (2.0)	38 (3.5)	55 (3.2)	91 (2.5)	9 (2.5)	0 (0.0)	39 (4.4)	57 (4.3)	4 (1.1)	80 (2.8)	20 (2.8)	0 (0.0)
Italy	12 (2.5)	51 (3.6)	37 (3.8)	69 (3.5)	29 (3.7)	2 (1.0)	22 (3.0)	59 (3.6)	19 (2.9)	52 (3.9)	47 (3.9)	1 (0.6)
Japan	15 (3.3)	28 (3.7)	56 (4.2)	85 (2.9)	14 (3.0)	1 (0.0)	24 (3.5)	50 (3.9)	26 (3.6)	60 (4.6)	40 (4.6)	0 (0.0)
Jordan	46 (4.1)	49 (4.0)	5 (1.5)	79 (3.5)	21 (3.5)	0 (0.0)	14 (3.0)	72 (3.7)	14 (2.7)	46 (4.2)	51 (4.3)	3 (1.3)
Kazakhstan	74 (2.5)	23 (2.4)	3 (0.8)	87 (1.7)	13 (1.7)	0 (0.0)	17 (2.0)	78 (2.0)	5 (1.1)	67 (2.3)	32 (2.3)	1 (0.5)
Korea, Rep. of	41 (4.1)	41 (3.7)	17 (2.7)	85 (3.2)	15 (3.2)	0 (0.0)	33 (3.7)	59 (4.0)	8 (2.2)	28 (3.2)	62 (3.5)	10 (2.3)
Lebanon	70 (3.0)	29 (3.0)	2 (0.9)	83 (2.9)	17 (2.9)	0 (0.0)	45 (3.4)	51 (3.4)	4 (1.3)	77 (2.7)	23 (2.8)	0 (0.2)
Lithuania	22 (1.9)	71 (2.1)	8 (1.2)	87 (1.2)	13 (1.1)	0 (0.2)	12 (1.3)	72 (1.7)	16 (1.4)	72 (1.8)	28 (1.8)	0 (0.2)
Macedonia, Rep. of r	8 (1.1)	30 (2.1)	63 (2.4)	r 37 (1.8)	52 (2.0)	11 (1.2)	r 23 (2.3)	68 (2.6)	9 (1.5)	r 52 (2.4)	47 (2.4)	2 (0.6)
Malaysia	13 (2.6)	43 (3.8)	44 (4.1)	64 (3.7)	36 (3.7)	0 (0.0)	37 (3.7)	60 (3.9)	3 (1.3)	38 (3.4)	60 (3.3)	2 (1.1)
Morocco	4 (1.1)	57 (2.4)	39 (2.3)	86 (1.8)	13 (1.7)	0 (0.0)	18 (1.8)	67 (2.2)	15 (1.9)	51 (2.4)	45 (2.5)	4 (1.1)
New Zealand	8 (1.8)	69 (3.0)	23 (2.8)	74 (2.9)	26 (2.9)	0 (0.0)	23 (3.1)	67 (3.3)	9 (2.1)	68 (3.3)	31 (3.3)	1 (0.5)
Norway	2 (1.0)	64 (3.2)	34 (3.2)	66 (3.9)	34 (3.9)	0 (0.0)	6 (1.9)	58 (4.5)	36 (4.2)	56 (4.3)	44 (4.3)	0 (0.0)
Oman	14 (2.1)	58 (2.9)	29 (3.0)	78 (3.1)	22 (3.1)	0 (0.0)	22 (2.6)	68 (3.3)	11 (2.2)	60 (3.6)	39 (3.6)	1 (0.6)
Palestinian Nat'l Auth.	59 (3.1)	37 (3.2)	4 (1.6)	82 (3.2)	18 (3.2)	0 (0.0)	16 (2.8)	66 (3.5)	18 (3.2)	71 (3.8)	27 (3.7)	2 (1.3)
Qatar	70 (4.0)	25 (4.1)	5 (1.7)	68 (3.3)	31 (3.3)	1 (0.7)	29 (3.2)	65 (3.2)	6 (1.5)	56 (4.5)	40 (4.4)	4 (1.1)
Romania	38 (2.3)	52 (2.3)	11 (1.6)	85 (1.9)	14 (1.8)	0 (0.3)	23 (2.2)	63 (2.6)	14 (1.9)	63 (2.6)	36 (2.6)	0 (0.2)
Russian Federation	67 (2.2)	28 (1.9)	5 (1.1)	87 (1.5)	13 (1.5)	0 (0.0)	5 (0.7)	72 (1.6)	23 (1.7)	55 (2.1)	44 (2.0)	1 (0.3)
Saudi Arabia	56 (4.2)	38 (4.2)	6 (1.7)	74 (3.7)	25 (3.6)	1 (0.6)	13 (2.7)	66 (4.0)	21 (3.7)	29 (3.7)	62 (4.1)	9 (2.4)
Singapore	28 (1.9)	49 (2.5)	23 (2.0)	71 (2.5)	29 (2.5)	0 (0.0)	7 (1.5)	52 (2.6)	41 (2.7)	50 (3.0)	47 (3.1)	3 (0.9)
Slovenia	0 (0.2)	1 (0.4)	98 (0.5)	87 (1.6)	13 (1.6)	0 (0.0)	17 (1.5)	59 (2.1)	24 (2.0)	51 (2.1)	46 (2.0)	3 (0.8)
Sweden r	1 (0.8)	39 (4.1)	60 (4.1)	r 91 (1.7)	8 (1.7)	0 (0.1)	r 17 (2.7)	66 (3.8)	18 (2.6)	r 66 (3.1)	30 (3.0)	4 (1.3)
Syrian Arab Republic r	33 (4.2)	43 (3.9)	25 (3.3)	r 66 (3.7)	34 (3.7)	0 (0.4)	r 12 (2.6)	61 (4.1)	26 (3.6)	r 35 (3.5)	54 (3.9)	11 (2.3)
Thailand	63 (4.1)	32 (3.9)	5 (1.4)	58 (3.7)	42 (3.7)	0 (0.0)	28 (3.8)	68 (4.0)	3 (1.5)	64 (4.2)	35 (4.1)	1 (0.9)
Tunisia	4 (1.5)	39 (3.6)	56 (3.7)	85 (2.8)	13 (2.8)	1 (0.8)	10 (2.1)	72 (3.4)	19 (3.1)	45 (3.8)	52 (4.0)	3 (1.3)
Turkey	21 (3.1)	76 (3.2)	2 (1.0)	80 (2.6)	20 (2.6)	0 (0.4)	20 (2.8)	61 (3.6)	19 (2.8)	23 (2.9)	61 (3.2)	16 (2.5)
Ukraine	44 (3.0)	43 (2.8)	13 (1.9)	95 (0.9)	5 (0.9)	0 (0.0)	63 (2.8)	37 (2.7)	0 (0.2)	73 (2.4)	26 (2.4)	1 (0.3)
United Arab Emirates r	57 (2.7)	40 (2.6)	3 (0.7)	r 84 (1.7)	16 (1.6)	1 (0.5)	r 20 (1.7)	66 (2.2)	14 (1.8)	r 52 (2.4)	44 (2.4)	3 (1.0)
United States s	62 (2.8)	33 (3.0)	6 (1.1)	s 79 (2.1)	21 (2.1)	0 (0.0)	s 19 (2.1)	65 (2.6)	16 (2.0)	s 49 (2.6)	43 (2.7)	8 (1.5)
International Avg.	35 (0.4)	41 (0.5)	24 (0.4)	78 (0.4)	22 (0.4)	1 (0.1)	21 (0.4)	62 (0.5)	17 (0.4)	54 (0.5)	42 (0.5)	3 (0.2)

( ) 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 less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 8.32: Classroom Assessment (Continued)

Country	Percentage of Students Whose Teachers Give Science Tests or Examinations			Percentage of Students Whose Teachers Give Test Questions								
				Involving Application of Knowledge and Understanding			Involving Developing Hypotheses and Designing Scientific Investigations			Requiring Explanations or Justifications		
	Every 2 Weeks or More	About Once a Month	A Few Times a Year or Less	Always or Almost Always	Sometimes	Never or Almost Never	Always or Almost Always	Sometimes	Never or Almost Never	Always or Almost Always	Sometimes	Never or Almost Never
Ninth Grade Participants												
Botswana	18 (3.3)	82 (3.3)	0 (0.0)	75 (3.8)	25 (3.8)	0 (0.0)	15 (3.1)	75 (3.4)	10 (2.5)	62 (4.6)	38 (4.5)	1 (0.0)
Honduras	57 (4.3)	40 (4.3)	3 (1.3)	81 (3.2)	19 (3.2)	0 (0.0)	21 (3.5)	61 (4.7)	18 (3.8)	37 (4.6)	54 (4.4)	9 (2.8)
South Africa	23 (3.8)	63 (4.4)	14 (2.4)	68 (3.6)	31 (3.6)	0 (0.3)	31 (3.5)	64 (3.8)	6 (1.7)	53 (3.4)	47 (3.4)	0 (0.0)
Benchmarking Participants												
Alberta, Canada	56 (4.4)	37 (4.3)	6 (2.1)	79 (3.5)	21 (3.5)	0 (0.0)	18 (3.5)	62 (3.9)	20 (3.1)	51 (4.3)	48 (4.3)	1 (0.7)
Ontario, Canada r	27 (3.5)	51 (4.3)	22 (3.5)	r 82 (3.2)	17 (3.2)	1 (0.5)	r 25 (4.2)	60 (4.4)	15 (2.7)	r 70 (4.1)	29 (4.1)	1 (0.9)
Quebec, Canada	27 (3.9)	59 (4.5)	14 (3.1)	r 73 (4.0)	27 (4.1)	0 (0.4)	r 21 (3.9)	66 (4.3)	13 (3.1)	r 60 (4.2)	39 (4.2)	0 (0.3)
Abu Dhabi, UAE r	61 (4.7)	36 (4.6)	3 (1.3)	r 80 (3.4)	20 (3.4)	0 (0.0)	r 14 (3.0)	65 (4.3)	21 (3.8)	r 48 (4.7)	49 (4.9)	3 (1.8)
Dubai, UAE r	57 (2.5)	40 (2.5)	3 (0.6)	r 87 (1.8)	13 (1.8)	0 (0.0)	r 20 (1.9)	73 (2.1)	6 (1.0)	r 55 (3.4)	44 (3.4)	1 (0.2)
Alabama, US s	85 (5.2)	15 (5.2)	0 (0.0)	s 80 (7.0)	20 (7.0)	0 (0.0)	s 24 (5.6)	59 (7.4)	17 (5.1)	s 45 (6.4)	46 (6.4)	9 (4.9)
California, US s	56 (5.4)	36 (5.4)	8 (3.2)	s 74 (5.3)	26 (5.3)	0 (0.0)	s 13 (3.6)	55 (5.2)	33 (5.3)	s 31 (5.1)	46 (5.4)	23 (5.6)
Colorado, US s	47 (7.3)	43 (7.4)	11 (4.2)	s 85 (4.5)	15 (4.5)	0 (0.0)	s 34 (6.6)	60 (7.7)	6 (3.8)	s 73 (5.7)	27 (5.7)	0 (0.0)
Connecticut, US s	34 (6.6)	51 (5.5)	15 (4.5)	s 89 (3.8)	11 (3.8)	0 (0.0)	s 45 (6.4)	51 (6.2)	4 (1.2)	s 86 (4.3)	12 (3.9)	1 (1.4)
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x
Indiana, US s	54 (5.9)	34 (5.9)	11 (5.0)	s 72 (6.7)	27 (6.7)	1 (0.8)	s 9 (3.7)	69 (5.9)	22 (5.3)	s 50 (7.5)	41 (6.8)	9 (3.2)
Massachusetts, US s	43 (7.5)	55 (7.3)	2 (1.4)	s 85 (5.0)	15 (5.0)	0 (0.0)	s 19 (6.0)	61 (6.5)	20 (5.6)	s 73 (6.3)	27 (6.3)	0 (0.0)
Minnesota, US r	70 (4.7)	27 (5.3)	4 (1.9)	r 87 (3.7)	13 (3.7)	0 (0.0)	r 15 (5.6)	70 (6.9)	15 (4.8)	r 48 (5.4)	48 (5.7)	4 (2.1)
North Carolina, US s	64 (8.5)	33 (8.5)	3 (2.6)	s 75 (7.4)	25 (7.4)	0 (0.0)	s 10 (4.6)	72 (6.5)	17 (6.6)	s 39 (7.4)	52 (7.9)	9 (4.2)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011