1 Mullis, I.V.S., Martin, M.O., Smith, T.A., Garden, R.A., Gregory, K.D., Gonzalez, E.J., Chrostowski, S..J, and O'Connor, K.M. (2003), *QĒ J PP >ppbpp j bkq Co^ j b t Iohp ^ka Pmb`fª`^qfIkp / - -O ⅛/ka Baftqf Ikₖ*, Chestnut Hill, MA: Boston College.
PlemPl] Ɓd Ɓdd Ec, TM.⌣ ciol MB Ecks and Sucifit ' ɜ ʊ ƙ˘ ' й tlp ų˜ ƙ m˛ ˝] ж ɜ] ɤ ʌ˜ (↑

development, also with additional funding from the US National Science Foundation, an enormous, collaborative test development effort involving the participating countries occurred at both grades to reflect the framework and its new emphasis on problem solving. Nevertheless, curriculum data collected as part of TIMSS[2] indicate differences in the grade level at which particular topics are introduced and in the teaching emphases given som soh

Measurement

1. attributes and units
2. tools, techniques, and formula

Geometry

1. lines and angles
2. two- and three-dimensional shapes
3. congruence and similarity
4. locations and spatial relationships
5. symmetry and transformations.

Data

1. data collection and organization
2. data representation
3. data interpretation
4. uncertainty and probability.

At grade 4, uncertainty and probability is not included.

How Does Achievement Differ Across Mathematics Content Areas?

Exhibit 3.1 presents average achievement in each of the five mathematics content areas at the eighth grade and the fourth grade. Countries are displayed in alphabetical order, and symbols indicate whether a country's performance is statistically significantly above or below the

Exhibit 3.1: **Average Achievement in Mathematics Content Areas**

	Armenia	473 (3.0)	▼	461 (4.1)	▼	465 (3.1)	▼	431 (3.8)	▼	417 (3.6)	▼
†	Australia	479 (4.3)	▼	495 (3.7)		514 (3.7)	▲	524 (3.7)	▲	525 (3.6)	▲
	Belgium (Flemish)	549 (1.9)	▲	542 (1.9)	▲	550 (1.4)	▲	533 (1.8)	▲	548 (2.2)	▲
	Chinese Taipei	568 (1.8)	▲	555 (2.4)	▲	557 (1.6)	▲	553 (2.5)	▲	564 (2.3)	▲
	Cyprus	514 (2.7)	▲	519 (2.4)	▲	506 (2.3)	▲	505 (2.3)	▲	509 (2.3)	▲
†	England	519 (4.1)	▲	523 (3.9)	▲	535 (3.3)	▲	542 (3.7)	▲	552 (3.4)	▲
†	Hong Kong, SAR	574 (3.3)	▲	568 (3.5)	▲	563 (2.7)	▲	557 (2.9)	▲	562 (2.3)	▲
	Hungary	524 (2.9)	▲	54		(2.3					

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

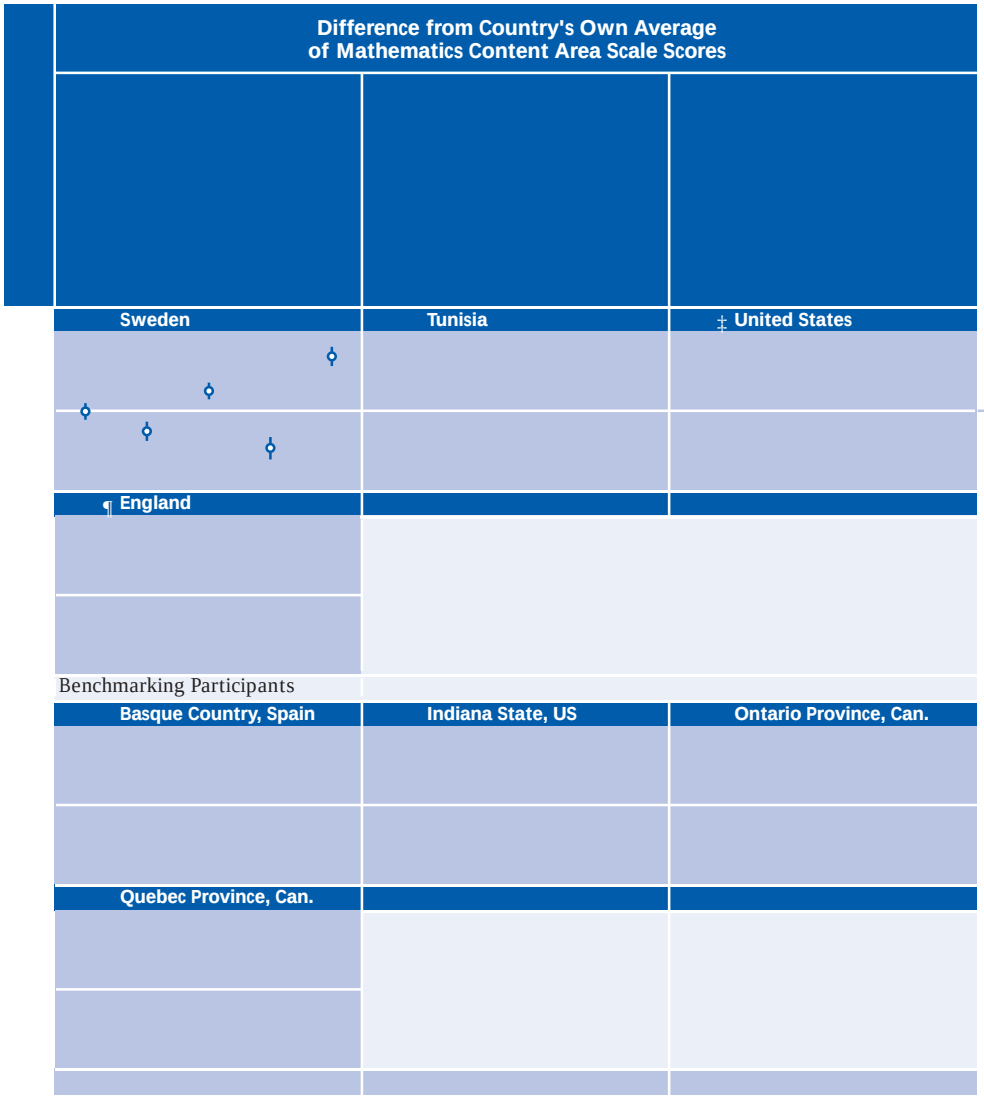
At both grades, the countries scoring highest in the overall mathematics assessments also tended to be the highest-scoring countries (though not always in the same rank order) in each of the major content areas. Correspondingly, countries scoring lowest on the overall tests tended to have low-average performance across all five content areas.

At the eighth grade, the differences in average achievement between the highest- and lowest-performing countries were greatest

In Which Content Areas Are Countries Relatively Strong or Weak?

Grade

Exhibit 3.2: Profiles of Within-Country Relative Performance in Mathematics Content Areas
(…Continued)



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

Exhibit 3.2: **Profiles of Within-Country Relative Performance in Mathematics Content Areas**
(Continued...)

MATHEMATICS Grade 4

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

Exhibit 3.3: Average Achievement in Mathematics Content Areas by Gender

MATHEMATICS Grade 4

@lrkqofbp	>sbo^db P`^ib P`lobp clo J^qeb j ^qf`p @lkqbkq >ob^p			
	Dblj bqov		A^q^	
	Girls	Boys	Girls	Boys
Armenia	437 (3.9)	425 (4.4)	424 (4.0)	411 (4.0)
† Australia	529 (3.6)	519 (4.9)	529 (4.3)	521 (4.7)
Belgium (Flemish)	534 (2.0)	531 (2.3)	547 (2.8)	549 (2.9)
Chinese Taipei	554 (2.6)	552 (2.7)	568 (2.1)	560 (3.3)
Cyprus	506 (2.5)	504 (2.7)	506 (2.4)	513 (3.1)
† England	545 (4.4)	538 (4.4)	554 (4.3)	549 (4.3)
† Hong Kong, SAR	559 (3.8)	555 (2.9)	563 (2.6)	561 (2.7)
Hungary	515 (4.1)	513 (3.7)	515 (4.6)	512 (3.8)
Iran, Islamic Rep. of	430 (5.9)	407 (4.7)	360 (7.3)	354 (5.4)
Italy	523 (4.2)	521 (3.4)	495 (3.9)	499 (3.5)
Japan	562 (1.9)	557 (2.7)	595 (2.4)	591 (2.4)
Latvia	525 (2.0)	520 (2.9)	529 (3.2)	522 (3.5)
1 Lithuania	525 (2.7)	526 (2.7)	519 (3.3)	518 (3.3)
Moldova, Rep. of	505 (5.5)	496 (4.8)	483 (4.9)	470 (4.3)
Morocco	362 (7.3)	362 (5.2)	356 (6.2)	354 (4.9)
† Netherlands	522 (4.1)	519 (3.1)	552 (2.8)	554 (3.1)
New Zealand	521 (2.4)	514 (2.5)	524 (2.9)	519 (2.9)
Norway	482 (2.7)	473 (2.9)	480 (2.8)	478 (3.0)
Philippines	336 (10.6)	334 (7.8)	393 (8.8)	374 (7.2)
Russian Federation	528 (5.2)	528 (4.9)	502 (4.8)	508 (4.3)
† Scotland	513 (2.8)	509 (3.3)	513 (3.2)	519 (3.6)
Singapore	573 (5.4)	566 (6.1)	579 (3.8)	571 (4.4)
Slovenia	502 (3.1)	495 (2.5)	486 (3.6)	487 (3.9)
Tunisia	351 (6.2)	342 (5.4)	311 (5.3)	305 (5.0)
† United States	517 (2.5)	519 (2.4)	546 (1.9)	551 (2.5)
International Avg.	498 (0.8)	493 (0.8)	497 (0.8)	494 (0.7)
?bk`e j ^ohfkd M^oqf`fm^kqp				
Indiana State, US	524 (3.4)	526 (5.0)	557 (4.4)	558 (3.6)
Ontario Province, Can.	532 (3.6)	537 (5.2)	542 (4.4)	546 (4.5)
Quebec Province, Can.	525 (2.1)	519 (3.6)	505 (3.0)	508 (3.4)

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

† 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).

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

than boys across countries was geometry. The girls had higher achievement in 7 countries and the boys none. Internationally, there was a 5-point difference favoring girls. The results were relatively similar for the genders in number (4 countries favoring girls and 6 entities favoring boys) and in data (5 countries favoring girls and 2 favoring boys). In data, however, the small difference between in the international averages was significantly higher for girls.

In some respects, the patterns in the performance of girls and boys found in TIMSS 2003 are consistent with previous IEA mathematics assessments. Girls tended to perform better than boys in algebra in both previous TIMSS assessments and the Second International Mathematics Study (SIMS),[4] while boys were markedly stronger in measurement in previous studies.

What Changes Have Occurred in Content Area Achievement?

To examine changes in achievement in the mathematics content areas, Exhibit 3.4 shows the average percent correct for eighth-grade students in 2003 and 1999 for items given in both the 2003 and 1999 TIMSS assessments. If achievement improved significantly between assessments, the 1999 result is annotated with an up arrow or down arrow. This content area trend analysis uses average percent correct rather than average scale score because there were insufficient items to reliably link the results for both assessments to the TIMSS scale in all of the five different content areas. The first column in the table shows overall trends in the average percentage correct metric. For the most part, significant differences agree with those in the overall scale score (and the direction is always consistent).

During the four years between 1999 and 2003, countries were consistent in either showing improvements or declines. No country showed statistically significant improvements in some areas while showing declines in other areas. Israel had statistically significant improvements in all five content areas. Lithuania improved in three areas. Participants improving in two areas included the Philippines,

4 Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Gregory, K.D., Garden, R.A., O'Connor, K.M., Chrostowki, S.J., and Smith, T.A. (2000), *QF JPP . 666 FkqbokˆqflkˆiJˆqebjˆqf`pObmlqq7 CfkafkdpcoljFB>$pObmbˆqIcqebQefoaFkqbokˆqflkˆiJˆqebjˆqf`pˆkaP`fbk`bPqravˆqqebBfdeqeDoˆab)* Chestnut Hill: MA: Boston College. Beaton, A.E., Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Kelly, D.L., and Smith, T.A. (1996), *Jˆqebjˆqf`p >`efbsbjbkqfkqebJfaaibP`elliVbˆqp7 FB>$pQefoaFkqbokˆqflkˆiJˆqebjˆqf`pˆkaP`fbk`bPqrav%QFJPP&)* Chestnut Hill, MA: Boston College. Robitaille D.F. (1989), "Student's Achievements: Population A" in D.F. Robitaille and R.A. Garden (eds.), *Qeb FB> PqravIcJˆqebjˆqf`pF7 @lk* qbuqpˆkaLrq`ljbpIcP`elliJˆqebjˆqf`p)* New York: Pergamon Press, p.121

the United States, and the Canadian province of Ontario. On the other hand, Bulgaria, Japan, the Slovak Republic, and Tunisia had

Australia	52 (1.0)	– –		53 (1.0)	– –		47 (1.3)	– –	
Belgium (Flemish)	60 (0.7)	64 (0.8)	▼	61 (0.8)	64 (1.0)	▼	52 (0.8)	56 (1.0)	▼
Bulgaria	45 (1.0)	53 (1.5)	▼	47 (1.0)	54 (1.5)	▼	43 (1.1)	53 (1.6)	▼
Chile	29 (0.6)	29 (0.8)		31 (0.6)	32 (0.9)		23 (0.7)	24 (0.9)	
Chinese Taipei	69 (1.0)	70		)0					

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

Australia	47 (1.2)	– –		50 (1.1)	– –		71 (1.1)	– –	
Belgium (Flemish)	54 (0.8)	60 (0.8)	▼	61 (0.9)	64 (1.0)	▼	79 (0.7)	81 (0.8)	
Bulgaria	35 (1.2)	45 (1.5)	▼	50 (0.9)	58 (1.6)	▼	58 (1.1)	62 (1.6)	▼
Chile	21 (0.6)	19 (0.8)		30 (0.7)	32 (0.9)		44 (1.0)	45 (1.0)	
Chinese Taipei	61 (1.1)	64 (1.0)		71 (1.0)	72 (0.9)		79 (0.8)	80 (0.7)	
Cyprus	34 (0.6)	40 (0.6)	▼	45 (0.5)	47 (0.6)	▼	61 (0.7)	61 (1.0)	
Hong Kong, SAR	66 (0.9)	66 (1.2)		73 (0.8)	72 (1.1)		76 (0.6)	78 (0.9)	
Hungary	51 (1.0)	53 (1.0)		55 (1.0)	55 (1.1)		69 (1.0)	71 (0.9)	
Indonesia	21 (0.8)	22 (0.8)		36 (0.8)	37 (1.0)		47 (1.1)	47 (1.1)	
Iran, Islamic Rep. of	20 (0.5)	22 (0.8)		36 (0.6)	39 (0.8)	▼	46 (0.8)	49 (1.0)	▼
Israel	39 (0.9)	32 (0.9)	▲	51 (1.1)	44 (0.9)	▲	65 (1.1)	59 (1.1)	▲
Italy	43 (1.0)	44 (1.0)		46 (1.0)	47 (1.0)		64 (0.9)	64 (1.2)	
Japan	58 (0.7)	63 (0.7)	▼	74 (0.6)	75 (0.6)	▼	76 (0.5)	79 (0.5)	▼
Jordan	23 (0.8)	27 (0.8)	▼	37 (0.8)	41 (0.7)	▼	46 (1.1)	49 (0.7)	
Korea, Rep. of	63 (0.7)	64 (0.6)		75 (0.6)	74 (0.6)		80 (0.4)	82 (0.4)	▼
Latvia (LSS									

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