

Chapter 10

Physics Students' Backgrounds and Attitudes

The students studying the physics assessed by TIMSS Advanced in the final year of secondary school are a very select group, comprising just a small fraction of the age cohort in every participating country (see Chapter 7). In order to gain entry to the physics tracks or courses targeted by TIMSS, students will have had to have demonstrated sustained achievement in physical science throughout their school careers, and to have had sufficient ability to enable them to come to terms with challenging physics content. Although a solid record of achievement and a facility for studying physics are probably the main determinants of success, there are many other factors that may be related to physics achievement, including a supportive home environment and a positive attitude to studying physics. To provide information on factors that can be important in interpreting the achievement results, this chapter summarizes students' reports on aspects of their home environments, how they spend their out of school time, computer use, preparation for examinations, attitudes toward physics, and expectations for further study.



Home Environments Supportive of Physics Achievement

Successive cycles of TIMSS and PIRLS have shown that students from homes well-endowed with literacy resources have higher achievement in mathematics, science, and reading than students from less advantaged homes. Exhibit 10.1, which presents students' reports about the number of books in their homes, shows that this is true of students taking physics in their final year of secondary school also. The exhibit shows, for each TIMSS Advanced 2008 participant, the percentage of students in five categories of book ownership, *more than 200 books*, *101–200 books*, *26–100 books*, *11–25 books*, and *0–10 books*, together with average physics achievement in each category and changes in percentages since 1995.

As shown in the exhibit, and in line with differences in the Human Development Index presented in Chapter 7, there was a range of book ownership across countries, from Norway and Sweden where more than 50 percent of students reported having more than 200 books at home to Lebanon with 10 percent. Compared with 1995, there was a pronounced downward trend in book ownership in 2008, with three of the four trend countries—Norway, the Russian Federation, and Slovenia—showing decreases in the percentages of students from homes with many books (more than 200). All four trend countries (the three already mentioned and Sweden) had increased percentages of students from homes with fewer books (25 or less). This downward trend may reflect the growth of Internet availability since 1995 and the greatly increased availability of literacy materials on the web.

Although the relationship is not identical in every country, in general there was a positive association between the number of books in the home and average achievement on the TIMSS Advanced physics assessment. The relationship was most pronounced in Sweden, where

Exhibit 10.1 Books in the Home with Trends



Country	More than 200 Books			101–200 Books			26–100 Books		
	2008 Percent of Students	Average Achievement	Difference in Percent from 1995	2008 Percent of Students	Average Achievement	Difference in Percent from 1995	2008 Percent of Students	Average Achievement	Difference in Percent from 1995
Armenia	29 (1.5)	491 (7.8)	◊ ◊	21 (1.3)	500 (7.7)	◊ ◊	27 (1.5)	492 (8.6)	◊ ◊
Iran, Islamic Rep. of	20 (1.3)	502 (12.3)	◊ ◊	13 (0.8)	469 (9.5)	◊ ◊	27 (1.0)	462 (8.7)	◊ ◊
Italy	40 (1.7)	434 (9.0)	◊ ◊	18 (1.2)	429 (8.9)	◊ ◊	24 (1.2)	415 (10.1)	◊ ◊
Lebanon	10 (0.8)	463 (8.2)	◊ ◊	11 (0.8)	465 (7.0)	◊ ◊	31 (1.3)	448 (5.3)	◊ ◊
Netherlands	37 (1.8)	588 (4.6)	◊ ◊	24 (1.1)	583 (5.3)	◊ ◊	26 (1.3)	579 (4.5)	◊ ◊
Norway	53 (1.7)	551 (4.7)	–8 (2.8) ▼	20 (1.0)	532 (6.1)	–1 (1.9)	16 (1.0)	524 (6.2)	1 (1.8)
Russian Federation	30 (1.5)	550 (11.5)	–13 (2.5) ▼	32 (0.9)	532 (9.5)	–2 (1.7)	28 (1.2)	498 (12.0)	8 (2.4) ▲
Slovenia	23 (1.1)	554 (4.8)	–10 (3.1) ▼	26 (1.0)	547 (4.9)	–4 (2.9)	37 (1.3)	528 (3.7)	4 (3.1)
Sweden	51 (1.4)	520 (4.9)	–3 (2.3)	19 (1.1)	496 (8.9)	–5 (2.1) ▼	20 (0.9)	468 (7.3)	3 (1.6)

SOURCE: IEA TIMSS Advanced 2008 ©

Country	11–25 Books			0–10 Books		
	2008 Percent of Students	Average Achievement	Difference in Percent from 1995	2008 Percent of Students	Average Achievement	Difference in Percent from 1995
Armenia	15 (1.7)	485 (10.5)	◊ ◊	7 (0.7)	476 (11.4)	◊ ◊
Iran, Islamic Rep. of	26 (1.1)	438 (6.6)	◊ ◊	15 (0.9)	429 (9.5)	◊ ◊
Italy	13 (1.2)	402 (11.9)	◊ ◊	5 (0.7)	392 (22.3)	◊ ◊
Lebanon	29 (1.1)	443 (4.8)	◊ ◊	19 (1.0)	420 (5.0)	◊ ◊
Netherlands	9 (0.9)	576 (6.1)	◊ ◊	4 (0.6)	574 (8.1)	◊ ◊
Norway	7 (0.7)	471 (8.2)	5 (0.8) ▲	3 (0.5)	469 (14.6)	2 (0.5) ▲
Russian Federation	9 (0.7)	467 (12.7)	7 (0.9) ▲	1 (0.2)	~ ~	0 (0.4)
Slovenia	12 (1.0)	510 (7.3)	8 (1.8) ▲	3 (0.5)	486 (14.1)	2 (0.6) ▲
Sweden	6 (0.6)	435 (10.1)	3 (0.9) ▲	3 (0.6)	424 (15.7)	2 (0.7) ▲

- ▲ 2008 percent significantly higher than 1995
- ▼ 2008 percent significantly lower than 1995

Data provided by students.

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

A diamond (◊) indicates the country did not participate in the 1995 assessment.

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

the difference in average achievement between students from homes in the highest category of book ownership (*more than 200 books*) and students from the lowest category (*0–10 books*) was almost 100 scale-score points. In contrast, the average achievement difference between students from the highest and lowest categories of book ownership in the Netherlands was just 14 score points.

Exhibit 10.2 presents the physics students' reports about how often they spoke the language they were tested in at home. In six of the nine participating countries—Armenia, Italy, the Netherlands, Norway, the Russian Federation, and Slovenia—almost all of the students assessed by TIMSS Advanced (95% or more) reported that they always or almost always spoke the language of the physics test at home, and in Sweden the percentage was almost as large (93%). Among countries with large majorities of students routinely speaking the language of the test at home and with enough data to support a comparison—these include Italy, the Netherlands, Norway, the Russian Federation, and Sweden—average physics achievement was usually lower among students speaking the language of the test sometimes at home than among those speaking it more frequently.

In Iran, 80 percent of physics students reported always or almost always speaking Farsi, the language of the test, with 12 percent sometimes speaking Farsi and 9 percent never speaking it.¹ Average physics achievement was about the same for those almost or almost always speaking Farsi and those never speaking it, but lower for intermittent Farsi speakers. In Lebanon, where the TIMSS Advanced assessment was administered in French while Arabic is the language of everyday life for most people, only 9 percent of students reported speaking French frequently at home. There was a positive relationship between physics achievement and frequency of speaking French at

1 After rounding, the percentages add to more than 100.

Exhibit 10.2 Students Speak Language of the Test at Home with Trends

TIMSSAdvanced2008
Physics

Country	Always or Almost Always			Sometimes			Never		
	2008 Percent of Students	Average Achievement	Difference in Percent from 1995	2008 Percent of Students	Average Achievement	Difference in Percent from 1995	2008 Percent of Students	Average Achievement	Difference in Percent from 1995
Armenia	98 (0.6)	491 (5.4)	◇ ◇	2 (0.6)	~ ~	◇ ◇	0 (0.2)	~ ~	◇ ◇
Iran, Islamic Rep. of	80 (2.4)	465 (7.8)	◇ ◇	12 (1.4)	419 (10.7)	◇ ◇	9 (1.4)	468 (17.3)	◇ ◇
Italy	96 (0.7)	423 (7.7)	◇ ◇	3 (0.6)	384 (20.1)	◇ ◇	1 (0.3)	~ ~	◇ ◇
Lebanon	9 (0.7)	479 (7.4)	◇ ◇	65 (1.4)	444 (3.8)	◇ ◇	26 (1.2)	434 (4.9)	◇ ◇
Netherlands	96 (0.6)	583 (3.5)	◇ ◇	3 (0.5)	569 (10.8)	◇ ◇	1 (0.3)	~ ~	◇ ◇
Norway	95 (0.5)	537 (4.2)	-1 (1.0)	4 (0.4)	486 (11.2)	1 (0.9)	1 (0.3)	~ ~	0 (0.5)
Russian Federation	96 (1.1)	522 (10.4)	-3 (1.1) ▼	3 (0.9)	508 (17.8)	3 (0.9) ▲	1 (0.4)	~ ~	0 (0.4)
Slovenia	97 (0.6)	536 (2.1)	1 (1.1)	2 (0.4)	~ ~	0 (0.8)	1 (0.3)	~ ~	-1 (0.9)
Sweden	93 (1.1)	502 (6.0)	-2 (1.4)	5 (0.8)	433 (14.4)	2 (1.1)	2 (0.4)	~ ~	0 (0.8)

SOURCE: IEA TIMSS Advanced 2008 ©

▲ 2008 percent significantly higher than 1995

▼ 2008 percent significantly lower than 1995

Data provided by students.

A diamond (◇) indicates the country did not participate in the 1995 assessment.

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

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

Exhibit 10.3 Students and Parents Born in the Country with Trends

TIMSSAdvanced2008
Physics

Country	Both Parents and the Student Born in the Country			At Least One of the Parents or the Student Born in the Country			Neither the Parents Nor the Student Born in the Country		
	2008 Percent of Students	Average Achievement	Difference in Percent from 1995	2008 Percent of Students	Average Achievement	Difference in Percent from 1995	2008 Percent of Students	Average Achievement	Difference in Percent from 1995
Armenia	88 (1.2)	490 (6.1)	◇ ◇	11 (1.3)	506 (10.9)	◇ ◇	1 (0.4)	~ ~	◇ ◇
Iran, Islamic Rep. of	98 (0.5)	460 (7.3)	◇ ◇	2 (0.5)	~ ~	◇ ◇	0 (0.1)	~ ~	◇ ◇
Italy	92 (0.7)	423 (7.5)	◇ ◇	7 (0.7)	414 (14.2)	◇ ◇	1 (0.3)	~ ~	◇ ◇
Lebanon	85 (0.9)	443 (3.4)	◇ ◇	15 (0.9)	452 (7.1)	◇ ◇	0 (0.1)	~ ~	◇ ◇
Netherlands	85 (1.3)	584 (3.6)	◇ ◇	12 (1.2)	578 (6.6)	◇ ◇	3 (0.5)	567 (12.8)	◇ ◇
Norway	83 (1.1)	540 (4.1)	-7 (1.7) ▼	13 (1.0)	517 (8.0)	5 (1.4) ▲	4 (0.6)	492 (15.1)	2 (0.9)
Russian Federation	83 (0.9)	520 (10.6)	3 (4.3)	14 (0.8)	533 (11.5)	-4 (4.2)	3 (0.3)	505 (16.2)	1 (0.5)
Slovenia	87 (0.9)	538 (2.2)	3 (2.2)	12 (0.9)	517 (7.6)	-1 (1.9)	1 (0.3)	~ ~	-2 (0.8) ▼
Sweden	77 (1.7)	508 (6.3)	-5 (3.4)	16 (1.1)	474 (11.1)	0 (2.7)	8 (1.1)	438 (9.8)	4 (1.3) ▲

SOURCE: IEA TIMSS Advanced 2008 ©

▲ 2008 percent significantly higher than 1995

▼ 2008 percent significantly lower than 1995

Data provided by students.

A diamond (◇) indicates the country did not participate in the 1995 assessment.

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

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

home, with highest average achievement among those always or almost always speaking French at home.

Related to the issue of the language spoken in the home in many countries is whether students and their parents were native to the country or were recent immigrants. As shown in Exhibit 10.3, more than 90 percent of the physics students in Iran and Italy reported that they and both their parents were born in the country, and in the other countries, with the exception of Sweden, the corresponding figures were between 80 and 90 percent. In Sweden, 77 percent of physics students reported that they and their parents were born in Sweden, with 8 percent reporting that neither they nor their parents were born in Sweden, and 16 percent that they themselves or at least one parent were Swedish born. In Norway, the percentage of physics students reporting that both they and their parents were born in Norway declined from 1995 (by 7 percentage points) and the percentage of students reporting that they themselves or at least one parent born in Norway increased (by 5 percentage points). In the Netherlands, Norway, Slovenia, and Sweden, students who were born in the country and whose parents also were native born had higher average physics achievement than students who reported that either they or at least one of their parents were born in the country.

Out of School Time and Computer Usage Among Physics Students

Exhibit 10.4 presents physics students' reports about how they spent their time outside of school on a normal school day. According to their reports, students spread their time across a range of activities, including doing schoolwork, taking part in organized activities, using a computer for things other than schoolwork, spending time with friends, working at a paid job, and watching movies or television. Most physics students reported spending between 0.8 and 2 hours on each of these activities.

Exhibit 10.4 Time in Hours Physics Students Spend on Various Activities Outside of School on a Normal School Day

TIMSSAdvanced2008
Physics

Country	Doing Schoolwork	Taking Part in Organized Activities	Using a Computer for Things Other than Schoolwork	Spending Time with Friends	Working at a Paid Job	Watching Movies or TV
Armenia	r 1.7 (0.07)	r 0.9 (0.05)	r 1.1 (0.05)	r 2.2 (0.08)	r 0.2 (0.03)	r 1.7 (0.07)
Iran, Islamic Rep. of	3.2 (0.04)	0.8 (0.03)	0.8 (0.03)	1.0 (0.03)	0.1 (0.02)	1.5 (0.03)
Italy	2.3 (0.07)	1.3 (0.04)	1.5 (0.04)	1.9 (0.05)	0.4 (0.03)	1.2 (0.04)
Lebanon	2.2 (0.04)	1.1 (0.03)	1.4 (0.03)	1.7 (0.04)	0.5 (0.03)	1.5 (0.03)
Netherlands	1.0 (0.02)	1.5 (0.03)	2.0 (0.04)	1.2 (0.03)	1.1 (0.04)	1.3 (0.03)
Norway	1.2 (0.04)	1.3 (0.03)	1.8 (0.04)	1.7 (0.04)	1.2 (0.06)	1.2 (0.03)
Russian Federation	2.1 (0.04)	1.4 (0.03)	1.8 (0.04)	2.7 (0.05)	0.2 (0.02)	1.3 (0.03)
Slovenia	1.3 (0.03)	--	1.7 (0.03)	1.8 (0.03)	0.6 (0.03)	1.1 (0.02)
Sweden	1.1 (0.04)	1.1 (0.03)	2.1 (0.08)	1.7 (0.04)	0.6 (0.06)	1.3 (0.03)

Data provided by students.

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

() Standard errors appear in parentheses.

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

Exhibit 10.5 Time Students Spend Using a Computer Each Day

TIMSSAdvanced2008
Physics

Country	No Time		Less than 1 Hour		1–2 Hours	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	r 24 (1.6)	505 (7.6)	30 (2.0)	486 (10.0)	31 (1.3)	492 (9.0)
Iran, Islamic Rep. of	27 (1.4)	449 (7.5)	39 (1.3)	473 (8.7)	24 (0.8)	455 (9.2)
Italy	2 (0.4)	~ ~	28 (1.3)	417 (10.9)	37 (1.8)	426 (8.7)
Lebanon	4 (0.6)	431 (14.0)	24 (1.1)	443 (5.5)	40 (1.4)	446 (4.5)
Netherlands	0 (0.1)	~ ~	15 (1.2)	582 (6.4)	40 (1.4)	585 (4.5)
Norway	0 (0.0)	~ ~	20 (1.3)	531 (6.3)	37 (1.1)	535 (4.8)
Russian Federation	4 (0.5)	478 (19.2)	26 (1.0)	525 (12.0)	40 (0.9)	521 (10.5)
Slovenia	1 (0.3)	~ ~	22 (1.1)	547 (5.1)	40 (1.6)	530 (4.5)
Sweden	0 (0.2)	~ ~	16 (1.2)	501 (9.1)	32 (1.5)	503 (6.6)

Country	More than 2 but Less than 4 Hours		4 or More Hours	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	r 9 (1.1)	490 (16.8)	7 (0.9)	497 (17.2)
Iran, Islamic Rep. of	7 (0.7)	458 (15.5)	3 (0.4)	433 (15.7)
Italy	23 (1.3)	425 (8.4)	10 (0.9)	424 (12.1)
Lebanon	23 (1.2)	456 (5.0)	9 (0.8)	426 (9.8)
Netherlands	29 (1.2)	582 (4.9)	16 (0.9)	582 (6.5)
Norway	28 (1.2)	535 (5.5)	15 (1.0)	539 (8.1)
Russian Federation	19 (0.8)	531 (10.5)	11 (0.7)	523 (13.7)
Slovenia	25 (1.4)	535 (4.3)	11 (1.0)	539 (7.0)
Sweden	30 (1.2)	496 (7.0)	21 (2.1)	487 (7.7)

Data provided by students.

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

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

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

Students in Iran, Italy, Lebanon, and the Russian Federation reported spending more than 2 hours daily on schoolwork (outside of school). Spending time with friends, using a computer, and watching movies or TV were popular pastimes in all countries, whereas working at a paid job was less common.

Exhibit 10.5 presents more detailed information on the amount of time physics students spent using a computer each day. It is clear from these reports that physics students in all countries except Armenia and Iran were frequent computer users, with 30–50 percent of students spending more than 2 hours using a computer each day. Computer usage in Armenia and Iran was relatively less, and in these countries approximately one student in four reported spending no time at all using a computer. There was no clear relationship across the countries between spending time using a computer and achievement in physics.

To provide information about whether computer use by physics students was a home or school activity or whether they used computers somewhere else, Exhibit 10.6 summarizes students' reports on the frequency of computer usage at home, at school, and elsewhere. The results indicate that the home was the principal locus of computer usage among physics students, with a large majority (more than 80%) in six of the nine participating countries—Italy, the Netherlands, Norway, the Russian Federation, Slovenia, and Sweden—reporting that they used a computer at home “a lot”. The majority of students in these countries reported sometimes using a computer in school also. In Armenia and Lebanon, relatively fewer physics students reported frequently using a computer at home (68% and 70%, respectively), and even fewer in Iran (44%). The relatively low level of home computer usage in these countries was offset somewhat by use in school and elsewhere. “Elsewhere” includes locations such as a public library, an Internet cafe, or a friend’s home. In line with the previous exhibit,

Exhibit 10.6 **Computer Use at Home and at School**

Country	Use a Computer at Home						
	A Lot		Sometimes		Never		
	Percent of Students	Average Achievement	Percent Students	Average Achievement	Percent Students	Average Achievement	
Armenia	s	68 (2.6)	487 (9.3)	21 (2.4)	508 (20.7)	11 (1.3)	475 (15.9)
Iran, Islamic Rep. of	r	44 (1.6)	482 (10.4)	54 (1.5)	453 (8.5)	2 (0.5)	~ ~
Italy		82 (1.3)	424 (7.0)	18 (1.3)	421 (14.5)	0 (0.1)	~ ~
Lebanon		70 (1.2)	451 (3.9)	28 (1.3)	437 (5.0)	3 (0.4)	425 (13.3)
Netherlands		90 (0.8)	583 (3.7)	10 (0.8)	582 (7.1)	0 (0.0)	~ ~
Norway		85 (1.2)	538 (4.2)	15 (1.1)	524 (6.4)	0 (0.1)	~ ~
Russian Federation		86 (0.7)	529 (10.3)	11 (0.7)	503 (11.4)	3 (0.5)	491 (20.6)
Slovenia		95 (0.7)	536 (2.1)	5 (0.7)	538 (10.2)	0 (0.1)	~ ~
Sweden		85 (1.1)	497 (6.1)	15 (1.1)	500 (8.1)	0 (0.1)	~ ~

SOURCE: IEA TIMSS Advanced 2008 ©

Country	Use a Computer at School						
	A Lot		Sometimes		Never		
	Percent of Students	Average Achievement	Percent Students	Average Achievement	Percent Students	Average Achievement	
Armenia	s	20 (2.4)	483 (17.0)	62 (3.3)	494 (11.3)	18 (1.7)	467 (18.6)
Iran, Islamic Rep. of	r	1 (0.3)	~ ~	18 (2.3)	518 (15.7)	81 (2.3)	458 (7.8)
Italy		2 (0.3)	~ ~	72 (2.9)	421 (8.3)	26 (3.1)	427 (10.0)
Lebanon		2 (0.3)	~ ~	50 (1.9)	460 (4.6)	48 (1.8)	436 (3.1)
Netherlands		6 (0.7)	586 (5.9)	90 (0.8)	583 (3.8)	4 (0.8)	581 (8.3)
Norway		19 (2.0)	532 (7.6)	77 (2.0)	538 (4.4)	5 (0.7)	516 (12.3)
Russian Federation		8 (0.8)	533 (15.2)	84 (1.1)	526 (10.2)	8 (1.0)	511 (15.3)
Slovenia		4 (0.6)	515 (14.3)	70 (1.3)	541 (2.6)	26 (1.0)	531 (4.7)
Sweden		12 (1.4)	490 (9.0)	83 (1.8)	499 (6.1)	5 (1.4)	500 (20.1)

Country	Use a Computer Elsewhere						
	A Lot		Sometimes		Never		
	Percent of Students	Average Achievement	Percent Students	Average Achievement	Percent Students	Average Achievement	
Armenia	s	22 (1.9)	503 (10.5)	58 (2.3)	476 (12.5)	20 (2.4)	492 (13.2)
Iran, Islamic Rep. of	r	2 (0.5)	~ ~	51 (1.6)	464 (8.9)	47 (1.6)	474 (10.2)
Italy		1 (0.3)	~ ~	34 (2.1)	420 (9.3)	65 (2.0)	424 (8.0)
Lebanon		15 (1.0)	438 (7.1)	67 (1.2)	449 (3.2)	17 (1.0)	451 (6.3)
Netherlands		1 (0.2)	~ ~	33 (1.3)	577 (3.8)	66 (1.3)	586 (4.0)
Norway		2 (0.4)	~ ~	53 (1.4)	532 (4.8)	45 (1.5)	540 (4.7)
Russian Federation		4 (0.4)	488 (17.0)	53 (1.2)	524 (9.7)	43 (1.3)	534 (11.3)
Slovenia		2 (0.4)	~ ~	54 (1.6)	533 (3.3)	44 (1.6)	544 (3.7)
Sweden		1 (0.3)	~ ~	46 (1.4)	495 (6.8)	52 (1.4)	502 (5.7)

Data provided by students.

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

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

An "r" indicates 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.

computer usage, whether at home, in school, or elsewhere, was lowest among students in Iran.

Because of the immense potential of the computer as an educational tool, TIMSS asked the physics students about the ways they used computers in doing their schoolwork. As shown in Exhibit 10.7, computer usage for schoolwork was widespread in all countries, with researching information from the Internet the most popular activity, followed by word processing, and analyzing and processing data. In the Netherlands, Norway, Slovenia, and Sweden, the percentage of physics students using computers for researching information on the Internet and for word processing was over 90 percent.

Despite the reported widespread use of computers for schoolwork, the physics students reported relatively little computer use for physics outside of class. As presented in Exhibit 10.8, the majority of students in all but two countries (the Russian Federation and Slovenia) reported never or almost never using a computer for physics outside class. Even in countries with very high levels of computer usage generally, such as the Netherlands, Norway, and Sweden, physics students reported only sporadic use for physics (about once a month for one student in four).

Exhibit 10.7 Various Ways Physics Students Use Computers for Schoolwork



Country	Percent of Students Using Computers in Various Ways for Schoolwork				
	Researching Information from the Internet	Word Processing	Analyzing and Presenting Data	Using Specialized Programs	Other
Armenia	r 76 (2.0)	r 64 (2.3)	s 31 (2.8)	s 35 (2.2)	s 33 (2.6)
Iran, Islamic Rep. of	81 (1.1)	38 (1.6)	25 (1.6)	16 (1.2)	68 (1.3)
Italy	98 (0.4)	37 (1.9)	53 (2.5)	26 (2.0)	71 (1.1)
Lebanon	88 (0.9)	42 (1.1)	40 (1.3)	34 (1.4)	71 (1.1)
Netherlands	99 (0.2)	98 (0.4)	68 (1.7)	33 (1.7)	23 (1.3)
Norway	99 (0.2)	96 (0.5)	57 (1.6)	19 (1.7)	70 (1.4)
Russian Federation	86 (1.0)	89 (0.8)	44 (1.5)	33 (1.5)	64 (1.2)
Slovenia	99 (0.3)	97 (0.5)	78 (1.2)	40 (1.7)	r 42 (1.7)
Sweden	100 (0.1)	95 (0.6)	51 (2.1)	17 (1.4)	68 (1.1)

SOURCE: IEA TIMSS Advanced 2008 ©

Data provided by students.

() Standard errors appear in parentheses.

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 10.8 Frequency of Computer Use for Physics Outside of Class



Country	Almost Every Day		Once or Twice a Week		About Once a Month		Never or Almost Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	8 (1.1)	489 (14.7)	14 (1.4)	515 (12.8)	13 (1.1)	482 (11.3)	65 (1.7)	488 (6.5)
Iran, Islamic Rep. of	1 (0.2)	~ ~	3 (0.4)	488 (22.6)	11 (0.7)	469 (12.9)	85 (0.8)	459 (7.0)
Italy	3 (0.5)	438 (18.2)	11 (1.0)	435 (14.9)	17 (1.5)	440 (13.3)	69 (2.1)	415 (8.3)
Lebanon	4 (0.6)	396 (12.5)	16 (1.2)	443 (8.2)	22 (1.1)	453 (5.4)	58 (1.4)	445 (3.2)
Netherlands	2 (0.3)	~ ~	6 (0.9)	582 (7.6)	25 (1.6)	580 (4.6)	67 (2.0)	584 (4.2)
Norway	2 (0.4)	~ ~	7 (1.2)	528 (10.1)	26 (2.5)	542 (4.2)	65 (3.2)	533 (4.7)
Russian Federation	5 (0.6)	553 (14.4)	22 (1.0)	534 (10.9)	26 (1.2)	534 (10.7)	47 (1.8)	505 (10.8)
Slovenia	7 (0.9)	508 (10.2)	18 (1.3)	521 (6.2)	37 (1.3)	544 (4.0)	38 (1.2)	539 (4.2)
Sweden	0 (0.1)	~ ~	3 (0.5)	479 (20.1)	15 (1.6)	496 (7.8)	82 (1.6)	498 (5.6)

SOURCE: IEA TIMSS Advanced 2008 ©

Data provided by students.

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

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

Working with a Physics Tutor and Preparing for Physics Tests

As described in Chapter 7, in almost all of the nine countries that assessed physics in TIMSS Advanced 2008, physics students write public examinations that have serious consequences for their future educational opportunities and life chances. In this situation, students may have recourse to physics tutors or other outside support to help them improve their physics knowledge and understanding. Exhibit 10.9 shows, however, that the practice is rare among physics students, with only Armenia (15%) and the Russian Federation (9%) having appreciable percentages of students working with a physics tutor as often as once a week. In all countries except Armenia and the Russian Federation, the students who never or almost never work with a tutor had higher physics achievement than those who sought help even occasionally.

According to Exhibit 10.10, a majority of physics students in six of the nine TIMSS Advanced countries, including Armenia, Iran, Italy, Lebanon, the Russian Federation, and Slovenia, prepare for tests or examinations about once a month or more. Studying for a physics test was less common in the Netherlands, Norway, and Sweden, where the majority of students reported preparing for a test about five times a year. Across the participating countries, there was no discernible relationship between frequency of testing and physics achievement.

Exhibit 10.9 Frequency of Working with Physics Tutor

TIMSS Advanced 2008
Physics

Country	More than Once a Week		About Once a Week		About Once a Month	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	15 (1.3)	532 (9.9)	3 (0.8)	467 (33.5)	2 (0.6)	~ ~
Iran, Islamic Rep. of	6 (1.0)	440 (17.9)	7 (0.7)	459 (14.8)	1 (0.3)	~ ~
Italy	2 (0.5)	~ ~	5 (0.8)	392 (15.9)	3 (0.7)	413 (27.0)
Lebanon	5 (0.5)	394 (9.9)	8 (0.8)	398 (8.3)	5 (0.6)	395 (15.6)
Netherlands	0 (0.1)	~ ~	2 (0.5)	~ ~	1 (0.2)	~ ~
Norway	--	--	--	--	--	--
Russian Federation	9 (1.0)	571 (14.2)	16 (1.0)	562 (10.6)	1 (0.2)	~ ~
Slovenia	0 (0.2)	~ ~	1 (0.2)	~ ~	1 (0.3)	~ ~
Sweden	--	--	--	--	--	--

SOURCE: IEA TIMSS Advanced 2008 ©

Country	Once in a While When I Need Extra Help		Never or Almost Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	9 (0.7)	525 (11.6)	71 (1.6)	478 (7.4)
Iran, Islamic Rep. of	9 (0.8)	436 (11.5)	76 (1.3)	465 (7.3)
Italy	22 (1.5)	394 (11.4)	68 (2.3)	434 (8.1)
Lebanon	15 (0.9)	430 (5.2)	67 (1.4)	461 (3.0)
Netherlands	9 (0.9)	553 (6.1)	88 (1.2)	587 (3.6)
Norway	--	--	--	--
Russian Federation	10 (0.7)	521 (12.6)	64 (1.5)	505 (11.0)
Slovenia	8 (0.8)	491 (10.1)	91 (0.8)	540 (2.0)
Sweden	--	--	--	--

Data provided by students.

A dash (-) indicates comparable data are not available. Norway and Sweden did not collect this information. According to the NRCs of these countries, tutors are not used.

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

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

Exhibit 10.10 Frequency of Preparing for Physics Test or Examination

TIMSSAdvanced 2008
Physics

Country	About Once a Week		About Once a Month		About 5 Times a Year	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	29 (2.0)	495 (7.5)	25 (1.9)	505 (9.7)	7 (0.9)	499 (11.6)
Iran, Islamic Rep. of	27 (1.6)	477 (11.6)	51 (1.3)	459 (7.2)	10 (0.8)	475 (12.1)
Italy	28 (1.6)	411 (10.3)	50 (1.9)	431 (8.7)	15 (1.4)	422 (12.3)
Lebanon	46 (1.4)	443 (4.4)	43 (1.4)	449 (4.7)	8 (0.8)	455 (11.0)
Netherlands	7 (0.7)	549 (7.9)	20 (2.3)	578 (5.1)	61 (2.4)	587 (4.2)
Norway	1 (0.2)	~ ~	35 (2.8)	527 (4.8)	61 (2.7)	542 (4.6)
Russian Federation	29 (1.4)	532 (10.7)	46 (1.6)	526 (10.2)	13 (1.3)	522 (15.9)
Slovenia	12 (1.0)	510 (8.1)	44 (1.7)	531 (3.4)	35 (1.5)	551 (3.9)
Sweden	1 (0.2)	~ ~	18 (1.3)	467 (8.1)	71 (1.7)	506 (5.9)

SOURCE: IEA TIMSS Advanced 2008 ©

Country	About Twice a Year		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	17 (1.8)	501 (10.8)	23 (2.0)	462 (10.3)
Iran, Islamic Rep. of	7 (0.7)	413 (10.6)	4 (0.4)	407 (13.6)
Italy	4 (1.0)	379 (19.9)	3 (0.5)	445 (19.8)
Lebanon	2 (0.4)	~ ~	1 (0.3)	~ ~
Netherlands	10 (1.4)	596 (5.4)	1 (0.3)	~ ~
Norway	3 (0.6)	512 (18.1)	0 (0.2)	~ ~
Russian Federation	8 (0.7)	500 (18.4)	5 (0.5)	449 (23.0)
Slovenia	7 (0.9)	530 (9.9)	1 (0.4)	~ ~
Sweden	10 (1.7)	501 (12.7)	1 (0.2)	~ ~

Data provided by students.

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

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

Students' Reasons for Studying Physics

As discussed earlier, the students studying the physics assessed by TIMSS Advanced were a very select group in all countries, drawing from the most scientifically able in their age groups. Since it is very important to attract such students to study physics in the first place, and then to retain them for tertiary-level study and a career involving physics, it is useful to know what factors attracted them to the study of physics in secondary school. Exhibits 10.11, 10.12, and 10.13 present student reports on three general reasons for studying physics—having a positive affect toward physics, good teachers and teaching, and advice from others.

Exhibit 10.11 summarizes students' responses to three statements about having a positive orientation toward physics as a reason for studying the subject at an advanced level:

- ▶ I enjoy conducting experiments or investigations for physics.
- ▶ I usually do well in physics.
- ▶ Physics lessons are interesting.

Students were asked to indicate the degree of importance of each reason in deciding to study physics in secondary school. In Exhibit 10.11, students were assigned to one of four categories of the positive orientation factor—*very important*, *important*, *unimportant*, and *very unimportant*—according to their average response across the three statements based on a 4-point Likert scale. The exhibit shows the percentage of students in each of the four categories for each country, together with average physics achievement for each category. Countries are ordered by the percentage of students in the “very important” category.

Exhibit 10.11 **Students' Reasons for Studying Physics – Students Have Positive Affect Toward Physics**

TIMSS Advanced 2008
Physics

Country	Very Important		Important		Unimportant		Very Unimportant	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Lebanon	58 (1.3)	458 (4.0)	33 (1.3)	430 (5.0)	7 (0.6)	418 (6.7)	2 (0.3)	~ ~
Iran, Islamic Rep. of	42 (1.3)	486 (8.5)	37 (1.1)	454 (7.8)	15 (0.8)	422 (8.9)	6 (0.6)	413 (14.5)
Armenia r	33 (2.4)	504 (4.7)	47 (1.9)	495 (7.7)	14 (1.6)	478 (10.2)	6 (1.2)	459 (16.8)
Slovenia	31 (1.5)	558 (3.8)	52 (1.7)	528 (4.3)	13 (1.0)	517 (7.4)	3 (0.5)	509 (14.9)
Norway	25 (1.4)	566 (5.7)	50 (1.2)	537 (4.4)	20 (1.2)	508 (6.1)	5 (0.6)	472 (9.9)
Russian Federation	20 (1.2)	562 (10.4)	51 (1.3)	531 (10.3)	23 (1.1)	488 (11.3)	6 (0.5)	444 (17.1)
Netherlands	20 (1.3)	607 (4.1)	54 (1.4)	585 (3.8)	22 (1.1)	563 (5.2)	4 (0.5)	546 (7.6)
Italy	17 (1.1)	458 (9.8)	45 (1.4)	435 (8.4)	25 (1.1)	399 (9.0)	13 (1.0)	373 (8.8)
Sweden	15 (1.0)	545 (6.4)	43 (1.4)	506 (5.6)	29 (1.6)	478 (7.3)	13 (0.8)	450 (12.3)

SOURCE: IEA TIMSS Advanced 2008 ©

Based on students' responses to three statements about why students study physics: 1) I enjoy conducting experiments or investigations for physics; 2) I usually do well in physics; and 3) Physics lessons are interesting. Average is computed across three statements based on a 4-point Likert scale: 1. Very important; 2. Important; 3. Unimportant; 4. Very unimportant. Very important indicates an average response score of 1 to less than 1.75. Important indicates an average of 1.75 through 2.5. Unimportant indicates an average response score of greater than 2.5 through 3.25. Very unimportant indicates an average greater than 3.25 through 4.

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

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

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

Exhibit 10.12 **Students' Reasons for Studying Physics – Good Teachers and Teaching**

TIMSS Advanced 2008
Physics

Country	Very Important		Important		Unimportant		Very Unimportant	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia r	56 (2.5)	493 (7.7)	34 (2.0)	500 (7.9)	4 (0.9)	485 (24.8)	6 (1.0)	467 (17.5)
Russian Federation	55 (2.2)	529 (10.2)	36 (1.7)	516 (11.7)	6 (0.7)	512 (17.4)	4 (0.5)	493 (23.5)
Lebanon	49 (1.7)	446 (4.1)	34 (1.5)	445 (4.6)	9 (0.8)	459 (7.2)	8 (0.9)	438 (9.3)
Iran, Islamic Rep. of	29 (1.6)	447 (7.6)	37 (1.2)	466 (8.8)	15 (0.8)	467 (9.4)	18 (1.3)	466 (10.3)
Sweden	27 (1.5)	506 (6.3)	44 (1.3)	500 (6.5)	15 (1.0)	499 (9.0)	14 (1.0)	470 (10.0)
Slovenia	27 (1.3)	540 (4.6)	47 (1.4)	534 (3.0)	17 (1.3)	534 (7.1)	10 (0.8)	531 (7.9)
Norway	26 (2.0)	541 (6.3)	44 (1.2)	540 (4.1)	19 (1.6)	535 (6.0)	11 (1.4)	504 (9.4)
Italy	22 (2.1)	420 (9.8)	47 (1.5)	429 (8.3)	15 (1.3)	419 (9.5)	16 (1.6)	408 (12.3)
Netherlands	15 (1.5)	587 (5.7)	49 (1.7)	585 (3.7)	25 (1.4)	581 (6.2)	11 (1.2)	575 (4.7)

SOURCE: IEA TIMSS Advanced 2008 ©

Based on students' responses to the two statements about why students study physics: 1) Physics has good teachers; and 2) I like the way physics is taught in my school. Average is computed across two statements based on a 4-point Likert scale: 1. Very important; 2. Important; 3. Unimportant; 4. Very unimportant. Very important indicates an average response score of 1 to less than 1.75. Important indicates an average of 1.75 through 2.5. Unimportant indicates an average response score of greater than 2.5 through 3.25. Very unimportant indicates an average greater than 3.25 through 4.

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

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

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



Perhaps not surprisingly, students in all countries considered having a positive orientation toward physics to be important in choosing to study the subject. In every country, the majority of students (ranging from 58% in Sweden to 91% in Lebanon) considered a positive orientation to be important or very important to their decision. In every country, also, students who considered a positive orientation to be important for choosing to study physics had higher average physics achievement than students who thought it less important.

Having physics teachers who are good mentors and role models and being exposed to good teaching are obvious positive sources of influence on the decision to study physics. Exhibit 10.12 presents students' responses to two statements about good teachers and teaching as reasons for studying physics:

- ▶ Physics has good teachers.
- ▶ I like the way physics is taught in my school.

Again, students were asked to indicate the degree of importance of each one in deciding to study physics in secondary school. As in the previous exhibit, students were assigned to one of four categories of the good teaching factor—*very important*, *important*, *unimportant*, and *very unimportant*—according to their average response based on a 4-point Likert scale. Exhibit 10.12 shows the percentage of students in each of the four categories for each country, together with the average physics achievement for each category. Countries are ranked by the percentage of students in the “very important” category.

Although in general, a large majority of students in all countries were in agreement that good teaching was an important reason to study physics, there was a wide range in the degree of importance across countries, ranging from Armenia, where 56 percent of students considered good teaching to be very important, to the Netherlands,

where the corresponding figure was just 15 percent. In Iran, Sweden, Slovenia, Norway, Italy, and the Netherlands, between one fourth and one third of the physics students indicated that good teaching was not important in the decision to study physics in secondary school. There was no consistent relationship across countries between physics achievement and students' reports that good teaching was an important reason for studying physics.

The third set of students' reasons for choosing to study physics involved advice from others—parents, teachers, school advisors—as well as simply doing what their friends were doing. More specifically, there were four statements about advice from others as reasons for studying physics:

- ▶ My parents advised me to study physics.
- ▶ A teacher advised me to study physics.
- ▶ My friends also are studying physics.
- ▶ The <study coordinator/mentor>² of my school advised me to study physics.

As with the other sets of reasons, students were asked to indicate the degree of importance of each reason in choosing to study physics. As in the previous exhibits, students were assigned to one of four categories of the advice-from-others factor—*very important*, *important*, *unimportant*, and *very unimportant*—according to their average response based on a 4-point Likert scale. Exhibit 10.13 shows the percentage of students in each of the four categories for each country, together with the average physics achievement for each category. Countries are ranked by the percentage of students in the “very important” category.

2 National Research Coordinators replaced the term <study coordinator/mentor> with a culturally appropriate term.

Exhibit 10.13 Students' Reasons for Studying Physics – Advice from Others



Country	Very Important		Important		Unimportant		Very Unimportant	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	10 (1.1)	491 (11.3)	45 (2.1)	495 (7.9)	28 (1.8)	499 (9.8)	17 (1.9)	477 (16.8)
Lebanon	4 (0.5)	393 (12.0)	24 (1.4)	427 (5.8)	35 (1.3)	448 (4.2)	36 (1.1)	461 (3.9)
Iran, Islamic Rep. of	4 (0.5)	380 (15.8)	22 (1.2)	418 (8.0)	32 (1.2)	450 (7.8)	42 (1.5)	498 (8.8)
Russian Federation	2 (0.2)	~ ~	24 (1.1)	529 (10.6)	48 (1.3)	525 (10.2)	27 (1.3)	506 (13.9)
Italy	1 (0.3)	~ ~	9 (1.2)	406 (12.8)	27 (1.4)	417 (9.1)	63 (2.0)	426 (8.3)
Norway	1 (0.3)	~ ~	16 (1.0)	530 (5.9)	50 (1.6)	533 (4.2)	33 (1.6)	542 (5.0)
Slovenia	1 (0.3)	~ ~	8 (0.7)	516 (10.1)	42 (1.4)	535 (3.6)	49 (1.4)	539 (3.6)
Sweden	1 (0.2)	~ ~	11 (0.8)	462 (8.3)	40 (1.1)	502 (5.8)	49 (1.2)	502 (6.6)
Netherlands	0 (0.1)	~ ~	11 (1.0)	581 (6.4)	52 (1.4)	582 (4.0)	37 (1.5)	585 (3.9)

SOURCE: IEA TIMSS Advanced 2008 ©

Based on students' responses to the four statements about why students study physics: 1) My parents advised me to study physics; 2) A teacher advised me to study physics; 3) My friends also are studying physics; and 4) The <study coordinator/mentor> of my school advised me to study physics. Average is computed across four statements based on a 4-point Likert scale: 1. Very important; 2. Important; 3. Unimportant; 4. Very unimportant. Very important indicates an average response score of 1 to less than 1.75. Important indicates an average of 1.75 through 2.5. Unimportant indicates an average response

score of greater than 2.5 through 3.25. Very unimportant indicates an average greater than 3.25 through 4.

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

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

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

In general, students considered advice from others to be a relatively less important reason for studying physics than having a positive orientation or good teaching, with the majority of students in all countries except Armenia indicating that advice from others was unimportant or very unimportant. In Italy, Norway, Slovenia, Sweden, and the Netherlands more than 80 percent of students were in these categories. Similar to students taking advanced mathematics (see Chapter 4), the more able physics students were less likely to rely on advice from others in deciding to study physics. In a number of countries except Armenia, the Russian Federation, Norway and the Netherlands, students with higher achievement were those reporting that advice from others was unimportant or very unimportant.

Areas of Future Study for Students of Physics

A solid grounding in physics is an excellent basis for future study in many disciplines, particularly engineering, but also computer and information science, mathematics, general science, business, and the health and social sciences. Students' reports of the areas in which they intended to pursue further study are summarized in Exhibit 10.14. Almost all (94% or more) physics students in each of the participating countries indicated that they planned to continue their education after finishing secondary school.

Engineering was the most popular area for post-secondary study among students who studied physics in the final year of secondary school, with more students choosing it than any other in six of the nine countries—Iran, Lebanon, Netherlands, Norway, Slovenia, and Sweden. In addition, while it was not the most popular choice in Italy and the Russian Federation, about 20 percent of the students in these countries also chose engineering for their future area of study. After engineering, business was the next most popular subject choice,

Exhibit 10.14 **Physics Student's Aspirations for Future Study**TIMSS Advanced 2008
Physics

Country	Percent of Students Intending to Continue Education	Percent of Students with Intended Area of Study							
		Science	Health Science	Engineering	Business	Computer and Information Science	Mathematics	Social Science	Other Field of Study
Armenia	94 (1.0)	6 (1.0)	14 (1.6)	2 (0.8)	22 (2.1)	11 (1.6)	5 (0.9)	3 (0.6)	36 (2.5)
Iran, Islamic Rep. of	100 (0.1)	4 (0.5)	1 (0.2)	82 (1.2)	2 (0.4)	4 (0.6)	1 (0.3)	1 (0.2)	4 (0.5)
Italy	96 (0.8)	10 (1.0)	26 (1.5)	19 (1.0)	12 (1.0)	4 (0.5)	2 (0.4)	7 (0.7)	19 (1.3)
Lebanon	99 (0.2)	4 (0.5)	2 (0.3)	65 (1.7)	5 (0.7)	8 (0.9)	8 (0.7)	1 (0.2)	8 (0.8)
Netherlands	100 (0.2)	17 (1.2)	14 (1.0)	40 (1.5)	7 (0.8)	7 (0.7)	4 (0.5)	3 (0.5)	7 (0.7)
Norway	100 (0.0)	11 (1.1)	15 (1.1)	41 (1.3)	12 (1.1)	5 (0.7)	2 (0.4)	5 (0.5)	10 (0.7)
Russian Federation	100 (0.0)	8 (0.7)	4 (0.5)	21 (1.1)	23 (0.9)	17 (1.0)	4 (0.5)	12 (0.7)	11 (0.8)
Slovenia	100 (0.0)	19 (1.2)	10 (0.8)	36 (1.4)	5 (0.6)	12 (0.9)	8 (0.8)	7 (0.8)	4 (0.5)
Sweden	99 (0.3)	17 (1.9)	16 (1.4)	29 (2.9)	9 (1.0)	9 (1.2)	2 (0.4)	6 (0.6)	12 (1.1)

SOURCE: IEA TIMSS Advanced 2008 ©

Data provided by students.

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

with more than 20 percent of students in Armenia and the Russian Federation choosing this option. Relatively few physics students in any country (less than 20 percent) chose science, computer and information science, mathematics, or social science as their area of future study; and only Italy had more than 20 percent choosing health science. In Armenia (36%), most physics students chose a field of study other than those listed above.

To provide a more detailed perspective on the subject areas that physics students planned to study after secondary school, Exhibit 10.15 presents the percentage of females choosing each subject area for each country and the percentage of males. If there were no differences in gender preferences, the percentages for females and males in a subject area for a country would be the same (and would be equal to the corresponding entry in Exhibit 10.14). The most pervasive gender differences were in engineering, health science, and computer and information science. The percentage of male physics students intending to study engineering exceeded the percentage of female students in every country, and in computer and information science the percentage of male students was greater than the percentage of female students in all countries except Iran and Lebanon. In contrast, health science and, to a lesser extent, social science were the areas of choice by females more often than by males in most countries—in all countries but Iran for health science, and in Italy, the Netherlands, the Russian Federation, and Slovenia for social science. A greater percentage of female physics students than males in Lebanon and Sweden chose science as a future area of study, and a greater percentage of male physics students than females chose it in the Russian Federation. Similarly, there were not many gender differences in the students choosing business, although more male students than females chose this area in Armenia, Italy, and the Netherlands, and more females than males in the Russian

Exhibit 10.15 **Physics Student's Aspirations for Future Study by Gender**

TIMSS Advanced 2008
Physics

Country	Percent of Students by Intended Area of Study							
	Science		Health Science		Engineering		Business	
	Females	Males	Females	Males	Females	Males	Females	Males
Armenia	5 (1.2)	8 (1.9)	20 (2.5) ▲	7 (1.3)	1 (0.4)	5 (1.7) ▲	19 (2.7)	27 (2.1) ▲
Iran, Islamic Rep. of	5 (0.8)	4 (0.6)	2 (0.4)	1 (0.3)	78 (2.1)	85 (1.3) ▲	3 (0.8)	1 (0.3)
Italy	9 (1.3)	10 (1.2)	35 (2.5) ▲	20 (1.8)	6 (1.0)	28 (1.9) ▲	9 (1.5)	15 (1.5) ▲
Lebanon	6 (1.1) ▲	3 (0.7)	4 (0.9) ▲	1 (0.4)	54 (2.4)	69 (2.0) ▲	7 (1.3)	5 (0.7)
Netherlands	21 (2.5)	16 (1.3)	26 (2.9) ▲	12 (1.0)	22 (2.7)	44 (1.6) ▲	5 (1.4)	8 (0.9) ▲
Norway	13 (2.1)	9 (1.1)	30 (3.2) ▲	8 (0.9)	30 (2.3)	46 (1.5) ▲	10 (1.4)	12 (1.4)
Russian Federation	6 (0.8)	9 (0.9) ▲	7 (1.0) ▲	2 (0.5)	10 (1.3)	30 (1.6) ▲	34 (1.5) ▲	14 (0.9)
Slovenia	18 (2.5)	19 (1.5)	22 (2.7) ▲	5 (0.9)	22 (2.9)	41 (1.6) ▲	4 (1.1)	5 (0.9)
Sweden	21 (2.1) ▲	15 (2.0)	31 (2.0) ▲	7 (0.8)	15 (2.1)	36 (3.3) ▲	9 (1.1)	9 (1.3)

SOURCE: IEA TIMSS Advanced 2008 ©

Country	Percent of Students by Intended Area of Study							
	Computer and Information Science		Mathematics		Social Science		Other Field of Study	
	Females	Males	Females	Males	Females	Males	Females	Males
Armenia	6 (2.0)	17 (1.8) ▲	5 (1.1)	4 (1.0)	3 (0.8)	3 (1.0)	41 (3.2) ▲	30 (2.6)
Iran, Islamic Rep. of	5 (1.3)	3 (0.4)	1 (0.5)	1 (0.3)	1 (0.3)	0 (0.3)	5 (0.9)	3 (0.6)
Italy	1 (0.5)	6 (0.8) ▲	3 (0.8)	2 (0.4)	12 (1.2) ▲	5 (0.8)	25 (2.3) ▲	15 (1.3)
Lebanon	7 (1.6)	9 (1.0)	13 (1.8) ▲	6 (0.7)	1 (0.4)	0 (0.2)	8 (1.4)	7 (1.1)
Netherlands	2 (0.9)	8 (0.8) ▲	5 (1.4)	4 (0.5)	7 (1.4) ▲	2 (0.5)	12 (2.1) ▲	6 (0.7)
Norway	2 (0.6)	7 (0.8) ▲	2 (0.7)	2 (0.4)	4 (1.2)	5 (0.6)	10 (1.4)	10 (0.9)
Russian Federation	6 (0.7)	27 (1.3) ▲	5 (0.7)	4 (0.6)	19 (1.3) ▲	5 (0.7)	14 (1.2) ▲	9 (0.9)
Slovenia	1 (0.8)	16 (1.2) ▲	15 (2.2) ▲	5 (0.8)	12 (2.1) ▲	5 (0.8)	6 (1.4)	4 (0.7)
Sweden	1 (0.3)	13 (1.5) ▲	2 (0.5)	2 (0.5)	8 (1.3)	5 (0.8)	13 (1.6)	12 (1.3)

▲ Significantly higher than other gender

Data provided by students.

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

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

Federation. In those planning to study mathematics, the only differences were in Lebanon and Slovenia, where the percentages of females were higher. Finally, more female physics students than males chose the “other” field of study in four of the nine countries, including Armenia, Italy, the Netherlands, and the Russian Federation.

