

Chapter 1

International Student Achievement in Mathematics

Chapter 1 summarizes achievement for eighth- and fourth-grade students on the TIMSS 2003 mathematics assessment for each of the participating countries. It also shows trends in student performance at the eighth grade for those countries that also participated in TIMSS 1995 and 1999. At the fourth grade, trends are presented for those countries that participated in the 1995 assessment (no assessment was conducted at the fourth grade in 1999). Achievement differences by gender at both grades are also provided.

How Do Countries Differ in Mathematics Achievement?

The first page of Exhibit 1.1 presents the distribution of student achievement¹ for the 46 countries and four benchmarking entities that participated at the eighth grade in TIMSS 2003 and the second page presents the distribution of student achievement for the 25 countries and three benchmarking entities that participated at the fourth grade.² Countries are shown in decreasing order of average (mean) scale score, together with an indication of whether the country average is significantly higher

2 Argentina was unable to complete the necessary steps on schedule for their data to appear in this report. Because the characteristics of their samples are not completely known, achievement results for Syria at the eighth grade and Yemen at the fourth grade are presented in Appendix F.

¹ TIMSS used item response theory (IRT) methods to summarize the achievement results on a scale with a mean of 500 and a standard deviation of 100. Given the matrix-sampling approach, scaling averages students' responses in a way that accounts for differences in the difficulty of different subsets of items. It allows students' performances to be summarized on a common metric even though individual students responded to different items in the mathematics test. For more detailed information, see the "IRT Scaling and Data Analysis" section of Appendix A.

or lower than the international average. The international average of 467 at the eighth grade was obtained by averaging across the mean scores for each of the 46 participating countries. The mean scores for the four benchmarking participants were not included in calculating the average.³ At the fourth grade, the international average of 495 was obtained by averaging across the mean scores for the 25 participating countries. It should be noted that the results for the eighth and fourth grades are not directly comparable. While the scales for the two grades are expressed in the same numerical units, they are not directly comparable in terms of being able to say how much achievement or learning at one grade equals how much achievement or learning at the other grade. Comparisons only can be made in terms of relative performance.⁴

At the eighth grade, with such a large number of participating countries, it is not surprising that the results reveal substantial differences in mathematics achievement between the highest- and lowestperforming countries, from an average of 605 for Singapore to 264 for South Africa. Twenty-six countries (including England) and the four benchmarking participants achieved average mathematics scores that were significantly above the international average and 18 countries scored below the international average. Romania and Moldova performed about the same as the international average. At the fourth grade, the range in achievement was from 594 in Singapore to 339 in Tunisia. Fourteen countries and the three benchmarking participants performed above the international average. Moldova, Australia, New Zealand, and Scotland performed at about the international average.

For both the eighth and fourth grades, Exhibit 1.1 illustrates the broad range of achievement both within and across the countries assessed. It shows a graphical representation of the distribution of student performance within each country. Achievement for each country is shown for the 25th and 75th percentiles as well as for the 5th and 95th percentiles.⁵ Each percentile point indicates the percentage of students performing

³ Even though England worked very hard to meet the TIMSS sampling requirements and adjustments were made to make the results representative, it did not meet the school participation rates as specified in the guidelines and consequently its results are shown below a line.

⁴ Since the TIMSS scales were developed using IRT technology, like all such scales, the eighth- and fourth-grade scales cannot be described in absolute terms.

⁵ Tables of the percentile values and standard deviations for all countries are presented in Appendix D.

below and above that point on the scale. For example, 25 percent of the eighth-grade students in each country performed below the 25th percentile for that country, and 75 percent performed above the 25th percentile. The range between the 25th and 75th percentiles represents performance by the middle half of the students. In most countries, the range of performance for the middle group was between 100 and 130 scale-score points. In contrast, performance at the 5th and 95th percentiles represents the extremes in both lower and higher achievement. The range of performance between these two score points, which includes 90 percent of the population, is approximately 270 to 300 points in most countries. The dark boxes at the midpoints of the distributions show the 95 percent confidence intervals around the average achievement in each country.⁶

As well as showing the wide spread of student achievement within each country, the percentiles also provide a perspective on the size of the differences among countries. Even though performance generally differed very little between one country and the next higher- or lower-performing country, the range in performance across the participating countries was very large at both grades. For example, Singaporean students had the highest average achievement at both grades, with their average eighth-grade performance exceeding performance at the 95th percentile in the lower-performing countries such as Botswana, Saudi Arabia, Ghana, and South Africa. Similarly, at the fourth grade, average performance in Singapore exceeded performance at the 95th percentile in Iran, the Philippines, Morocco, and Tunisia. This means that only the most proficient students in the lower-performing countries approached the level of achievement of Singaporean students of average proficiency.

To aid in interpretation, Exhibit 1.1 also includes the years of formal schooling and average age of the students in each country. Equivalence of chronological age does not necessarily mean that students have received the same number of years of formal schooling or studied the same curriculum. For example, as described in the introduction,

⁶ See the "IRT Scaling and Data Analysis" section of Appendix A for more details about calculating standard errors and confidence intervals for the TIMSS statistics.

Exhibit 1.1: Distribution of Mathematics Achievement

TIMSS2003

Grade (O

Countries	Years of Schooling*	Average Age	Mathematics Achievement Distribution	Average Scale Score	Human Development Index**
Singapore	8	14.3		605 (3.6)	0.884
Morea, Rep. of	8	14.6		589 (2.2)	0.879
[†] Hong Kong, SAR	8	14.4	and the second	586 (3.3)	0.889
Chinese Taipei	8	14.2	and the second	585 (4.6)	
Japan	8	14.4		570 (2.1)	0.932
Belgium (Flemish)	8	14.1		537 (2.8)	0.937
[†] Netherlands	8	14.3		536 (3.8)	0.938
Estonia	8	15.2		531 (3.0)	0.833
Hungary	8	14.5		529 (3.2)	0.837
Malaysia	8	14.3		508 (4.1)	0.790
Latvia	8	15.0	the second se	508 (3.2)	0.811
Russian Federation	7 or 8	14.2		508 (3.7)	0.779
Slovak Republic	8	14.3		508 (3.3)	0.836
Australia	8 or 9	13.9		505 (4.6)	0.939
[‡] United States	8	14.2		504 (3.3)	0.937
¹ Lithuania	8	14.9		502 (2.5)	0.824
Sweden	8	14.9		499 (2.6)	0.941
† Scotland	9	13.7		498 (3.7)	0.930
² Israel	8	14.0		496 (3.4)	0.905
New Zealand	8.5 - 9.5	14.1		494 (5.3)	0.917
Slovenia	7 or 8	13.8		493 (2.2)	0.881
Italy	8	13.9		484 (3.2)	0.916
Armenia	8	14.9		478 (3.0)	0.729
¹ Serbia	8	14.9		477 (2.6)	-
Bulgaria	8	14.9		476 (4.3)	0.795
Romania	8	15.0		475 (4.8)	0.773
International Avg.	8	14.5		467 (0.5)	—
Norway	7	13.8		461 (2.5) 💌	0.944
Moldova, Rep. of	8	14.9		460 (4.0)	0.700
Cyprus	8	13.8		459 (1.7)	0.891
² Macedonia, Rep. of	8	14.6		435 (3.5)	0.784
Lebanon	8	14.6		433 (3.1)	0.752
Jordan	8	13.9		424 (4.1)	0.743
Iran, Islamic Rep. of	8	14.4		411 (2.4)	0.719
	8	14.5		411 (4.8)	0.682
Tunisia	8	14.8		410 (2.2)	0.740
Egypt	8	14.4		406 (3.5)	0.648
Banrain	8	14.1		401 (1.7)	0.839
Palestinian Nat'l Auth.	8	14.1		390 (3.1)	0.731
	õ	14.2		387 (3.3)	0.831
* WIOFOCCO	8	15.2		387 (2.5)	0.606
Philippines	ð	14.8		378 (5.2)	0.751
Botswaria Saudi Arabia	0	14.1		300 (2.0)	0.014
Saudi Arabia	ŏ	14.1		332 (4.6)	0.769
	0	15.5		270 (4.7) •	0.507
± England	õ	14.2		204 (5.5)	0.084
* England Benchmarking Participants	9	14.5		498 (4.7)	0.930
Pasque Country Engin	0	1/1		197 (2 7)	
Indiana State US	ő 9	14.1		407 (2.7) 0	_
Optario Provinco Con	Ő O	14.0		500 (3.2)	_
Ouchos Province, Can.	Ő O	1/10		5/2 (2.0)	_
Quebec Province, Can.	δ	14.2	100 200 300 400 500 600 700 800)	_
			Percentiles of Performance 5th 25th 75th 95th	Country averag than internation	e significantly higher nal average

Country average significantly lower than international average

- * Represents years of schooling counting from the first year of ISCED Level 1.
- ** Taken from United Nations Development Programme's Human Development Report 2003, p. 237-240.
 Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).
- Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).
- Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

National Desired Population does not cover all of International Desired Population (see Exhibit A.6).
 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

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- ← Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.
- () Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
- A dash (--) indicates comparable data are not available.

95% Confidence Interval for Average (±2SE)

Exhibit 1.1: Distribution of Mathematics Achievement

TIMSS2003

Grade

Countries	Years of Schooling*	Average Age	Mathematics Achievement Distribution	Average Scale Score	Human Development Index**
Singapore	4	10.3		594 (5.6)	0.884
[†] Hong Kong, SAR	4	10.2		575 (3.2)	0.889
Japan	4	10.4		565 (1.6)	0.932
Chinese Taipei	4	10.2		564 (1.8)	-
Belgium (Flemish)	4	10.0		551 (1.8)	0.937
[†] Netherlands	4	10.2		540 (2.1)	0.938
Latvia	4	11.1		536 (2.8)	0.811
¹ Lithuania	4	10.9		534 (2.8)	0.824
Russian Federation	3 or 4	10.6	and the second	532 (4.7)	0.779
[†] England	5	10.3		531 (3.7)	0.930
Hungary	4	10.5		529 (3.1)	0.837
[†] United States	4	10.2	and the second se	518 (2.4)	0.937
Cyprus	4	9.9		510 (2.4)	0.891
Moldova, Rep. of	4	11.0		504 (4.9)	0.700
Italy	4	9.8		503 (3.7)	0.916
[†] Australia	4 or 5	9.9		499 (3.9)	0.939
International Avg.	4	10.3		495 (0.8)	-
New Zealand	4.5 - 5.5	10.0		493 (2.2)	0.917
[†] Scotland	5	9.7	and the second	490 (3.3)	0.930
Slovenia	3 or 4	9.8		479 (2.6) 💿	0.881
Armenia	4	10.9		456 (3.5) 💿	0.729
ø Norway	4	9.8		451 (2.3) 💿	0.944
Iran, Islamic Rep. of	4	10.4		389 (4.2) 💿	0.719
Philippines	4	10.8		358 (7.9) 💿	0.751
Morocco	4	11.0		347 (5.1) 💿	0.606
Tunisia	4	10.4		339 (4.7) 💿	0.740
Benchmarking Participants					
Indiana State, US	4	9.5		533 (2.8)	-
Ontario Province, Can.	4	9.8		511 (3.8)	-
Quebec Province, Can.	4	10.1		506 (2.4)	-
			0 100 200 300 400 500 600 700 800 Percentiles of Performance <u>5th</u> 25th 75th 95th 95% Confidence Interval for Average (±25E)	 Country average than internation Country average than internation 	e significantly higher nal average e significantly lower nal average

* Represents years of schooling counting from the first year of ISCED Level 1.

- ** Taken from United Nations Development Programme's *Human Development Report*, p. 237-240.
 Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).
- 1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).
- ø Norway: 4 years of formal schooling, but First Grade is called "First grade/Preschool."
- () Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

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

countries have different policies about the age at which students begin formal schooling and different policies about promotion and retention from grade to grade.

At the eighth grade, the aim was that the students assessed would have had eight years of formal schooling. Most notably, students in Norway, most of Slovenia, and parts of the Russian Federation had fewer years of formal schooling than their counterparts in other countries, while those in England, Scotland, New Zealand, and parts of Australia had more years of schooling. Even though the students assessed at the eighth grade typically averaged between 14 and 15 years old, the variety of countries assessed and their situations also resulted in a considerable range in the average age of the students assessed. To illustrate how education policies can affect the interaction between age and number of years of schooling, it is interesting to note that Scotland, one of the few countries with an additional year of schooling, starts formal schooling at an early age and had the youngest students assessed—13.7 years old on average. Other countries assessing students younger than 14 years old included Slovenia, Norway, and Cyprus with 13.8 and Australia, Jordan, and Italy with 13.9. Students in the Balkans and some Eastern European countries start school later and tended to be older, particularly in Estonia with an average of 15.2. Students also were older in several African countries including Botswana and South Africa both averaging 15.1, Morocco averaging 15.2, and Ghana averaging 15.5. In these countries, it is not unusual for students to start school at an older age and also perhaps to find it necessary to interrupt their schooling.

At the fourth grade, the aim was to assess students having had four years of formal schooling and this was the case for the most part. However, some students in Slovenia and parts of the Russian Federation had only three years of formal schooling, and students in England and Scotland as well as some in Australia and New Zealand had five years. In terms of chronological age, students in most countries averaged between 10 and 11 years old. Consistent with the patterns at the eighth grade, students were somewhat younger in Scotland, averaging 9.7 years old; Italy, Slovenia, and Norway, averaging 9.8; and Australia and Cyprus, averaging 9.9. The students in the Balkan and Eastern European countries were somewhat older, especially in Latvia with an average age of 11.1.

As a reminder that not all countries are equally well equipped to meet the challenge of educating their young people, Exhibit 1.1 includes the value for each country on the Human Development Index provided by the United Nations Development Programme (UNDP).⁷ The index has a minimum value of 0 and a maximum of 1.0. Countries with high values on the index enjoy long life expectancy, high levels of school enrollment and adult literacy, and a good standard of living as measured by per capita GDP. For example, TIMSS countries with index values greater than 0.9 included Australia, Belgium (Flemish), England, Israel, Italy, Japan, New Zealand, Norway, The Netherlands, Scotland, Sweden, and the United States. All except Norway have average eighth-grade mathematics achievement above the international average. However, not all countries above the international average had an index value as high as this.

Exhibit 1.2 shows how a country's average achievement in mathematics compares to achievement in the other countries. This figure shows whether or not the differences in average achievement between pairs of countries are statistically significant. Selecting a country of interest and reading across the table, a circle with a triangle pointing up indicates significantly higher performance than the comparison country listed across the top; absence of a symbol indicates no significant difference in performances; and a circle with triangle pointing down indicates significantly lower performance.

The data in Exhibit 1.2 reinforce the point that, when ordered by average achievement, adjacent countries usually did not significantly differ from each other, although the differences in achievement between the highperforming and low-performing countries were very large. Because of this wide range in performance, the pattern for a number of countries was one of having lower mean achievement than some countries, about the same mean achievement as other countries, and higher mean achievement than a third group of countries.

⁷ Human Development Report 2003, p. 237-240.

Exhibit 1.2: Multiple Comparisons of Average Mathematics Achievement

TIMSS2003

Ο MATHEMATICS Grade 0

nstructions: Read across the row whether the average achievemer hat of the comparison country, c	i for a nt of t or if th	a cou the o here	untry coun is n	y to itry i o st	com in th atist	ipar le ro ical	e pe w is ly si	rtor s sig gnif	mar nifio ican	nce v cant it dif	with ly lo ffere	the wei ence	tha bet	untri in th wee	ies li nat c en th	isteo of th ne a	d ald le co vera	ong ompa ige a	the ariso achio	top on c ever	of ti oun nen	he c try, s t of	hart sign the	t. The ifica two	e sy intly cou	mbo hig Intri	ls ir her es.	thai	ate 1	
Countries	Singapore	Korea, Rep. of	Hong Kong, SAR	Chinese Taipei	Japan	Belgium (Flemish)	Netherlands	Estonia	Hungary	Malaysia	Latvia	Russian Federation	Slovak Republic	Australia	United States	Lithuania	Sweden	England	Scotland	Israel	New Zealand	Slovenia	Italy	Armenia	Serbia	Bulgaria	Romania	Norway	Moldova, Rep. of	Cyprus
Singapore		0	0	٥	0	٥	٥	٥	٥	0	0	0	0	0	0	0	0	0	0	٥	0	٥	٥	0	٥	٥	0	٥	0	0
Korea Rep of		-	-	-	0	٥	٥	٥	٥	0	0	0	0	0	0	0	٥	٥	٥	0	٥	0	٥	0	0	٥	٥	0	0	0
Hong Kong, SAR					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chinese Tainei					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
lanan	•				-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Belgium (Elemish)		•	•			-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	•									0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estopio										0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estorila	•	•	•	•	•					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malaysia										-		-	-	-	-		-	-	-	0	0	0	0	0	0	0	0	0	0	0
Iviaiaysia																	0		0	0	0	0	0	0	0	0	0	0	0	0
Pussian Endoration										-					-		0		0	0	0	0	0	0	0	0	0	0	0	0
Slovak Bapublic																	0		0	0	0	0	0	0	0	0	0	0	0	0
										-					-		-		-	-	-	0	0	0	0	0	0	0	0	0
Australia	•																					0	~	0	0	0	~	0	0	0
United States	•					•				_					_							0	0	0	0	0	0	0	0	0
Litriuania	•																					0	0	0	0	0	0	0	0	0
Sweden	•								•	-	J	J	J		-								0	0	0	0	~	~	0	0
England	•			•		•	•	•	•														0	0	0	0	0	0	0	0
Scotland	•					•	•				•	•											0	0	0	0	0	0	0	0
Israel	•					•	•	•	•		•	•											0	0	0	0	0	0	0	0
New Zealand																							^	0	0	0	0	0	0	0
Siovenia																							0	0	0	0	0	0	0	0
italy																												0	0	0
Armenia																												0	0	0
Serbia																												0	0	0
Bulgaria																												0	0	0
Romania																									0			0	0	0
Norway																														
Moldova, Rep. of																														
Cyprus																												0	0	
Macedonia, Rep. of																														
Lebanon																														
Jordan																														
Iran, Islamic Rep. of																														
Indonesia																														
Tunisia																														
Egypt						۲	۲	۲	۲		۲					۲				•		۲	۲		•	۲	۲			
Bahrain																														
Palestinian Nat'l Auth.																														
Chile																														
Morocco																														
Philippines																														
Botswana																														
Saudi Arabia																														
Ghana																														
South Africa																														
Benchmarking Participants																														
Basque Country, Spain	۲			۲	۲	۲	۲	۲	۲		۲	۲	۲	۲		۲	۲	۲	۲	۲				0	0	0	0	0	0	0
Indiana State, US	۲	۲	۲	۲	۲	۲	۲	۲	۲											0		0	0	0	0	0	0	0	0	0
Ontario Province, Can.	۲			۲	۲	۲	۲	۲		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quebec Province Can								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: 5% of these comparisons would be statistically significant by chance alone.

Exhibit 1.2: Multiple Comparisons of Average Mathematics Achievement

Grade (O

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average achievement of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average achievement of the two countries.

Macedonia, Rep. of	Lebanon	Jordan	Iran, Islamic Rep. of	Indonesia	Tunisia	Egypt	Bahrain	Palestinian Nat I Auth.	Chile	Morocco	Philippines	Botswana	Saudi Arabia	Ghana	South Africa		Basque Country, Spain	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.	Countries
٥	0	0	0	٥	٥	٥	٥	0	0	٥	0	٥	٥	٥	٥		٥	0	0	٥	Singapore
٥	٥	٥	0	٥	٥	٥	٥	0	٥	٥	٥	٥	٥	٥	0		٥	0	٥	٥	Korea, Rep. of
0	٥	٥	0	٥	٥	٥	٥	0	٥	٥	٥	٥	٥	٥	0		٥	0	٥	٥	Hong Kong, SAR
0	0	٥	0	٥	٥	٥	٥	0	٥	٥	٥	٥	٥	٥	0		٥	0	٥	٥	Chinese Taipei
0	0	0	0	٥	٥	0	0	0	0	0	0	0	0	0	0		0	0	0	0	Japan
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0		Belgium (Flemish)
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0		Netherlands
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0		Estonia
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0			Hungary
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0		•		Malaysia
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0				Latvia Duccion Fodoration
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0			•	Russian Federation
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0				
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0				United States
0	0	0	0	٥	0	0	0	0	0	0	0	0	0	0	0		0				Lithuania
0	0	0	0	٥	٥	0	0	0	0	0	0	٥	٥	٥	0		0		۲	۲	Sweden
0	0	٥	0	٥	٥	٥	٥	0	0	٥	٥	٥	٥	٥	0		٥		۲	۲	England
0	0	0	0	٥	٥	٥	٥	0	0	0	٥	٥	٥	٥	0		0		۲	۲	Scotland
0	٥	٥	0	٥	٥	٥	٥	0	٥	٥	٥	٥	٥	٥	0		٥	\odot	۲	۲	Israel
0	٥	٥	0	٥	٥	٥	٥	0	٥	٥	٥	٥	٥	٥	0				۲	۲	New Zealand
0	٥	٥	0	٥	٥	٥	٥	0	٥	٥	٥	٥	٥	٥	0			۲	۲	۲	Slovenia
0	0	0	0	٥	٥	٥	٥	0	٥	٥	0	٥	٥	٥	0			۲	۲	۲	Italy
0	0	٥	0	٥	٥	٥	٥	0	٥	٥	٥	٥	٥	٥	0		۲	۲	۲	۲	Armenia
0	0	0	0	٥	0	٥	٥	0	٥	0	0	0	0	٥	0		۲	۲	۲	۲	Serbia
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		۲	۲	۲	۲	Bulgaria
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	_					Romania
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						Norway
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	_					Moldova, Rep. of
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						Cyprus
		0	0	0	0	0	0	0	0	0	0	0	0	0	0						Macedonia, Rep. of
			0	0	0	0	0	0	0	0	0	0	0	0	0		•			•	Lebanon
•			-	Ŭ	Ŭ	•	0	0	0	0	0	0	0	0	0						Jordan
								0	0	0	0	0	0	0	0		•				Indonesia
		۲					0	0	0	0	0	0	0	0	0		۲	۲	۲		Tunisia
۲	۲	۲						0	0	0	0	0	0	0	0		۲	۲	۲	۲	Egypt
۲	۲	۲	۲		۲			0	٥	٥	٥	٥	٥	٥	٥		۲	۲	۲	۲	Bahrain
۲	۲	۲	۲	۲	۲	۲	۲				0	0	0	0	٥		۲	۲	۲	۲	Palestinian Nat l Auth.
\odot	۲	۲	۲	۲	\bigcirc	۲	۲					٥	٥	٥	٥		۲	۲	۲	۲	Chile
۲	۲	۲	۲	۲	۲	۲	۲					٥	٥	٥	٥		۲	۲	۲	۲	Morocco
۲	۲	۲	۲	۲	۲	۲	۲	۲					٥	٥	0		۲	۲	۲	۲	Philippines
۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲			٥	٥	٥		۲	۲	۲	۲	Botswana
۲	۲	۲	۲	۲	۲	۲	۲		۲	۲	۲	۲	-	0	٥		۲	۲	۲	۲	Saudi Arabia
۲	۲	۲	۲	۲	۲	۲	۲		۲	۲		۲	۲				۲	۲	۲		Ghana
																		۲			South Africa
0	6		6	6	6	•	•	6		•	6	6	6	6	6				0		Benchmarking Participants
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						Basque Country, Spain
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0			Indiana State, US
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0		Ontario Province, Can.
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9		9	9	9		Quebec Province, Can.

• Average achievement significantly higher than comparison country

 Average achievement significantly lower than comparison country

Note: 5% of these comparisons would be statistically significant by chance alone.

Multiple Comparisons of Average Mathematics Achievement

Exhibit 1.2:

TIMSS2003

(TIMSS) 2003

Grade

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average achievement of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average achievement of the two countries.

Countries	Singapore	Hong Kong, SAR	Japan	Chinese Taipei	Belgium (Flemish)	Netherlands	Latvia	Lithuania	Russian Federation	England	Hungary	United States	Cyprus	Moldova, Rep. of	Italy	Australia	New Zealand	Scotland	Slovenia	Armenia	Norway	Iran, Islamic Rep. of	Philippines	Morocco	Tunisia		Indiana State, US	Ontario Province, Can.	Quebec Province, Can.	U
Singapore		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	
Hong Kong, SAR			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	
Japan	۲	۲			0	0	0	٥	0	0	٥	0	0	0	0	0	0	0	٥	0	٥	0	0	0	0		0	0	0	
Chinese Taipei	$\overline{\bullet}$	$\overline{\bullet}$			0	0	0	0	0	0	0	0	0	0	0	0	0	0	٥	0	0	0	0	0	0		0	0	0	
Belgium (Flemish)	۲	۲	۲	۲		٥	0	٥	0	0	٥	0	٥	0	٥	٥	0	0	٥	٥	٥	0	0	0	٥		0	0	0	1
Netherlands	۲	۲	lacksquare	lacksquare	۲					٥	٥	0	٥	٥	٥	٥	0	٥	٥	٥	٥	٥	٥	٥	٥		0	0	0	
Latvia	۲	۲	۲	۲	۲							0	0	0	0	0	٥	٥	٥	0	٥	0	٥	0	0			0	0	1
Lithuania	\odot	۲	۲	۲	۲							٥	٥	٥	0	٥	٥	٥	٥	٥	٥	٥	٥	٥	0			0	٥	Ì
Russian Federation	۲	۲	۲	۲	۲							0	٥	٥	٥	٥	0	0	٥	٥	٥	٥	٥	٥	٥			0	0	L C
England	۲	۲	\bigcirc	\bigcirc	۲	\odot						٥	0	0	0	0	٥	٥	٥	٥	٥	0	٥	٥	0			0	0	-
Hungary	۲	۲	۲	۲	۲	۲						0	0	0	0	0	٥	0	٥	0	٥	0	0	0	0			0	0	C
United States	\odot	۲	lacksquare	lacksquare	۲	\odot	lacksquare	۲	۲	۲	lacksquare		0	0	0	0	٥	٥	٥	٥	٥	٥	٥	0	0		۲		٥	
Cyprus	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲				0	0	0	٥	0	٥	0	0	٥	0		۲			
Moldova, Rep. of	۲	۲	۲	۲	۲	\bigcirc	۲	۲	۲	۲	۲	۲			_		0	٥	٥	0	٥	٥	0	٥	0		۲			
Italy	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲					0	0	٥	0	٥	0	0	0	٥		۲			
Australia	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲		_				٥	0	٥	٥	٥	0	0		۲	۲		
New Zealand	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲				0	0	0	0	0	0	0		۲	۲	۲	
Scotland	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲				٥	0	0	0	0	0	0		۲	۲		
Slovenia	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲		0	٥	0	0	0	٥	_	۲	۲		
Armenia	۲	۲	۲	۲		۲	۲	۲	۲		۲	۲	۲	۲	۲	۲		۲	۲			0	0	0	0					
Norway	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲	۲			0	0	0	٥		۲		۲	
Iran, Islamic Rep. of	۲	۲	۲	۲		۲	۲	۲	۲	۲	۲	۲	۲	۲			۲	۲	۲		۲		0	0	0					
Philippines	۲					•	۲	۲			۲			۲	۲	۲	۲	۲	۲		۲	۲			0	_	۲			
Morocco																							0							
Tunisia	۲										۲																			
Benchmarking Participants	_					_					_				_					_						_	_		_	
Indiana State, US		۲										0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	
Ontario Province, Can.	۲		۲	۲	۲	۲	۲	۲	۲		۲					0	0	0	0	0	0	0	0	0	0		۲			
Quebec Province, Can.	۲					۲					۲						0	0	0	0	0	0	0	0	0					

• Average achievement significantly higher than comparison country

€ Average achievement significantly lower than comparison country

Note: 5% of these comparisons would be statistically significant by chance alone.

At both the eighth and fourth grades, Singapore was the topperforming country having significantly higher mean achievement than the rest of the participating countries. At the eighth grade, the Republic of Korea, Hong Kong SAR, and Chinese Taipei had significantly higher mean achievement than all of the other participating countries except Singapore. Japan also performed very well, with significantly higher achievement than most other participating countries, as did Belgium (Flemish), the Netherlands, Estonia, and Hungary. At the fourth grade, in addition to Singapore, Hong Kong SAR, Japan, and Chinese Taipei had significantly higher average achievement than most of the other participating countries as did Belgium (Flemish).

How Has Mathematics Achievement Changed Since 1995 and 1999?

Exhibit 1.3 shows the countries that have comparable data from previous TIMSS assessments at the eighth and fourth grades. At the eighth grade, 35 countries and three of the benchmarking participants have data from one or both of the previous TIMSS assessments conducted in 1995 and 1999. Well over half of the countries and two of the benchmarking entities, the Canadian provinces of Ontario and Quebec, have participated in all three assessments. Of these, 18 countries as well as Ontario and Quebec have trends in mathematics achievement for their eighth-grade students across three points in time—1995, 1999, and 2003. For several three-time participants, not all the results are presented because they were not strictly comparable. For example, changes in policy about age of school entry complicated trend data collection in Australia and Slovenia so their 1999 data are not shown. Also, the 1995 data are not shown for Israel, Italy, and South Africa since the characteristics of their samples were not completely known in that first assessment. Twelve countries and the US state of Indiana can monitor changes in performance between 1999 and 2003, and five countries between 1995 and 2003, including Australia, Sweden, Scotland, Slovenia, and Norway. At the fourth grade, 15 of the TIMSS 2003

Exhibit 1.3: Trends in Mathematics Achievement

TIMSS2003

Grade (O

Countries	Average Scale Score	1999 to 2003 Difference	1995 to 200 Difference	Mathematics Achievement Distribution	Average Age
Singapore					
2003	605 (3.6)				14.3
1999	604 (6.3)	1 (7.2)			14.4
1995	609 (4.0)		-3 (5.4)		14.5
Korea, Rep. of					
2003	589 (2.2)				14.6
1999	587 (2.0)	2 (2.9)			14.4
1995	581 (2.0)		8 (3.0)		14.2
Hong Kong, SAR					
2003	586 (3.3)				14.4
1999	582 (4.3)	4 (5.4)			14.2
1995	569 (6.1)		17 (7.0)		14.2
Chinese Taipei					
2003	585 (4.6)				14.2
1999	585 (4.0)	0 (6.0)		and the second sec	14.2
Japan	. ,				
2003	570 (2.1)				14.4
1999	579 (1.7)	-9 (2.6) 💌			14.4
1995	581 (1.6)	() 0	-11 (2.6)		14.4
Belgium (Flemish)					
2003	537 (2.8)				14.1
1999	558 (3.3)	-21 (4 1) 🐨			14.1
1995	550 (5.9)	21 (11) 0	-13 (65)		14.1
Netherlands	550 (5.5)		-15 (0.5)		14.1
2003	536 (3.8)				1/1 3
1000	540 (7.1)	/ (9.1)			14.5
1999	540 (7.1)	-4 (0.1)	7 (7 2)		14.2
Hungany	525 (0.1)		1 (1.3)		14.4
nungary	F20 (2 2)				145
2003	529 (3.2)	2 (4 0)			14.5
1999	532 (3.7)	-2 (4.9)	2 (4 5)		14.4
1995	527 (3.2)		3 (4.5)		14.3
Malaysia	500 (11)				
2003	508 (4.1)				14.3
1999	519 (4.4)	-11 (6.0)			14.4
Russian Federation					
2003	508 (3.7)				14.2
1999	526 (5.9)	-18 (7.1) 💌			14.1
1995	524 (5.3)		-16 (6.5)		14.0
Slovak Republic					
2003	508 (3.3)				14.3
1999	534 (4.0)	-26 (5.1) 💿			14.3
1995	534 (3.1)		-26 (4.4)		14.3
Latvia (LSS)					
2003	505 (3.8)				15.1
1999	505 (3.4)	0 (5.1)			14.5
1995	488 (3.6)		17 (5.2)		14.3
Australia					
2003	505 (4.6)				13.9
1995	509 (3.7)		-4 (6.0)		13.9
United States					
2003	504 (3.3)				14.2
1999	502 (4.0)	3 (5.2)			14.2
1995	492 (4.7)		12 (5.8)		14.2

2003 country average significantly higher than previous assessment year



Percentiles of Performance 95th 95% Confidence Interval for Average (±2SE)

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia, and 1995 data are not shown for Israel, Italy, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995. Data for Latvia in this exhibit include Latvian-speaking schools only.

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

Exhibit 1.3: Trends in Mathematics Achievement (Continued...)

TIMSS2003

Ο MATHEMATICS Grade Ο

Countries		Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference	Mathematics Achievement Distribution	Average Age
Lithuania						
	2003	502 (2.5)				14.9
	1999	482 (4.3)	20 (5.0) 🗅			15.2
	1995	472 (4.1)		30 (4.8) 🗅		14.3
Sweden						
	2003	499 (2.6)				14.9
	1995	540 (4.3)		-41 (5.0) 💿		14.9
Scotland						
	2003	498 (3.7)				13.7
	1995	493 (5.7)		4 (6.7)		13.7
Israel						
	2003	496 (3.4)				14.0
	1999	466 (3.9)	29 (5.2) 🗅			14.1
New Zeala	nd					
	2003	494 (5.3)				14.1
	1999	491 (5.2)	3 (7.4)			14.0
	1995	501 (4.7)		-7 (7.1)		14.0
Slovenia				. ,		
	2003	493 (2.2)				13.8
	1995	494 (2.9)		-2 (3.7)		13.8
Italy		131 (213)		2 (517)		1510
italy	2003	484 (3.2)				13.9
	1999	479 (3.8)	4 (4 9)			14.0
Bulgaria	1555	475 (5.0)	4 (4.5)			14.0
bulgaria	2003	176 (13)				1/1 0
	1000	470 (4.3) 511 (5.9)	24 (7 2)			14.5
	1999	527 (5.8)	-54 (7.5) 🐨	-51 (7.2)		14.0
Romania	1995	JZ7 (J.0)		-51 (7.2) 🐨		14.0
Komama	2002	175 (1 9)				15.0
	1000	473 (4.8)	2 (7 5)			1/ 9
	1999	472 (5.6)	5 (7.5)	2 (6 6)		14.0
Nemuou	1995	474 (4.6)		2 (0.0)		14.0
Norway	2002	461 (2 5)				12.0
	2003	461 (2.5)		27 (2 2)		13.8
	1995	498 (2.2)		-37 (3.3)		13.9
ivioidova, F	kep. of	460 (4.0)				14.0
	2003	460 (4.0)	0 (5 5)			14.9
<u> </u>	1999	469 (3.9)	-9 (5.5)			14.4
Cyprus	2002	450 (4 7)				42.0
	2003	459 (1.7)	47 /2 4			13.8
	1999	4/6 (1.8)	-17 (2.4) 💌	0 (0 - 2) - 0		13.8
	1995	468 (2.2)		-8 (3.0) 💌		13.7
Macedonia	a, Rep. of					
	2003	435 (3.5)				14.6
	1999	447 (4.2)	-12 (5.5) 💿			14.6
Jordan						
	2003	424 (4.1)			and the second se	13.9
	1999	428 (3.6)	-3 (5.5)			14.0
Iran, Islami	ic Rep. of					
	2003	411 (2.4)				14.4
	1999	422 (3.4)	-11 (4.2) 💿			14.6
	1995	418 (3.9)		-7 (4.5)		14.6
				() 100 200 200 400 500 600 700 90	0

2003 country average significantly ٥ higher than previous assessment year

- \bigcirc 2003 country average significantly lower than previous assessment year



Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia, and 1995 data are not shown for Israel, Italy, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995. Data for Latvia in this exhibit include Latvian-speaking schools only.

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

Exhibit 1.3: Trends in Mathematics Achievement (...Continued)

TIMSS2003

C MATHEMATICS Grade 0

Countries	Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference	Mathematics Achievement Distribution	Average Age
Indonesia					
2003	411 (4.8)				14.5
1999	403 (4.9)	8 (6.8)			14.6
Tunisia					
2003	410 (2.2)				14.8
1999	448 (2.4)	-38 (3.4) 💿			14.8
Chile					
2003	387 (3.3)				14.2
1999	392 (4.4)	-6 (5.2)			14.4
Philippines					
2003	378 (5.2)				14.8
1999	345 (6.0)	33 (7.8) 🗅			14.1
South Africa					
2003	264 (5.5)				15.1
1999	275 (6.8)	-11 (8.4)			15.5
[‡] England					
2003	498 (4.7)				14.3
1999	496 (4.1)	2 (6.2)			14.2
1995	498 (3.0)		1 (5.6)	and the second	14.0
Benchmarking Participants Indiana State, US					
2003	508 (5.2)				14.5
1999	515 (7.2)	-6 (8.9)			14.4
Ontario Province, Can.					
2003	521 (3.1)				13.8
1999	517 (3.0)	4 (4.3)			13.9
1995	501 (2.9)		20 (4.3) \tag		14.0
Quebec Province, Can.					٦
2003	543 (3.0)				14.2
1999	566 (5.3)	-23 (6.1) 💌			14.3
1995	556 (5.9)		-13 (6.6) 💿		14.5
• 20	03 country average	e significantly	0	100 200 300 400 500 600 700	800
	ther than previous	accessment year		Percentiles of Performance	

higher than previous assessment year

2003 country average significantly lower than previous assessment year \bigcirc

95% Confidence Interval for Average (±2SE)

75th 95th

5th 25th

Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia, and 1995 data are not shown for Israel, Italy, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995. Data for Latvia in this exhibit include Latvian-speaking schools only.

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

Exhibit 1.3: Trends in Mathematics Achievement



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Countries		Average Scale Score	1995 to 2003 Difference	Mathematics Achievement Distribution	Average Age
Singapore					
	2003	594 (5.6)			10.3
	1995	590 (4.5)	4 (7.2)		10.3
Hong Kong, S	AR				
	2003	575 (3.2)			10.2
	1995	557 (4.0)	18 (5.0)		10.1
Japan					
	2003	565 (1.6)	- ()		10.4
	1995	567 (1.9)	-3 (2.5)		10.4
Netherlands	2002	540 (2.4)			40.2
	2003	540 (2.1)	0 (2 7)		10.2
Latvia (LCC)	1995	549 (3.0)	-9 (3.7)		10.3
Latvia (LSS)	2002	E22 (2 1)			11 1
	1005	333 (3.1) 400 (4.6)	24 (5 5)		10.5
England	1999	433 (4.0)) (J.J)		10.5
Lingianu	2003	531 (37)			10.3
	1995	484 (3 3)	47 (5 0)		10.0
Hungary		101 (5.5)	17 (5.0)		10.0
	2003	529 (3.1)			10.5
	1995	521 (3.6)	7 (4.8)		10.4
United States		,	. ()		
	2003	518 (2.4)			10.2
	1995	518 (2.9)	0 (3.8)		10.2
Cyprus					
	2003	510 (2.4)			9.9
	1995	475 (3.2)	35 (4.1)		9.8
Australia					
	2003	499 (3.9)			9.9
	1995	495 (3.4)	4 (5.2)		9.9
New Zealand					
	2003	496 (2.1)			10.0
	1995	469 (4.4)	26 (4.9)		10.0
Scotland					
	2003	490 (3.3)			9.7
	1995	493 (4.2)	-3 (5.3)		9.7
Slovenia					
	2003	479 (2.6)			9.8
	1995	462 (3.1)	17 (4.1) C		9.9
Norway	2002	454 (2.2)			0.0
	2003	451 (2.3)	25 (27)		9.8
Iron Jalami - D	1995	476 (3.0)	-25 (3.7)		9.9
iran, islamic R	ep. of	200 (4 2)			10.4
	2003	389 (4.2)	2 (C E)		10.4
Renchmarking Par	ticinante	507 (5.0)	2 (0.3)		10.5
Ontario Provi	nce Can				
	2003	511 (3.8)			9.8
	1995	489 (3.5)	23 (5 2)		99
Quebec Provi	nce, Can.	.00 (0.0)	20 (3.2)		5.5
	2003	506 (2.4)			10.1
	1995	550 (4.2)	-44 (4.8)		10.3
		(,	,,		10
				0 100 200 300 400 500 600 /00 8L	10
0	2003 co	ountry average signi	ificantly sment year	Percentiles of Performance	
	2003 cc	ountry average signi	ificantly	5th 25th 75th 95th	

2003 country average significantly lower than previous assessment year

95% Confidence Interval for Average (±2SE)

Trend notes: Because of differences between 1995 and 2003 in population coverage, 1995 data are not shown for Italy. Data for Latvia in this exhibit include Latvian-speaking schools only. To be comparable with 1995, 2003 data for New Zealand in this exhibit include students in English medium instruction only (98% of the estimated population).

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

countries and Ontario and Quebec also participated in TIMSS 1995. Since TIMSS was not conducted at the fourth grade in 1999, these participants can track changes in student achievement over an eight-year period, between 1995 and 2003.

For the countries participating in assessments prior to TIMSS 2003, Exhibit 1.3 compares average achievement between the years.⁸ Countries are presented in descending order according to their average TIMSS 2003 achievements. At the eighth grade, a number of countries had significantly higher achievement in TIMSS 2003 than in previous assessments. Most notably, Korea, Hong Kong SAR, the US, Latvia (LSS), Lithuania, and Ontario have shown a pattern of improvement with significant change over the 8-year period. For Lithuania, the increase between 1995 and 1999 also was significant. Israel and the Philippines showed significant improvement from 1999 to 2003. Countries showing a decrease at the eighth grade in TIMSS 2003, from 1995, 1999, or both, included Japan, Belgium (Flemish), the Russian Federation, the Slovak Republic, Sweden, Bulgaria, Norway, Cyprus, Macedonia, Iran, Tunisia, and Quebec.

At the fourth grade, many countries had significant increases in average achievement between 1995 and 2003. Participants showing improved performance included Hong Kong SAR, Latvia (LSS), England, Cyprus, New Zealand, Slovenia, and Ontario. Several participants showed significant declines, including the Netherlands, Norway, and Quebec.

A number of countries showed remarkable changes in mathematics achievement over the eight-year period covered by the TIMSS assessments, some of which may be the result of societal or educational changes during this time. For example, the political changes in Eastern Europe more than a decade ago spawned far-reaching educational reform initiatives that have changed the face of education in many countries in the region. The achievement growth in Latvia and Lithuania, as well as the strong performance of Estonia in its first TIMSS appearance, may reflect the efforts at improvement in those countries. In contrast, countries in the region where reform efforts seem to have been less successful

⁸ TIMSS used IRT methods to place the TIMSS 2003 results on the same scales that were developed for 1995 and also used for 1999 at the eighth grade. See Appendix A for more detailed information.

include Bulgaria, the Russian Federation, and the Slovak Republic, each of which show large decreases over the period.

What Are the Gender Differences in Mathematics Achievement?

Exhibit 1.4 shows gender differences in eighth- and fourth-grade mathematics achievement in 2003. It presents average achievement separately for girls and boys for each of the TIMSS 2003 countries, as well as the difference between the means. Countries are shown in increasing order of this gender difference. The gender difference for each country is shown by a bar indicating the amount of the difference, whether the direction of the difference favored girls or boys, and whether the difference is statistically significant (indicated by a darkened bar).

On average, across all countries, there was essentially no difference in achievement between boys and girls at either the eighth or fourth grade, although the situation varied from country to country. In many countries the results paralleled the international pattern and the gender difference was negligible. However, at the eighth grade, countries where girls had significantly higher achievement included Serbia, Macedonia, Armenia, Moldova, Singapore, the Philippines, Cyprus, Jordan, and Bahrain. Participants where boys had significantly higher achievement included the United States, Italy, Hungary, Lebanon, Belgium (Flemish), Morocco, Chile, Ghana, Tunisia, US state of Indiana and Quebec province. At the fourth grade, girls had significantly higher average achievement in Singapore, Moldova, the Philippines, and Armenia. Boys had higher average achievement in the Netherlands, the United States, Italy, Cyprus, Scotland, and in the two Canadian provinces.

Achievement differences between TIMSS 2003 and 1995 and 1999 are presented separately for girls and for boys in Exhibit 1.5. At the eighth grade, both boys and girls had significantly higher achievement in 2003 in Israel, Lithuania, the Philippines, the United States, and Ontario. Girls showed improved performance compared to previous

Exhibit 1.4: Average Mathematics Achievement by Gender

TIMSS2003

Grade O

	Gi	irls	B	oys	Difference	Gender	Difference	2003
Countries	Percent of Students	Average Scale Score	Percent of Students	Average Scale Score	(Absolute Value)	Girls Scored Higher	Boys Scored Higher	V (TIMSS)
Slovak Republic	48 (1.3)	508 (3.4)	52 (1.3)	508 (4.0)	0 (3.5)			Stud
Sweden	51 (0.9)	499 (3.0)	49 (0.9)	499 (2.7)	1 (2.2)			buce
1 Indonesia	50 (0.7)	411 (4.9)	50 (0.7)	410 (5.3)	1 (3.0)			Scie
Egypt	46 (2.7)	407 (4.4)	54 (2.7)	406 (5.0)	1 (6.4)			and
Bulgaria	48 (1.3)	476 (5.5)	52 (1.3)	477 (4.3)	1 (4.7)			atics
International Avg.	50 (0.2)	467 (0.6)	50 (0.2)	466 (0.6)	1 (0.6)		C .	e de
† Hong Kong, SAR	50 (2.4)	587 (3.8)	50 (2.4)	585 (4.6)	2 (5.1)			Math
Estonia	50 (1.0)	532 (3.4)	50 (1.0)	530 (3.3)	2 (3.0)			
New Zealand	52 (1.7)	495 (4.8)	48 (1.7)	493 (7.0)	3 (5.7)			atio
Japan	49 (1.2)	569 (4.0)	51 (1.2)	571 (3.6)	3 (6.4)			tern
South Africa	51 (0.9)	262 (6.2)	49 (0.9)	264 (6.4)	3 (5.8)			i i
Norway	50 (0.8)	463 (2.7)	50 (0.8)	460 (3.0)	3 (2.8)			a spu
Russian Federation	49 (1.2)	510 (3.5)	51 (1.2)	507 (4.4)	3 (2.8)			Tre
Slovenia	50 (0.9)	495 (2.6)	50 (0.9)	491 (2.6)	3 (2.8)			EA
Botswana	51 (0.7)	368 (2.6)	49 (0.7)	365 (2.9)	3 (1.8)			<u>ن</u>
Romania	52 (0.9)	477 (5.1)	48 (0.9)	473 (5.0)	4 (3.3)			L NO
1 Lithuania	50 (0.9)	503 (2.9)	50 (0.9)	499 (3.0)	5 (2.9)			- N
† Scotland	50 (1.3)	500 (4.3)	50 (1.3)	495 (3.8)	5 (3.5)			
⊷ Korea, Rep. of	48 (2.8)	586 (2.7)	52 (2.8)	592 (2.6)	5 (3.1)			
Latvia	49 (0.8)	511 (3.3)	51 (0.8)	506 (3.7)	6 (2.9)			
+ United States	52 (0.7)	502 (3.4)	48 (0.7)	507 (3.5)	6 (1.9)			
Italy	50 (0.9)	481 (3.0)	50 (0.9)	486 (3.9)	6 (2.8)			
† Netherlands	49 (1.2)	533 (4.1)	51 (1.2)	540 (4.5)	7 (3.6)			
' Serbia	49 (0.8)	480 (2.9)	51 (0.8)	4/3 (2.9)	7 (2.8)			
	48 (1.0)	589 (4.9)	52 (1.0)	582 (5.2)	7 (4.2)			
Hungary	50 (1.0)	526 (3.7)	50 (1.0)	533 (3.5)	7 (3.2)		_	
Malaysia	50 (1.8)	512 (4.7)	50 (1.8)	505 (4.5)	8 (4.2)			
2 Israel Balastinian Nat'l Auth	52 (1.6)	492 (3.3)	48 (1.6)	500 (4.5)	8 (4.0)			
Palestinian Nat I Auto.	55 (2.4) 40 (0.0)	394 (3.9)	45 (2.4)	380 (4.7)	8 (5.9) 0 (2.5)			
2 Macedonia, Rep. of	49 (0.9)	439 (4.0)	51 (0.9) 60 (4.1)	451 (5.9)	9 (5.5)			
Lobanon	40 (4.1) 57 (1.9)	417 (4.3)	/12 (1 9)	408 (4.2)	9 (7.2) 10 (4.0)			
Armenia	53 (0.7)	429 (3.0)	43 (1.8)	439 (3.9)	10 (4.0)			
Moldova Rep. of	51 (0.8)	465 (3.3)	47 (0.7)	475 (3.4)	10 (3.5)			
Singapore	J1 (0.8)	611 (3.3)	49 (0.8) 51 (0.8)	601 (4.3)	10 (3.3)			
Saudi Arabia	43 (0.0)	326 (7.9)	57 (0.0)	336 (5.5)	10 (2.3)			
Belgium (Elemish)	54 (2.1)	520 (7.5)	46 (2.1)	542 (3.8)	11 (4.8)			
1 ± Morocco	50 (1.8)	381 (2.8)	50 (1.8)	393 (3.0)	12 (3.1)			
Australia	51 (2.2)	499 (5.8)	49 (2.2)	511 (5.8)	13 (7.0)			
Philippines	58 (0.9)	383 (5.2)	42 (0.9)	370 (5.8)	13 (3.4)			
Chile	48 (1.6)	379 (3.5)	52 (1.6)	394 (4.3)	15 (4.5)			
Cyprus	49 (0.6)	467 (1.9)	51 (0.6)	452 (2.3)	16 (2.7)			
Ghana	45 (0.9)	266 (5.1)	55 (0.9)	283 (4.9)	17 (3.1)			
Tunisia	53 (0.7)	399 (2.6)	47 (0.7)	423 (2.2)	24 (1.9)			
Jordan	49 (1.7)	438 (4.6)	51 (1.7)	411 (5.8)	27 (6.8)			
Bahrain	50 (0.4)	417 (2.4)	50 (0.4)	385 (2.4)	33 (3.3)			
‡ England	50 (2.4)	499 (5.3)	50 (2.4)	498 (5.8)	0 (6.0)			
Benchmarking Participants								
Basque Country, Spain	49 (1.7)	490 (2.5)	51 (1.7)	484 (3.7)	6 (3.1)			
Indiana State, US	49 (1.2)	502 (5.1)	51 (1.2)	514 (5.8)	12 (3.4)			
Ontario Province, Can.	51 (0.9)	520 (3.4)	49 (0.9)	522 (3.4)	2 (2.8)			
Quebec Province, Can.	50 (1.6)	540 (3.7)	50 (1.6)	546 (3.3)	7 (3.3)			
						40 20	0 20	40

Gender difference statistically significant

1 Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

* Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

- 2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).
- ↔ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.
- () Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Gender difference not statistically significant

Exhibit 1.4: Average Mathematics Achievement by Gender

TIMSS2003



Countries	G	irls	В	oys	Difference		Gen	der Diffe	rence	
Countries	Percent of Students	Average Scale Score	Percent of Students	Average Scale Score	(Absolute Value)	Sco	Girls red Highe	r	Boys Scored Higher	
[†] Hong Kong, SAR	47 (1.1)	575 (3.4)	53 (1.1)	575 (3.4)	0 (2.3)					
New Zealand	50 (1.1)	493 (2.7)	50 (1.1)	494 (2.4)	0 (2.9)					
Chinese Taipei	48 (0.5)	564 (1.7)	52 (0.5)	564 (2.1)	1 (1.7)					
Latvia	49 (0.9)	536 (2.9)	51 (0.9)	536 (3.5)	1 (2.9)					
¹ Lithuania	49 (0.9)	535 (3.5)	51 (0.9)	536 (3.2)	1 (2.8)			1		
International Avg.	49 (0.2)	495 (0.8)	51 (0.2)	496 (0.8)	1 (0.7)					
[†] England	50 (0.9)	530 (3.9)	50 (0.9)	532 (4.5)	2 (4.0)					
Belgium (Flemish)	50 (1.0)	549 (1.8)	50 (1.0)	552 (2.5)	2 (2.5)					
Hungary	50 (0.9)	527 (3.8)	50 (0.9)	530 (3.3)	3 (3.4)					
† Australia	50 (1.0)	497 (4.5)	50 (1.0)	500 (4.3)	3 (4.0)					
Japan	49 (0.6)	563 (1.8)	51 (0.6)	566 (2.1)	4 (2.3)					
Russian Federation	50 (0.7)	530 (5.4)	50 (0.7)	534 (4.7)	4 (3.5)					
Norway	50 (0.8)	449 (2.7)	50 (0.8)	454 (2.7)	5 (2.8)					
Slovenia	48 (1.1)	477 (3.0)	52 (1.1)	481 (3.5)	5 (3.8)					
Tunisia	48 (0.9)	342 (5.0)	52 (0.9)	337 (4.9)	5 (2.8)					
[†] Netherlands	49 (1.1)	537 (2.7)	51 (1.1)	543 (2.2)	6 (2.4)					
Morocco	49 (1.1)	344 (6.1)	51 (1.1)	350 (5.1)	6 (4.7)					
Iran, Islamic Rep. of	39 (4.2)	394 (6.5)	61 (4.2)	386 (5.5)	8 (8.8)					
[†] United States	50 (0.5)	514 (2.4)	50 (0.5)	522 (2.7)	8 (1.6)				l	
Singapore	49 (1.4)	599 (5.5)	51 (1.4)	590 (6.2)	8 (3.9)					
Italy	48 (0.8)	498 (4.1)	52 (0.8)	507 (3.7)	9 (2.6)				l i	
Cyprus	49 (0.7)	505 (2.7)	51 (0.7)	514 (2.9)	9 (2.8)					
Moldova, Rep. of	50 (0.8)	510 (5.2)	50 (0.8)	499 (5.1)	11 (3.5)					
[†] Scotland	51 (1.0)	485 (3.2)	49 (1.0)	496 (4.4)	11 (4.1)					
Philippines	51 (1.0)	364 (9.2)	49 (1.0)	352 (7.0)	12 (4.6)					
Armenia	49 (0.8)	462 (3.7)	51 (0.8)	450 (3.8)	12 (2.9)					
nchmarking Participants										
Indiana State, US	52 (1.1)	532 (3.1)	48 (1.1)	534 (3.4)	2 (3.3)					
Ontario Province, Can.	48 (1.1)	505 (3.6)	52 (1.1)	517 (4.7)	11 (3.7)					
Quebec Province, Can.	50 (0.9)	502 (2.7)	50 (0.9)	509 (2.8)	7 (2.7)					
						1	20	1	20	

20 0

Gender difference statistically significant

Gender difference not statistically significant

Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9). t

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National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

Exhibit 1.5: Trends in Average Mathematics Achievement by Gender

TIMSS2003

Grade (O)

		Girls			Boys	
Countries	2003 Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference	2003 Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference
Australia	499 (5.8)		-13 (7.1)	511 (5.8)		4 (7.5)
Belgium (Flemish)	532 (3.5)	-28 (7.7) 💿	-21 (8.9)	542 (3.8)	-13 (9.0)	-4 (9.5)
Bulgaria	476 (5.5)	-35 (8.1) 🔍	-57 (8.0)	477 (4.3)	-34 (8.2) 💿	-45 (7.5) 💿
Chile	379 (3.5)	-9 (5.4)	$\diamond \diamond$	394 (4.3)	-3 (7.0)	\diamond \diamond
Chinese Taipei	589 (4.9)	5 (6.2)	\diamond \diamond	582 (5.2)	-5 (7.4)	\diamond \diamond
Cyprus	467 (1.9)	-11 (2.7) 🔍	-4 (3.3)	452 (2.3)	-23 (3.6) 💿	-13 (4.2) 🔍
Hong Kong, SAR	587 (3.8)	4 (6.1)	28 (7.9)	585 (4.6)	4 (7.5)	8 (8.5)
Hungary	526 (3.7)	-3 (5.4)	-1 (5.2)	533 (3.5)	-2 (5.6)	6 (5.1)
Indonesia	411 (4.9)	10 (7.2)	\diamond \diamond	410 (5.3)	5 (7.3)	\diamond \diamond
Iran, Islamic Rep. of	417 (4.3)	9 (6.0)	12 (7.5)	408 (4.2)	-24 (6.4) 🔍	-21 (6.3) 💿
Israel	492 (3.3)	33 (5.4)		500 (4.5)	25 (6.7)	
Italy	481 (3.0)	6 (5.3)		486 (3.9)	2 (5.8)	
Japan	569 (4.0)	-6 (4.7)	-8 (4.5)	571 (3.6)	-11 (4.2) 💿	-14 (4.2) 💿
Jordan	438 (4.6)	7 (6.7)	\diamond \diamond	411 (5.8)	-14 (8.3)	\diamond \diamond
Korea, Rep. of	586 (2.7)	2 (4.1)	15 (4.1)	592 (2.6)	2 (3.2)	3 (3.8)
Latvia (LSS)	509 (4.0)	6 (5.3)	22 (5.5)	502 (4.4)	-6 (6.0)	11 (6.1)
Lithuania	503 (2.9)	23 (5.4)	32 (5.5)	499 (3.0)	16 (5.8)	27 (5.5)
Macedonia, Rep. of	439 (4.0)	-7 (6.5)	\diamond \diamond	431 (3.9)	-16 (5.8) 💿	\diamond \diamond
Malaysia	512 (4.7)	-9 (6.7)	\diamond \diamond	505 (4.5)	-12 (7.4)	\diamond \diamond
Moldova, Rep. of	465 (4.1)	-3 (5.8)	$\diamond \diamond$	455 (4.8)	-16 (6.7) 💌	$\diamond \diamond$
Netherlands	533 (4.1)	-4 (8.6)	11 (7.8)	540 (4.5)	-3 (8.4)	5 (7.9)
New Zealand	495 (4.8)	0 (7.4)	-1 (7.2)	493 (7.0)	5 (10.2)	-12 (9.3)
Norway	463 (2.7)	$\diamond \diamond$	-35 (3.8)	460 (3.0)	\diamond \diamond	-39 (4.1) 💿
Philippines	383 (5.2)	31 (8.4)	\diamond \diamond	370 (5.8)	34 (8.7)	$\diamond \diamond$
Romania	477 (5.1)	2 (8.0)	5 (6.8)	473 (5.0)	3 (8.0)	-2 (7.3)
Russian Federation	510 (3.5)	-16 (6.9)	-15 (6.1)	⁾ 507 (4.4)	-20 (7.7)	-16 (7.5)
Scotland	500 (4.3)	$\diamond \diamond$	14 (6.8)	495 (3.8)	⇒ ⇒	-5 (7.9)
Singapore	611 (3.3)	7 (7 0)	1 (5.9)	601 (4 3)	-5 (8.6)	-7 (6.4)
Slovak Republic	508 (3.4)	-24 (5 3)	-25 (4 7)	508 (4.0)	-28 (6.0)	-28 (5 3)
Slovenia	495 (2.6)		3 (3.9)	491 (2.6)		-6 (4.4)
South Africa	262 (6.2)	-6 (9.4)		264 (6.4)	-19 (97)	
Sweden	499 (3.0)	 (5,) 	-43 (5 5)	204 (0.4) 209 (2.7)	♦ ♦	-39 (5.4) 🐨
Tunisia	399 (2.6)	-37 (3 7)	♦ ♦	423 (2.2)	-37 (3.8)	↔ ↔
United States	502 (3.4)	3 (5 2)	12 (5.8)	507 (2.5)	2 (5 9)	12 (6 3)
± England	499 (5 3)	12 (7.6)	4 (6 7)	498 (5.8)	-7 (7 7)	-2 (7 9)
International Avg	486 (0.7)	0 (1 2)	-5 (1-3)	435 (0.8)	-6 (1.4)	-9 (1 4)
Benchmarking Participants		0 (1.2)	 - - - - - - -		0 (1.4)	- 3 (1.4) C
Indiana State, US	502 (51)	-8 (8 6)	$\diamond \diamond$	514 (5.8)	-6 (10.0)	\diamond \diamond
Ontario Province Can	520 (3.4)	6 (4 7)	20 (4 5)	572 (3.4)	3 (4 7)	18 (4.8)
Quebec Province, Can	540 (3.4)	27 (6.9)	20 (4.3)	546 (2.2)	10 (6.5)	6 (7.2)
Quebec Flovince, can.	540 (3.7)	-27 (0.8)	-20 (7.7)	240 (3.3)	-19 (0.5)	-0 (7.2)

2003 significantly higher

2003 significantly lower

Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia, and 1995 data are not shown for Israel, Italy, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995. Data for Latvia in this exhibit include Latvian-speaking schools only. () Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

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

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

Exhibit 1.5: Trends in Average Mathematics Achievement by Gender

TIMSS2003

Grade

Countries	Girls		Boys		
	2003 Average Scale Score	1995 to 2003 Difference	2003 Average Scale Score	1995 to 200 Difference)3 :
Australia	497 (4.5)	4 (5.9)	500 (4.3)	4 (6.0)	
Cyprus	505 (2.7)	34 (4.5)	514 (2.9)	35 (4.8)	0
England	530 (3.9)	51 (5.7)	532 (4.5)	44 (5.7)	0
Hong Kong, SAR	575 (3.4)	17 (5.1)	575 (3.4)	18 (5.5)	0
Hungary	527 (3.8)	8 (5.5)	530 (3.3)	6 (5.1)	
Iran, Islamic Rep. of	394 (6.5)	15 (8.9)	386 (5.5)	-8 (9.7)	
Japan	563 (1.8)	-1 (2.6)	566 (2.1)	-5 (3.3)	
Latvia (LSS)	535 (3.2)	30 (5.9)	531 (3.9)	38 (6.9)	0
Netherlands	537 (2.7)	-6 (4.4)	543 (2.2)	-13 (4.2)	$\overline{\bullet}$
New Zealand	495 (2.8)	22 (5.1)	496 (2.4)	31 (6.6)	0
Norway	449 (2.7)	-25 (5.0) 🔍	454 (2.7)	-24 (4.5)	۲
Scotland	485 (3.2)	-8 (5.2)	496 (4.4)	3 (6.5)	
Singapore	599 (5.5)	4 (7.8)	590 (6.2)	4 (7.8)	
Slovenia	477 (3.0)	19 (4.8)	481 (3.5)	15 (4.9)	0
United States	514 (2.4)	-2 (3.8)	522 (2.7)	3 (4.1)	
	512 (0.9)		515 (1.0)	10 (1.5)	
Benchmarking Participants					
Ontario Province, Can.	505 (3.6)	19 (4.9)	517 (4.7)	26 (6.4)	0

-46 (6.1)

 $\overline{\mathbf{v}}$

509 (2.8)

Quebec Province, Can.

502 (2.7)

2003 significantly higher than 1995

-42 (5.6)

lacksquare

2003 significantly lower than 1995

Trend notes: Because of differences between 1995 and 2003 in population coverage, 1995 data are not shown for Italy. Data for Latvia in this exhibit include Latvian-speaking schools only. To be comparable with 1995, 2003 data for New Zealand in this exhibit include students in English medium instruction only (98% of the estimated population).

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

assessments in Hong Kong SAR, Korea, Latvia (LSS), and Scotland. There was no country in which boys showed improvement and girls did not. Both boys and girls had significantly lower average achievement in TIMSS 2003 in Bulgaria, Cyprus, Norway, the Russian Federation, the Slovak Republic, Sweden, Tunisia, and Quebec. In Belgium (Flemish), the girls showed a significant decrease but the boys did not. In Iran, Japan, Macedonia, and Moldova the boys had the significant decrease. At the fourth grade, changes in achievement were very consistent for both boys and girls. Both genders improved in Cyprus, England, Hong Kong, Latvia (LSS), New Zealand, Slovenia, and Ontario. In Norway and Quebec, both boys and girls showed declines. Only in the Netherlands did the genders behave differently, with boys showing a decline but not girls.