

# Chapter 4

## Mathematics Students' Backgrounds and Attitudes

The advanced mathematics that is the focus of this report is learned only through sustained study throughout the years of schooling; and it is the school context, including the curriculum, school and classroom resources, and instruction in the classroom that is the main object of study by TIMSS. Nonetheless, previous IEA studies of mathematics achievement<sup>1</sup> have shown that student achievement is related to home environment among students at fourth and eighth grades, and that students from advantaged homes have higher achievement than their less advantaged classmates. As evidenced by the TIMSS Advanced Mathematics Coverage Index presented in earlier chapters, the students taking the advanced mathematics courses assessed by TIMSS Advanced are clearly a select group in every country, and presumably among the most able students of their age cohort. Even in such a select group, however, it is likely that a positive relationship between home environment and mathematics achievement exists. Since information on such factors can be very 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 mathematics, and expectations for further study.

<sup>1</sup> For example, for results from TIMSS 2007, see Mullis, I.V.S., Martin, M.O., & Foy, P. (2008). *TIMSS 2007 international mathematics report: Findings from IEA's Trends in International Mathematics and Science Report at the fourth and eighth grades*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

## Home Environments Supportive of Advanced Mathematics 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 4.1, which presents students' reports about the number of books in their homes, shows that this is true of students taking advanced mathematics in their final year of secondary school also. The exhibit shows, for each TIMSS Advanced 2008 participating country, 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 their average mathematics achievement and changes in percentages since 1995.

As shown in the exhibit, and in line with differences in the Human Development Index described in Chapter 2, there was a range of book ownership across countries, from Norway and Sweden where 50 percent or more of students reported having more than 200 books at home to Lebanon with 11 percent and the Philippines with 6 percent. Compared with 1995, there was a pronounced downward trend in book ownership in 2008, with three of the four trend countries—the Russian Federation, Slovenia, and Sweden—showing decreases in the percentages of students from homes with many books (more than 200) and increases in the percentages from homes with fewer books (100 or less). 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 mathematics assessment. The relationship was most pronounced in Italy and Sweden, where the difference in average achievement between students from homes in the highest category of book ownership (more

Exhibit 4.1 Books in the Home with Trends

**TIMSS Advanced 2008**  
Advanced Mathematics

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	30 (2.1)	444 (5.1)	◊ ◊	22 (1.9)	462 (8.3)	◊ ◊	27 (1.9)	426 (6.9)	◊ ◊
Iran, Islamic Rep. of	19 (1.4)	528 (10.8)	◊ ◊	14 (1.0)	500 (10.5)	◊ ◊	28 (1.1)	499 (6.1)	◊ ◊
Italy	33 (2.1)	475 (7.1)	3 (3.5)	18 (1.2)	460 (9.4)	-7 (3.8)	27 (1.3)	438 (7.8)	-4 (3.3)
Lebanon	11 (0.7)	566 (5.2)	◊ ◊	12 (0.8)	559 (5.4)	◊ ◊	31 (1.2)	548 (3.7)	◊ ◊
Netherlands	36 (1.9)	556 (2.9)	◊ ◊	21 (1.0)	555 (4.1)	◊ ◊	26 (1.4)	549 (3.2)	◊ ◊
Norway	52 (1.6)	454 (4.8)	◊ ◊	21 (1.1)	438 (5.5)	◊ ◊	16 (1.0)	424 (5.9)	◊ ◊
Philippines	6 (0.8)	387 (17.3)	◊ ◊	12 (0.7)	377 (10.9)	◊ ◊	38 (1.3)	371 (5.3)	◊ ◊
Russian Federation	38 (1.5)	575 (6.5)	-8 (2.6) ▼	31 (1.0)	561 (8.5)	-2 (2.0)	25 (1.1)	548 (8.9)	6 (2.0) ▲
Slovenia	21 (1.3)	467 (7.7)	-9 (2.5) ▼	25 (0.9)	461 (6.4)	-6 (2.3) ▼	38 (1.2)	456 (4.5)	5 (2.8) ▲
Sweden	50 (1.6)	439 (5.7)	-8 (2.5) ▼	19 (0.9)	410 (7.9)	-4 (1.9) ▼	19 (1.1)	379 (7.0)	5 (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	13 (1.3)	418 (10.0)	◊ ◊	7 (1.2)	376 (14.4)	◊ ◊
Iran, Islamic Rep. of	26 (1.2)	486 (6.1)	◊ ◊	13 (1.1)	465 (8.1)	◊ ◊
Italy	16 (1.1)	420 (10.6)	2 (2.6)	7 (0.8)	400 (15.7)	5 (1.0) ▲
Lebanon	26 (0.9)	542 (4.6)	◊ ◊	20 (1.0)	523 (3.8)	◊ ◊
Netherlands	12 (0.9)	552 (3.8)	◊ ◊	5 (0.6)	544 (8.2)	◊ ◊
Norway	7 (0.8)	387 (16.3)	◊ ◊	4 (0.5)	406 (14.7)	◊ ◊
Philippines	31 (1.0)	336 (6.6)	◊ ◊	13 (1.0)	323 (9.2)	◊ ◊
Russian Federation	6 (0.6)	525 (11.3)	3 (0.8) ▲	1 (0.2)	~ ~	0 (0.3)
Slovenia	14 (0.9)	448 (7.0)	8 (1.2) ▲	3 (0.4)	428 (15.4)	2 (0.6) ▲
Sweden	8 (0.8)	371 (14.1)	4 (1.3) ▲	4 (0.6)	362 (12.9)	4 (0.6) ▲

▲ 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.

than 200 books) and students from the lowest category (0–10 books) was 75 scale-score points or more in both countries. In contrast, the average achievement difference between students from the highest and lowest categories of book ownership in the Netherlands was just 12 score points.

In 5 of the 10 participating countries—Armenia, Italy, the Netherlands, the Russian Federation, and Slovenia—almost all of the students assessed by TIMSS Advanced (96% or more) reported that they always or almost always spoke the language of the TIMSS advanced mathematics test at home, and in Norway and Sweden the percentages were 94 and 93, respectively (see Exhibit 4.2). 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 the Netherlands, Norway, the Russian Federation, and Sweden—average mathematics achievement was usually lower among students speaking the language of the test sometimes or never at home than among those speaking it more frequently.

In Iran, 80 percent of the advanced mathematics students reported always or almost always speaking Farsi, the language of the test, and 20 percent sometimes or never. In Lebanon, where the TIMSS Advanced assessment was administered in French while Arabic is the language of everyday life for most people, only 10 percent of students reported speaking French frequently at home. Mathematics achievement was somewhat lower (13–15 scale-score points) among those reporting never speaking French at home compared to those who sometimes or always spoke it. In the Philippines, TIMSS Advanced was administered in English as the language of instruction for advanced academics, although only 15 percent of the students assessed reported speaking English frequently at home. Average mathematics

Exhibit 4.2 Students Speak Language of the Test at Home with Trends

TIMSSAdvanced2008  
Advanced Mathematics

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	97 (0.9)	436 (3.7)	◇ ◇	2 (0.9)	~ ~	◇ ◇	1 (0.2)	~ ~	◇ ◇
Iran, Islamic Rep. of	80 (2.3)	498 (7.1)	◇ ◇	10 (1.4)	473 (12.7)	◇ ◇	9 (1.4)	509 (12.1)	◇ ◇
Italy	99 (0.2)	449 (7.2)	2 (0.8) ▲	1 (0.2)	~ ~	-3 (0.8) ▼	0 (0.1)	~ ~	0 (0.2)
Lebanon	10 (0.8)	547 (5.7)	◇ ◇	66 (1.4)	549 (2.7)	◇ ◇	24 (1.3)	534 (4.1)	◇ ◇
Netherlands	96 (0.6)	553 (2.7)	◇ ◇	3 (0.4)	532 (8.9)	◇ ◇	1 (0.3)	~ ~	◇ ◇
Norway	94 (0.5)	442 (5.1)	◇ ◇	5 (0.5)	411 (13.9)	◇ ◇	1 (0.3)	~ ~	◇ ◇
Philippines	15 (1.0)	371 (10.0)	◇ ◇	81 (1.1)	350 (5.4)	◇ ◇	4 (0.3)	402 (11.4)	◇ ◇
Russian Federation	97 (0.8)	562 (7.3)	-3 (0.8) ▼	3 (0.6)	527 (14.7)	2 (0.6) ▲	1 (0.3)	~ ~	0 (0.4)
Slovenia	97 (0.4)	460 (4.3)	0 (0.6)	2 (0.4)	~ ~	0 (0.5)	1 (0.2)	~ ~	0 (0.3)
Sweden	93 (1.0)	418 (5.4)	-3 (1.3) ▼	6 (0.8)	355 (13.0)	2 (1.1) ▲	2 (0.4)	~ ~	1 (0.5)

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 4.3 Students and Parents Born in the Country with Trends

TIMSSAdvanced2008  
Advanced Mathematics

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	89 (1.4)	432 (3.6)	◇ ◇	11 (1.3)	460 (15.4)	◇ ◇	0 (0.2)	~ ~	◇ ◇
Iran, Islamic Rep. of	98 (0.5)	497 (6.5)	◇ ◇	2 (0.5)	~ ~	◇ ◇	0 (0.1)	~ ~	◇ ◇
Italy	93 (0.6)	449 (7.2)	-2 (1.4)	5 (0.6)	448 (14.5)	1 (1.4)	1 (0.2)	~ ~	1 (0.4)
Lebanon	85 (1.0)	545 (2.5)	◇ ◇	15 (1.0)	547 (4.6)	◇ ◇	0 (0.1)	~ ~	◇ ◇
Netherlands	86 (1.2)	554 (2.7)	◇ ◇	13 (1.0)	549 (5.1)	◇ ◇	2 (0.5)	~ ~	◇ ◇
Norway	81 (1.5)	444 (4.7)	◇ ◇	14 (1.4)	426 (11.9)	◇ ◇	5 (0.8)	401 (14.5)	◇ ◇
Philippines	97 (1.5)	356 (5.6)	◇ ◇	3 (1.2)	356 (15.7)	◇ ◇	0 (0.3)	~ ~	◇ ◇
Russian Federation	80 (2.3)	562 (6.9)	1 (4.2)	17 (1.9)	561 (9.7)	-3 (3.9)	3 (0.5)	546 (20.5)	2 (0.7) ▲
Slovenia	84 (1.2)	462 (4.6)	1 (1.9)	15 (1.2)	443 (6.3)	-1 (1.8)	1 (0.2)	~ ~	0 (0.4)
Sweden	76 (1.8)	423 (5.1)	-8 (2.2) ▼	17 (1.2)	395 (10.2)	5 (1.7) ▲	7 (0.9)	355 (14.4)	3 (1.1) ▲

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.

achievement was higher for these students than for the 81 percent that reported sometimes speaking English.

Related to the issue of the language spoken in the home in many countries is whether students and their parents were native to their countries or were recent immigrants. As shown in Exhibit 4.3, more than 90 percent of the advanced mathematics students in Iran, Italy, and the Philippines 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, 76 percent of students reported that they and their parents were born in the country, with 7 percent reporting that neither they nor their parents were born in the country, and 17 percent that they and at least one of their parents were native born. Sweden also was the only country where the percent of native-born students declined from 1995 (by 8 percentage points). In Norway, Slovenia, and Sweden, advanced mathematics students who were born in the country and whose parents also were native born had higher average mathematics achievement than others.

### **Out of School Time and Computer Usage Among Mathematics Students**

Exhibit 4.4 presents advanced mathematics students' reports about how they spent their time outside of school. On a normal school day, they spread their time outside of school 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 advanced mathematics students reported spending between 1 and 2 hours on each of these activities. Students in Iran, Italy, Lebanon, and the Russian Federation reported spending more than 2 hours daily

Exhibit 4.4 **Time in Hours Mathematics Students Spend on Various Activities Outside of School on a Normal School Day**

**TIMSS Advanced 2008**  
Advanced Mathematics

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	1.9 (0.06) r	1.0 (0.04) r	1.1 (0.04) r	2.1 (0.05) r	0.2 (0.04) r	1.6 (0.06) r
Iran, Islamic Rep. of	3.3 (0.04)	0.8 (0.02)	0.8 (0.03)	1.0 (0.04)	0.1 (0.01)	1.5 (0.03)
Italy	2.1 (0.08)	1.4 (0.04)	1.5 (0.04)	1.9 (0.06)	0.4 (0.04)	1.2 (0.03)
Lebanon	2.2 (0.04)	1.1 (0.03)	1.4 (0.03)	1.7 (0.04)	0.5 (0.03)	1.4 (0.03)
Netherlands	1.0 (0.03)	1.5 (0.03)	1.9 (0.04)	1.1 (0.03)	1.2 (0.04)	1.3 (0.03)
Norway	1.3 (0.04)	1.4 (0.03)	1.7 (0.03)	1.8 (0.04)	1.3 (0.06)	1.3 (0.02)
Philippines	1.9 (0.04)	1.2 (0.04)	1.5 (0.04)	2.6 (0.04)	0.1 (0.01)	2.0 (0.05)
Russian Federation	2.1 (0.04)	1.5 (0.02)	1.9 (0.04)	2.6 (0.04)	0.2 (0.02)	1.1 (0.03)
Slovenia	1.6 (0.04)	--	1.7 (0.05)	2.0 (0.04)	0.6 (0.03)	1.3 (0.04)
Sweden	1.1 (0.04)	1.2 (0.03)	2.1 (0.05)	1.7 (0.05)	0.6 (0.04)	1.3 (0.03)

Data provided by students.

( ) Standard errors appear in parentheses.

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 TIMSS Advanced 2008 ©



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 4.5 presents more detailed information on the amount of time advanced mathematics students spent using a computer each day. It is clear from these reports that 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 mathematics.

To provide information about whether computer use by advanced mathematics students was a home or school activity or whether they used computers somewhere else, Exhibit 4.6 summarizes students' reports on the frequency of computer usage at home, at school, and elsewhere. According to the results, the home was the principal locus of computer usage among advanced mathematics students, with a large majority (more than 80%) in 6 of the 10 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 students reported frequently using a computer at home (63% and 68%, respectively), and in Iran and the Philippines less than half (47% and 48%, respectively). The relatively low level of home computer usage in these countries was offset somewhat by use in school (Armenia and the Philippines) and elsewhere (Armenia, Lebanon, and the Philippines). “Elsewhere” includes locations such as a public library, an Internet cafe,

Exhibit 4.5 Time Students Spend Using a Computer Each Day

TIMSS Advanced 2008  
Advanced Mathematics

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	26 (1.5)	428 (8.8)	31 (1.8)	447 (7.1)	29 (1.8)	439 (8.0)
Iran, Islamic Rep. of	25 (1.3)	497 (6.9)	40 (1.4)	513 (7.6)	26 (1.3)	485 (8.1)
Italy	2 (0.4)	~ ~	27 (1.4)	455 (8.5)	38 (1.4)	453 (7.8)
Lebanon	3 (0.5)	524 (17.5)	23 (1.1)	552 (4.3)	41 (1.3)	545 (3.3)
Netherlands	0 (0.1)	~ ~	14 (0.9)	551 (4.2)	42 (1.4)	549 (3.2)
Norway	0 (0.1)	~ ~	18 (1.2)	437 (6.6)	40 (1.6)	441 (6.2)
Philippines	4 (0.4)	301 (12.1)	18 (1.0)	336 (8.8)	43 (1.2)	350 (5.8)
Russian Federation	2 (0.3)	~ ~	24 (1.2)	561 (9.3)	41 (1.3)	565 (7.8)
Slovenia	1 (0.2)	~ ~	28 (2.0)	464 (5.3)	40 (1.3)	457 (5.9)
Sweden	0 (0.1)	~ ~	14 (1.0)	410 (11.5)	34 (1.1)	418 (6.6)

SOURCE: IEA TIMSS Advanced 2008 ©

Country	More than 2 but Less than 4 Hours		4 or More Hours	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	8 (1.1)	439 (12.2)	5 (0.8)	426 (17.3)
Iran, Islamic Rep. of	7 (0.8)	481 (11.9)	2 (0.4)	~ ~
Italy	22 (1.1)	444 (9.8)	11 (0.9)	431 (10.3)
Lebanon	23 (1.2)	546 (4.4)	11 (0.9)	539 (5.5)
Netherlands	30 (1.4)	556 (4.0)	15 (1.0)	559 (4.3)
Norway	27 (1.1)	434 (6.5)	15 (1.8)	450 (6.9)
Philippines	24 (1.1)	369 (7.2)	12 (1.0)	401 (11.3)
Russian Federation	21 (1.1)	563 (7.7)	12 (0.9)	554 (7.9)
Slovenia	23 (1.1)	454 (5.3)	8 (0.8)	453 (9.8)
Sweden	31 (1.1)	412 (6.6)	20 (1.3)	411 (8.3)

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.

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



Exhibit 4.6 Computer Use at Home and at School

TIMSS Advanced 2008  
Advanced Mathematics

Country	Use a Computer at Home						
	A Lot		Sometimes		Never		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	s	63 (3.1)	448 (9.4)	28 (2.9)	437 (14.4)	9 (1.1)	418 (12.1)
Iran, Islamic Rep. of		47 (1.8)	505 (9.1)	51 (1.7)	496 (7.2)	2 (0.5)	~ ~
Italy		81 (1.0)	452 (7.0)	18 (1.0)	438 (9.6)	1 (0.2)	~ ~
Lebanon		68 (1.3)	548 (2.5)	29 (1.4)	546 (4.0)	3 (0.6)	516 (11.9)
Netherlands		91 (0.8)	553 (2.8)	9 (0.8)	549 (4.2)	0 (0.1)	~ ~
Norway		83 (1.0)	441 (5.0)	17 (1.0)	434 (6.7)	0 (0.1)	~ ~
Philippines		48 (2.2)	385 (6.9)	20 (1.1)	364 (7.4)	32 (1.9)	327 (6.9)
Russian Federation		88 (0.9)	564 (7.1)	11 (0.9)	544 (8.1)	1 (0.2)	~ ~
Slovenia		94 (0.6)	459 (4.4)	6 (0.6)	449 (7.8)	0 (0.1)	~ ~
Sweden		85 (0.8)	416 (5.4)	15 (0.7)	406 (9.1)	0 (0.1)	~ ~

SOURCE: IEA TIMSS Advanced 2008 ©

Country	Use a Computer at School						
	A Lot		Sometimes		Never		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	s	18 (2.1)	420 (11.8)	62 (3.1)	459 (10.7)	20 (2.3)	404 (11.6)
Iran, Islamic Rep. of	r	1 (0.3)	~ ~	20 (2.5)	536 (13.3)	79 (2.5)	497 (6.6)
Italy		5 (1.1)	386 (23.8)	64 (2.3)	448 (7.4)	31 (2.6)	462 (9.7)
Lebanon	r	1 (0.2)	~ ~	54 (2.0)	554 (3.0)	45 (1.9)	542 (3.6)
Netherlands		6 (0.8)	555 (7.3)	90 (0.8)	553 (2.6)	4 (0.8)	544 (7.2)
Norway		22 (2.9)	439 (9.6)	74 (2.6)	442 (5.0)	4 (0.6)	409 (13.2)
Philippines		10 (1.1)	331 (11.6)	79 (1.3)	363 (5.7)	11 (1.6)	382 (12.0)
Russian Federation		6 (0.5)	558 (11.4)	84 (0.9)	563 (7.3)	9 (0.9)	563 (9.5)
Slovenia		2 (0.5)	~ ~	62 (2.5)	465 (5.2)	36 (2.5)	453 (5.9)
Sweden		15 (2.0)	415 (9.0)	82 (1.9)	415 (5.9)	3 (0.6)	398 (17.8)

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.

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 4.6 Computer Use at Home and at School (Continued)

TIMSS Advanced 2008  
Advanced Mathematics

Country	Use a Computer Elsewhere						
	A Lot		Sometimes		Never		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	s	22 (2.5)	429 (9.5)	61 (2.5)	442 (6.8)	17 (2.2)	456 (13.9)
Iran, Islamic Rep. of	r	4 (0.6)	474 (17.8)	52 (2.0)	497 (8.3)	44 (1.9)	509 (8.0)
Italy		2 (0.3)	~ ~	36 (1.5)	449 (8.2)	62 (1.5)	449 (6.9)
Lebanon		16 (1.1)	541 (4.9)	67 (1.2)	548 (3.0)	17 (0.9)	556 (3.7)
Netherlands		0 (0.2)	~ ~	32 (1.3)	551 (3.3)	68 (1.2)	554 (3.0)
Norway		2 (0.4)	~ ~	56 (1.7)	438 (5.0)	42 (1.7)	446 (5.9)
Philippines		24 (1.5)	351 (5.7)	70 (1.1)	359 (6.2)	6 (0.7)	404 (13.1)
Russian Federation		4 (0.3)	548 (11.4)	54 (1.1)	560 (7.2)	42 (1.1)	569 (7.5)
Slovenia		2 (0.4)	~ ~	53 (2.3)	460 (4.9)	45 (2.1)	460 (5.0)
Sweden		1 (0.3)	~ ~	43 (1.0)	411 (6.0)	55 (1.1)	417 (6.2)

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.

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.

or a friend's home. In line with the previous exhibit, 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 advanced mathematics students about the ways they used computers in doing their schoolwork. As shown in Exhibit 4.7, 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, the Russian Federation, Slovenia, and Sweden, more than 90 percent of the advanced mathematics students reported using computers for researching information on the Internet and for word processing.

Despite the reported widespread use of computers for schoolwork, the advanced mathematics students reported relatively little computer use for mathematics outside of class. As presented in Exhibit 4.8, the majority of students in almost every country reported never or almost never doing mathematics on a computer outside class. Even in countries with very high levels of computer usage generally, such as the Netherlands, Norway, and Sweden, mathematics students reported only sporadic use for mathematics outside of class.

Exhibit 4.7 **Various Ways Mathematics Students Use Computers for Schoolwork**

**TIMSSAdvanced2008**  
Advanced Mathematics

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 71 (1.8)	r 67 (2.1)	r 30 (2.1)	s 37 (2.6)	s 35 (3.1)
Iran, Islamic Rep. of	81 (1.1)	38 (1.4)	23 (1.4)	13 (0.9)	68 (1.5)
Italy	95 (0.6)	38 (1.5)	51 (2.3)	24 (1.6)	72 (1.3)
Lebanon	88 (0.8)	40 (1.4)	41 (1.5)	33 (1.3)	70 (1.3)
Netherlands	99 (0.3)	97 (0.6)	65 (1.9)	34 (1.8)	27 (1.2)
Norway	99 (0.2)	96 (0.5)	57 (1.6)	17 (2.0)	73 (1.5)
Philippines	98 (0.4)	88 (0.9)	63 (1.3)	27 (1.0)	84 (0.7)
Russian Federation	91 (0.8)	92 (0.7)	46 (1.2)	32 (1.3)	64 (1.0)
Slovenia	99 (0.2)	96 (0.4)	75 (1.5)	26 (1.2)	r 42 (2.0)
Sweden	100 (0.1)	94 (0.7)	51 (1.3)	17 (1.3)	66 (1.2)

SOURCE: IEA TIMSS Advanced 2008 ©

Data provided by students.

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.

( ) Standard errors appear in parentheses.

Exhibit 4.8 **Frequency of Computer Use for Mathematics Outside of Class**

**TIMSSAdvanced2008**  
Advanced Mathematics

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	12 (1.4)	469 (17.3)	14 (1.2)	444 (10.9)	10 (1.1)	448 (13.2)	65 (1.7)	428 (4.1)
Iran, Islamic Rep. of	1 (0.2)	~ ~	4 (0.4)	488 (15.8)	12 (0.7)	492 (10.1)	83 (0.8)	499 (6.0)
Italy	3 (0.4)	436 (18.7)	10 (0.9)	447 (13.3)	13 (1.0)	464 (10.7)	73 (1.4)	447 (7.3)
Lebanon	4 (0.6)	530 (10.0)	14 (1.2)	528 (5.3)	22 (0.8)	554 (3.9)	60 (1.3)	548 (2.8)
Netherlands	2 (0.4)	~ ~	7 (0.9)	561 (7.2)	19 (1.5)	558 (3.7)	72 (1.8)	551 (3.0)
Norway	4 (1.0)	431 (15.7)	8 (1.3)	452 (11.7)	9 (0.9)	439 (11.8)	79 (2.5)	438 (4.7)
Philippines	2 (0.3)	~ ~	24 (1.1)	337 (7.1)	28 (1.0)	350 (7.7)	46 (1.5)	369 (6.0)
Russian Federation	6 (0.5)	545 (9.4)	19 (1.3)	565 (9.7)	19 (1.1)	574 (8.9)	56 (1.9)	557 (7.2)
Slovenia	10 (0.7)	462 (6.8)	13 (0.9)	451 (7.9)	19 (1.5)	457 (8.6)	59 (1.6)	460 (4.3)
Sweden	1 (0.2)	~ ~	3 (0.4)	447 (14.2)	7 (0.7)	416 (11.8)	88 (0.9)	413 (5.3)

SOURCE: IEA TIMSS Advanced 2008 ©

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.

### Working with a Mathematics Tutor and Preparing for Mathematics Tests

As described in Chapter 1, in almost all of the 10 countries participating in TIMSS Advanced 2008, mathematics students write public examinations that have serious consequences for their future educational opportunities and life chances. In this situation, students may have recourse to mathematics tutors or other outside support to help them improve their mathematics knowledge and understanding. Exhibit 4.9 shows, however, that the practice is relatively rare among the advanced mathematics students in the TIMSS Advanced 2008 countries, with only Armenia and the Russian Federation having appreciable percentages of students working with a mathematics tutor as often as once a week (41% and 45%, respectively). In all countries except Armenia, the students who never or almost never work with a tutor had higher mathematics achievement than those who sought help even occasionally.

According to Exhibit 4.10, advanced mathematics students in the TIMSS Advanced countries prepare for tests or examinations quite frequently. In 7 of the 10 countries, the majority of students reported preparing for a test at least once a month; and, of these, in Armenia, Lebanon, and the Philippines, the majority of students reported preparing for a test about once a week. Studying for a 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 mathematics achievement.

Exhibit 4.9 Frequency of Working with Mathematics Tutor

TIMSSAdvanced2008  
Advanced Mathematics

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	36 (1.9)	469 (5.9)	5 (1.1)	450 (31.5)	1 (0.2)	~ ~
Iran, Islamic Rep. of	8 (1.1)	483 (15.9)	8 (0.8)	494 (13.4)	1 (0.3)	~ ~
Italy	5 (0.5)	427 (14.5)	11 (1.3)	417 (10.0)	3 (0.6)	400 (15.8)
Lebanon	7 (0.7)	505 (6.6)	7 (0.6)	503 (6.1)	3 (0.5)	506 (8.2)
Netherlands	1 (0.2)	~ ~	4 (0.7)	533 (8.7)	1 (0.3)	~ ~
Norway	--	--	--	--	--	--
Philippines	2 (0.6)	~ ~	2 (0.3)	~ ~	1 (0.2)	~ ~
Russian Federation	17 (1.2)	544 (10.1)	28 (1.7)	554 (8.9)	1 (0.2)	~ ~
Slovenia	1 (0.2)	~ ~	5 (0.8)	400 (12.8)	4 (0.5)	393 (10.9)
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	14 (1.2)	421 (12.5)	45 (2.2)	417 (5.3)
Iran, Islamic Rep. of	12 (0.9)	482 (9.5)	71 (1.6)	503 (6.5)
Italy	34 (1.5)	425 (8.8)	47 (1.5)	479 (8.1)
Lebanon	16 (1.0)	532 (4.3)	67 (1.2)	559 (2.8)
Netherlands	12 (1.0)	529 (4.9)	82 (1.3)	559 (3.0)
Norway	--	--	--	--
Philippines	29 (1.2)	340 (7.5)	66 (1.2)	364 (5.8)
Russian Federation	11 (0.8)	549 (9.1)	43 (2.1)	575 (8.4)
Slovenia	27 (1.2)	418 (5.4)	62 (1.4)	486 (4.1)
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 4.10 Frequency of Preparing for Mathematics Test or Examination

TIMSS Advanced 2008  
Advanced Mathematics

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	53 (2.1)	442 (5.3)	22 (2.0)	435 (9.5)	4 (0.7)	474 (20.9)
Iran, Islamic Rep. of	27 (1.7)	523 (9.8)	54 (1.6)	498 (6.7)	9 (0.9)	489 (6.8)
Italy	38 (1.8)	442 (5.9)	49 (1.8)	464 (8.7)	8 (0.9)	431 (11.5)
Lebanon	50 (1.2)	543 (3.0)	40 (1.1)	550 (3.8)	5 (0.7)	547 (8.4)
Netherlands	9 (0.9)	543 (4.3)	15 (1.6)	543 (3.9)	64 (2.3)	555 (3.2)
Norway	1 (0.4)	~ ~	39 (4.0)	437 (6.6)	55 (3.8)	444 (5.9)
Philippines	76 (1.3)	350 (5.5)	16 (1.0)	367 (8.9)	4 (0.4)	393 (16.6)
Russian Federation	43 (1.9)	541 (7.4)	38 (1.2)	565 (7.4)	9 (0.8)	586 (7.7)
Slovenia	30 (1.4)	444 (6.8)	44 (1.5)	463 (4.7)	21 (1.6)	466 (4.8)
Sweden	0 (0.1)	~ ~	21 (2.0)	397 (8.6)	60 (1.9)	428 (5.6)

SOURCE: IEA TIMSS Advanced 2008 ©

Country	About Twice a Year		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	9 (1.1)	421 (13.1)	11 (1.2)	414 (8.9)
Iran, Islamic Rep. of	8 (1.1)	448 (13.4)	3 (0.4)	431 (14.8)
Italy	2 (0.3)	~ ~	3 (0.6)	401 (18.1)
Lebanon	3 (0.4)	530 (12.8)	1 (0.3)	~ ~
Netherlands	10 (1.9)	560 (5.2)	1 (0.3)	~ ~
Norway	4 (0.7)	425 (15.0)	1 (0.2)	~ ~
Philippines	1 (0.2)	~ ~	3 (0.4)	363 (15.9)
Russian Federation	7 (0.9)	611 (11.6)	3 (0.4)	597 (15.4)
Slovenia	3 (0.5)	456 (15.1)	2 (0.3)	~ ~
Sweden	11 (1.8)	435 (7.0)	8 (0.8)	332 (10.2)

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 Advanced Mathematics

As discussed earlier, the students studying the advanced mathematics assessed by TIMSS Advanced were a very select group in all countries, representing the most mathematically educated students in their age groups. Since it is very important to attract these students to study advanced mathematics in the first place, and then to retain them for tertiary-level study of mathematics and a career involving mathematics, it is useful to know what factors attracted them to the study of mathematics. Exhibits 4.11, 4.12, and 4.13 present student reports on three reasons for studying advanced mathematics—having a positive affect toward mathematics, good teachers and teaching, and advice from others.

Exhibit 4.11 summarizes students' responses to three statements about having a positive orientation toward mathematics as a reason for studying advanced mathematics:

- ▶ I enjoy solving mathematical problems.
- ▶ I usually do well in mathematics.
- ▶ Advanced mathematics lessons are interesting.

Students were asked to indicate the degree of importance of each reason in deciding to study advanced mathematics. In Exhibit 4.11, 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 the average mathematics achievement for each category. Countries are ordered by the percentage of students in the “very important” category.

Exhibit 4.11 **Students' Reasons for Studying Advanced Mathematics – Students Have Positive Affect Toward Mathematics**

TIMSS Advanced 2008  
Advanced Mathematics

Country	Very Important		Important		Unimportant		Very Unimportant	
	Percent of Students	Average Achievement						
Lebanon	64 (1.4)	551 (2.7)	31 (1.3)	536 (3.8)	4 (0.5)	536 (9.7)	0 (0.2)	~ ~
Philippines	38 (1.4)	366 (7.0)	50 (1.0)	349 (6.1)	10 (0.7)	347 (7.8)	2 (0.3)	~ ~
Armenia r	38 (2.2)	470 (5.1)	37 (2.5)	434 (8.7)	18 (1.7)	394 (7.3)	8 (0.8)	418 (18.3)
Iran, Islamic Rep. of	38 (1.2)	522 (8.0)	39 (1.0)	493 (6.2)	18 (1.0)	471 (8.7)	5 (0.6)	447 (10.7)
Russian Federation	24 (0.9)	588 (7.3)	49 (1.0)	561 (8.7)	22 (1.1)	538 (6.8)	4 (0.4)	527 (11.0)
Norway	24 (1.1)	481 (6.0)	47 (1.1)	440 (5.3)	23 (0.9)	411 (5.2)	6 (0.7)	384 (8.3)
Slovenia	23 (0.9)	496 (5.9)	44 (1.2)	464 (4.4)	24 (1.3)	437 (5.7)	9 (0.8)	393 (8.6)
Sweden	22 (1.2)	490 (7.8)	37 (1.6)	433 (5.9)	26 (1.5)	372 (6.0)	15 (1.3)	329 (6.8)
Italy	18 (1.1)	493 (8.3)	38 (1.4)	459 (8.4)	25 (1.3)	438 (8.3)	19 (1.3)	399 (9.3)
Netherlands	17 (1.3)	580 (4.8)	53 (1.4)	554 (3.2)	25 (1.4)	537 (3.1)	5 (0.7)	523 (5.5)

SOURCE: IEA TIMSS Advanced 2008 ©

Based on students' responses to three statements about why students study advanced mathematics: 1) I enjoy solving mathematical problems; 2) I usually do well in mathematics; and 3) Advanced mathematics 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 4.12 **Students' Reasons for Studying Advanced Mathematics – Good Teachers and Teaching**

TIMSS Advanced 2008  
Advanced Mathematics

Country	Very Important		Important		Unimportant		Very Unimportant	
	Percent of Students	Average Achievement						
Armenia r	60 (2.0)	447 (5.2)	30 (2.1)	426 (9.8)	6 (1.3)	439 (19.2)	4 (0.8)	463 (18.8)
Russian Federation	55 (2.0)	559 (7.3)	37 (1.5)	565 (8.5)	5 (0.6)	560 (10.2)	3 (0.5)	551 (17.8)
Philippines	54 (1.4)	346 (6.1)	40 (1.0)	364 (6.3)	4 (0.6)	398 (14.2)	1 (0.2)	~ ~
Lebanon	47 (1.3)	540 (2.8)	35 (1.3)	547 (3.6)	10 (0.7)	558 (5.2)	8 (0.6)	561 (7.6)
Iran, Islamic Rep. of	29 (1.4)	486 (6.7)	38 (1.2)	501 (6.9)	14 (0.9)	507 (10.0)	19 (1.3)	503 (9.0)
Slovenia	29 (1.9)	472 (6.0)	47 (1.1)	458 (4.6)	16 (1.3)	452 (7.0)	8 (0.7)	426 (7.8)
Sweden	28 (1.9)	429 (7.0)	45 (1.5)	421 (5.9)	16 (1.1)	405 (8.2)	12 (1.2)	365 (8.8)
Italy	24 (1.5)	454 (8.5)	43 (2.0)	451 (7.7)	16 (1.1)	452 (10.3)	17 (1.8)	433 (10.1)
Norway	20 (1.6)	435 (7.2)	47 (1.5)	441 (5.2)	20 (1.1)	450 (6.4)	13 (1.4)	426 (10.1)
Netherlands	15 (1.6)	552 (5.7)	50 (1.3)	553 (2.8)	23 (1.1)	554 (3.6)	12 (1.0)	550 (4.9)

SOURCE: IEA TIMSS Advanced 2008 ©

Based on students' responses to the two statements about why students study advanced mathematics: 1) Advanced mathematics has good teachers; and 2) I like the way advanced mathematics is taught in my school. Average is computed across the two statements based on a 4-point Likert scale: 1. Very important; 2. Important; 3. Unimportant; and 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 mathematics to be important in choosing to study advanced mathematics. In every country, the majority of students (ranging from 56% in Italy to 95% in Lebanon) considered a positive orientation to be important or very important to their decision. Across the participating countries, students who considered a positive orientation to be important for choosing to study mathematics had higher average mathematics achievement than students who thought it less important.

Having mathematics 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 advanced mathematics. Exhibit 4.12 presents students' responses to two statements about good teachers and teaching as reasons for studying advanced mathematics:

- ▶ Advanced mathematics has good teachers.
- ▶ I like the way advanced mathematics is taught in my school.

Again, students were asked to indicate the degree of importance of each one in deciding to study advanced mathematics. 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 4.12 shows the percentage of students in each of the four categories for each country, together with the average mathematics 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 advanced mathematics, there was a wide range in the degree of emphasis across countries, ranging from Armenia, where 60 percent

of students considered good teaching to be very important, to the Netherlands, where the corresponding figure was just 15 percent. In Iran, Sweden, Italy, Norway, and the Netherlands, about one fourth to one third of the advanced mathematics students indicated that good teaching was unimportant in the decision to study advanced mathematics. There was no consistent relationship across countries between mathematics achievement and reporting that good teaching was an important reason for studying advanced mathematics.

The third set of students' reasons for choosing to study advanced mathematics 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 advanced mathematics:

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

As with the other sets of reasons, students were asked to indicate the degree of importance of each reason in choosing to study advanced mathematics. 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 4.13 shows the percentage of students in each of the four categories for each country, together with the average mathematics achievement for each category. Countries are ordered 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 4.13 **Students' Reasons for Studying Advanced Mathematics – Advice from Others**



Country	Very Important		Important		Unimportant		Very Unimportant	
	Percent of Students	Average Achievement						
Armenia	29 (1.6)	436 (5.4)	48 (2.1)	435 (6.5)	17 (1.4)	441 (10.0)	7 (1.2)	497 (16.3)
Philippines	14 (0.9)	304 (6.6)	51 (1.3)	341 (6.1)	28 (1.6)	392 (6.0)	6 (0.6)	423 (9.9)
Iran, Islamic Rep. of	9 (0.8)	451 (8.7)	30 (1.2)	474 (7.2)	34 (1.3)	497 (6.7)	27 (1.3)	541 (8.1)
Lebanon	6 (0.7)	519 (6.4)	27 (1.2)	533 (4.0)	38 (1.2)	547 (3.2)	29 (1.4)	561 (4.1)
Russian Federation	5 (0.6)	555 (11.1)	37 (1.1)	551 (8.0)	43 (1.1)	565 (7.7)	16 (1.0)	577 (7.9)
Italy	3 (0.4)	440 (25.9)	16 (0.9)	442 (5.9)	33 (1.3)	447 (7.6)	48 (1.5)	453 (8.3)
Slovenia	1 (0.3)	~ ~	17 (1.2)	457 (7.9)	48 (1.3)	456 (4.6)	33 (1.2)	462 (5.8)
Norway	1 (0.3)	~ ~	21 (1.0)	421 (6.3)	50 (1.5)	438 (5.3)	28 (1.3)	458 (6.5)
Sweden	1 (0.3)	~ ~	12 (1.0)	400 (9.2)	42 (1.4)	409 (6.4)	45 (1.5)	424 (5.9)
Netherlands	0 (0.1)	~ ~	13 (0.8)	546 (4.9)	51 (1.8)	551 (3.0)	36 (1.8)	558 (3.4)

SOURCE: IEA TIMSS Advanced 2008 ©

Based on students' responses to the four statements about why students study advanced mathematics: 1) My parents advised me to study advanced mathematics; 2) A teacher advised me to study advanced mathematics; 3) My friends also are studying advanced mathematics; and 4) The <study coordinator/mentor> of my school advised me to study advanced mathematics. Average is computed across the four statements based on a 4-point Likert scale: 1. Very important; 2. Important; 3. Unimportant; and 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 advanced mathematics than having a positive orientation or good teaching, with the majority of students in all countries except Armenia and the Philippines indicating that advice from others was unimportant or very unimportant. In Italy, Slovenia, Sweden, and the Netherlands, more than 80 percent of students were in these categories. Furthermore, it appears that the less able students were more likely to rely on advice from others in deciding to study advanced mathematics, as in every country, the students with the highest achievement were those reporting that advice from others was very unimportant.

### Areas of Future Study for Students of Advanced Mathematics

A solid grounding in mathematics is a prerequisite for future study in mathematics and engineering, as well as branches of many other disciplines such as science, computer and information 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 4.14. Almost all (96% or more) advanced mathematics students in the participating countries, with the exception of Italy (86%), indicated that they planned to continue their education after finishing secondary school.

It is clear from Exhibit 4.14 that students who studied advanced mathematics in secondary school planned to study a variety of subjects in their post-secondary careers. Engineering was the most popular choice, with more students choosing it than any other in half of the 10 countries—Iran, Lebanon, the Netherlands, Norway, and Sweden. In addition, 20 percent or more of the students in Italy, the Philippines, and the Russian Federation chose engineering for their future area of study. After engineering, business was the next most popular choice,

Exhibit 4.14 **Advanced Mathematics Students' Aspirations for Future Study**

**TIMSS Advanced 2008**  
Advanced Mathematics

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	96 (0.6)	4 (0.7)	11 (0.9)	3 (0.9)	26 (2.4)	13 (1.8)	7 (0.9)	4 (0.7)	31 (1.6)
Iran, Islamic Rep. of	100 (0.1)	4 (0.4)	1 (0.3)	82 (0.9)	3 (0.5)	4 (0.5)	1 (0.3)	1 (0.2)	5 (0.6)
Italy	86 (1.5)	9 (0.9)	17 (0.8)	20 (1.3)	13 (1.1)	4 (0.6)	2 (0.5)	10 (0.8)	25 (1.3)
Lebanon	100 (0.1)	4 (0.5)	3 (0.4)	66 (1.3)	4 (0.4)	7 (0.6)	7 (0.8)	1 (0.2)	9 (0.8)
Netherlands	100 (0.1)	15 (0.9)	15 (1.1)	41 (1.5)	9 (0.9)	6 (0.6)	5 (0.5)	4 (0.4)	7 (0.6)
Norway	99 (0.2)	8 (0.7)	18 (1.2)	32 (1.6)	14 (1.0)	5 (0.7)	1 (0.3)	9 (0.6)	12 (1.1)
Philippines	100 (0.1)	7 (0.5)	23 (1.3)	21 (1.2)	21 (1.3)	11 (0.9)	2 (0.4)	6 (0.7)	9 (0.9)
Russian Federation	100 (0.0)	6 (0.5)	4 (0.8)	22 (1.0)	25 (1.1)	19 (1.4)	5 (0.6)	10 (0.7)	9 (0.5)
Slovenia	100 (0.1)	14 (1.1)	8 (0.8)	13 (1.2)	12 (1.2)	5 (0.7)	3 (0.4)	34 (1.5)	10 (0.8)
Sweden	99 (0.2)	16 (1.4)	17 (1.0)	22 (1.4)	9 (0.7)	9 (1.3)	2 (0.4)	8 (0.6)	16 (1.5)

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, the Philippines, and the Russian Federation choosing this option. Relatively few students in any country (less than 20 percent) chose science, computer and information science, or mathematics as their area of future study; only the Philippines had more than 20 percent choosing health science, and only Slovenia more than 20 percent choosing social science. More than 20 percent of students in Armenia (31%) and Italy (25%) chose a field of study other than those listed above.

To provide a more detailed perspective on the subject areas that advanced mathematics students planned to study after secondary school, Exhibit 4.15 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 4.14). Engineering and computer and information science were the subject areas with the greatest gender differences in students planning to study them, with the percentage of males exceeding the percentage of females in every country in engineering and in computer and information science in all countries except Iran and Lebanon. In contrast, health science and social science were the areas of choice for females more often than by males in most countries—in 7 of the 10 countries for health science and in 8 countries for social science. In science, the only gender difference was in Slovenia, with a greater percentage of males than females planning future study in this area. Similarly, there were few gender differences in business, although more males than females chose this area in Armenia, and more females than males in the Philippines and the Russian Federation. In mathematics, the only difference was in Lebanon, where the percentage of females was higher. Finally, more females than males chose the “other” field of study in 5 of the 10 countries, including Armenia, Iran, the Philippines, the Russian Federation, and Sweden.

Exhibit 4.15 **Advanced Mathematics Students' Aspirations for Future Study by Gender**

**TIMSS Advanced 2008**  
Advanced Mathematics

Country	Percent of Students by Intended Area of Study							
	Science		Health Science		Engineering		Business	
	Females	Males	Females	Males	Females	Males	Females	Males
Armenia	3 (1.0)	5 (1.0)	13 (1.2) ▲	8 (1.3)	2 (0.8)	6 (1.5) ▲	21 (2.7)	32 (3.3) ▲
Iran, Islamic Rep. of	4 (0.6)	3 (0.5)	2 (0.5)	1 (0.3)	79 (1.7)	85 (1.0) ▲	3 (0.8)	2 (0.5)
Italy	9 (1.2)	9 (1.3)	26 (2.0) ▲	12 (0.9)	8 (1.6)	27 (1.6) ▲	11 (1.8)	13 (1.4)
Lebanon	5 (0.9)	3 (0.6)	4 (1.0)	2 (0.5)	55 (2.5)	70 (1.5) ▲	5 (1.0)	4 (0.6)
Netherlands	16 (1.6)	15 (1.2)	36 (2.5) ▲	9 (1.0)	23 (2.7)	46 (1.6) ▲	6 (1.4)	9 (1.0)
Norway	9 (1.2)	8 (0.9)	31 (2.2) ▲	9 (1.0)	20 (1.6)	40 (2.2) ▲	13 (1.5)	15 (1.3)
Philippines	7 (0.6)	8 (0.9)	27 (1.5) ▲	15 (1.5)	13 (1.2)	35 (1.8) ▲	24 (1.4) ▲	17 (1.7)
Russian Federation	6 (0.7)	6 (0.7)	5 (0.9) ▲	3 (0.9)	10 (0.9)	32 (1.4) ▲	36 (1.3) ▲	16 (1.1)
Slovenia	11 (1.4)	18 (1.8) ▲	10 (1.2)	7 (1.2)	6 (0.9)	25 (2.6) ▲	12 (1.4)	11 (1.5)
Sweden	17 (1.5)	16 (2.0)	29 (1.6) ▲	9 (0.8)	10 (1.3)	31 (1.8) ▲	9 (1.4)	10 (0.8)

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	10 (1.4)	16 (2.8) ▲	6 (1.2)	9 (1.4)	6 (1.2) ▲	2 (0.9)	39 (2.2) ▲	22 (1.8)
Iran, Islamic Rep. of	4 (0.9)	3 (0.5)	1 (0.5)	1 (0.4)	1 (0.4)	1 (0.3)	6 (1.2) ▲	3 (0.5)
Italy	1 (0.4)	7 (1.0) ▲	3 (0.8)	2 (0.7)	15 (1.4) ▲	6 (0.7)	27 (2.2)	24 (1.7)
Lebanon	7 (1.0)	7 (0.8)	12 (1.8) ▲	5 (0.8)	2 (0.5)	1 (0.2)	11 (1.6)	8 (1.0)
Netherlands	1 (0.6)	7 (0.7) ▲	5 (1.2)	5 (0.6)	6 (1.1) ▲	3 (0.4)	8 (1.5)	6 (0.7)
Norway	1 (0.3)	8 (1.0) ▲	1 (0.8)	1 (0.4)	12 (1.2) ▲	8 (0.8)	13 (1.6)	11 (1.3)
Philippines	10 (1.1)	14 (1.0) ▲	2 (0.4)	2 (0.6)	8 (0.9) ▲	4 (0.8)	10 (1.0) ▲	6 (0.8)
Russian Federation	8 (0.8)	27 (1.8) ▲	6 (0.8)	5 (0.7)	17 (1.2) ▲	5 (0.5)	13 (0.9) ▲	6 (0.6)
Slovenia	2 (0.6)	11 (1.4) ▲	3 (0.7)	3 (0.5)	45 (1.9) ▲	18 (1.6)	11 (1.3)	9 (0.9)
Sweden	1 (0.3)	14 (1.8) ▲	2 (0.6)	2 (0.5)	13 (1.1) ▲	5 (0.6)	19 (2.1) ▲	14 (1.5)

▲ 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.

