CHAPTER 3

South African mathematics achievement in an international context

This chapter summarises the achievement of the TIMSS 2003 mathematics assessment for each of the participating countries, and contextualises the performance of South African learners in relation to the 50 study participants. This overview is based on trends in the TIMSS 2003 report (Mullis et al. 2004).[1] In addition to presenting the international comparative results, a comparison of results for the participating group of African countries is given. There is also a discussion of the performance trend from 1999 to 2003, an examination of performance as it relates to gender, and an analysis of performance at the different performance benchmarks.

Mathematics achievement of participating countries in TIMSS 2003

Figure 3.1 presents the mathematics achievement distribution for each of the participating countries. TIMSS used IRT methods to calculate the achievement scores. A scale of 800 points and a standard deviation of 100 points was used. The international average was computed by averaging the mean scores of each of the participating countries. In Figure 3.1, average scores are arranged from the highest to the lowest. The results show substantial differences in mathematics achievement between the highest and lowest performing countries, from an average of 605 for Singapore to 264 for South Africa. Thirty countries achieved average mathematics scores significantly higher than the international average and 18 countries achieved scores significantly lower than the international average. The five highest performing countries for mathematics were: Singapore, Republic of Korea, Hong Kong (SAR), Chinese Taipei and Japan. The five lowest performing countries were: Philippines, Botswana, Saudi Arabia, Ghana and South Africa.

Figure 3.1 illustrates the broad range of achievement both within and across the countries assessed. Achievement for each country is shown at the 25th and 75th percentiles, as well as the 5th and 95th percentiles. Each percentile point indicates the percentage of learners performing below and above that point on the scale. For example, 25 per cent of the learners in each country performed below the 25th percentile and 75 per cent performed above the 25th percentile. The range between the 25th and 75th percentiles represents performance by the middle half of the learners. Performance at the 5th and 95th percentile represents the extremes in lower and higher achievement. The range of performance between these two score points, which included 90 per cent of the population, is approximately 270 to 300 points in most countries. The dark boxes at the midpoints of the distributions show the 95 per cent confidence intervals around the average achievement in each country.

As shown in Figure 3.1, the average scale score for South African Grade 8 learners was the lowest at 264 (SE = 5.5), and this was significantly lower than the international average scale score (Mean [M] = 467, SE = 0.5). In comparing individual countries, the

1 This report is available at: http://www.timss/bc/edu.

South African average scale score was not statistically different from that of Ghana, but it was significantly lower than the remaining participating countries.

Apart from the substantial differential in mathematics achievement scores between the highest performing country (Singapore) and South Africa, it is interesting to observe the variation of scores within countries. This variation was examined using the range of scores between the 5th and 95th percentiles. A striking feature of Figure 3.1 includes the fact that Singapore's average performance exceeds South African performance at the 95th percentile – this means that only the most proficient learners in South Africa approached the average proficiency of Singaporean learners. Secondly, of all the countries participating, South Africa had the widest range of scores between the 5th and 95th percentiles – a difference of approximately 360 points. This suggests that South Africa has some learners who perform very poorly and some who perform very well.

When interpreting the comparative results presented in this report, it is important to remember that each country's result is an estimate of the total population value, inferred from the result obtained from the sample of learners tested. Because it is an estimate, it is subject to some potential level of error. The variability of the average score is given by the SE of the average, presented in the tables. We can say with 95 per cent confidence that the true population average lies within about 2 standard errors of the sample average. Standard errors are influenced by the size of the sample, the design of the sample, and the variation of scores in the sample.

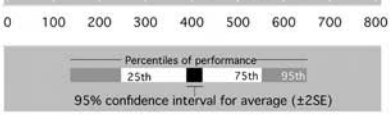
To illustrate the use of standard errors with the average, we can look at South Africa's score. South Africa had an average score of 264 with an SE of 5.5. This means that the average score for the population of Grade 8 learners in South Africa lies between 258.5 and 269.5.

To help interpret scores of the different countries, Figure 3.1 also includes the years of formal schooling and the average age of the learners assessed in each of the participating countries. Most countries assessed the learners at the end of their eighth year of schooling. The international average age of the learners assessed is 14.5 years. Learners in some Eastern European countries start school later and so tended to be older. Learners were older in many African countries, where they may have started school later or had their schooling interrupted.

Not all countries have similar socio-economic conditions. Figure 3.1 includes the value of the HDI for each of the participating countries. This index, calculated by the UNDP has a minimum value of 0 and a maximum value of 1. The index is a summary measure of human development in a country and is constructed from three dimensions: values for life expectancy at birth, knowledge – constructed from the adult literacy rate and combined primary, secondary and tertiary gross enrolment rates – and standard of living as measured by the per capita gross domestic product (GDP). TIMSS countries with an HDI value greater than 0.9 included Australia, Belgium, England, Israel, Japan, Norway and the United States. The HDI for South Africa was 0.684. Other TIMSS countries with an HDI less than 0.7 were Indonesia (0.682), Botswana (0.614), Morocco (0.606), and Ghana (0.567).

Figure 3.1 Distribution of mathematics achievement

Countries	Years of schooling*	Average age	Mathematics achievement distribution	Average scale score		Human Development Index**
Singapore	8	14.3		605 (3.6)	h	0.884
Korea, Rep. of	8	14.6		589 (2.2)	h	0.879
Hong Kong, SAR	8	14.4		586 (3.3)	h	0.889
Chinese Taipei	8	14.2		585 (4.6)	h	–
Japan	8	14.4		570 (2.1)	h	0.932
Belgium (Flemish)	8	14.1		537 (2.8)	h	0.937
Netherlands	8	14.3		536 (3.8)	h	0.938
Estonia	8	15.2		531 (3.0)	h	0.833
Hungary	8	14.5		529 (3.2)	h	0.837
Malaysia	8	14.3		508 (4.1)	h	0.790
Latvia	8	15.0		508 (3.2)	h	0.811
Russian Federation	7 or 8	14.2		508 (3.7)	h	0.779
Slovak Republic	8	14.3		508 (3.3)	h	0.836
Australia	8 or 9	13.9		505 (4.6)	h	0.939
United States	8	14.2		504 (3.3)	h	0.937
Lithuania	8	14.9		502 (2.5)	h	0.824
Sweden	8	14.9		499 (2.6)	h	0.941
Scotland	9	13.7		498 (3.7)	h	0.930
Israel	8	14.0		496 (3.4)	h	0.905
New Zealand	8.5–9.5	14.1		494 (5.3)	h	0.917
Slovenia	7 or 8	13.8		493 (2.2)	h	0.881
Italy	8	13.9		484 (3.2)	h	0.916
Armenia	8	14.9		478 (3.0)	h	0.729
Serbia	8	14.9		477 (2.6)	h	–
Bulgaria	8	14.9		476 (4.3)	h	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)	l	0.944
Moldova, Rep. of	8	14.9		460 (4.0)		0.700
Cyprus	8	13.8		459 (1.7)	l	0.891
Macedonia, Rep. of	8	14.6		435 (3.5)	l	0.784
Lebanon	8	14.6		433 (3.1)	l	0.752
Jordan	8	13.9		424 (4.1)	l	0.743
Iran, Islamic Rep. of	8	14.4		411 (2.4)	l	0.719
Indonesia	8	14.5		411 (4.8)	l	0.682
Tunisia	8	14.8		410 (2.2)	l	0.740
Egypt	8	14.4		406 (3.5)	l	0.648
Bahrain	8	14.1		401 (1.7)	l	0.839
Palestinian Nat'l Auth.	8	14.1		390 (3.1)	l	0.731
Chile	8	14.2		387 (3.3)	l	0.831
Morocco	8	15.2		387 (2.5)	l	0.606
Philippines	8	14.8		378 (5.2)	l	0.751
Botswana	8	15.1		366 (2.6)	l	0.614
Saudi Arabia	8	14.1		332 (4.6)	l	0.769
Ghana	8	15.5		276 (4.7)	l	0.567
South Africa	8	15.1		264 (5.5)	l	0.684
England	9	14.3		498 (4.7)	h	0.930
Benchmarking participants						
Basque Country, Spain	8	14.1		487 (2.7)	h	–
Indiana State, US	8	14.5		508 (5.2)	h	–
Ontario Province, Can.	8	13.8		521 (3.1)	h	–
Quebec Province, Can.	8	14.2		543 (3.0)	h	–



Notes:
* Represents years of schooling counting from the first year of ISCED Level 1.
** Taken from the *Human Development Report 2003*: 237–240. (UNDP 2003)
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.
h Country average significantly higher than international average.
l Country average significantly lower than international average.

South Africa in relation to other African countries

The TIMSS 2003 study included six African countries. These were: Botswana, Egypt, Ghana, Morocco, Tunisia and South Africa. Morocco, Tunisia and South Africa had participated in TIMSS 1999, while the other three made their debut in TIMSS 2003. A comparison of these countries is sensible because other variables, together with mathematics achievement scores, can provide a more contextualised perspective. Table 3.1 provides information on key indicators in these countries.

Table 3.1: Scale scores and key indicators of African country participants in TIMSS 2003

	Average math scale score (SE)	Population (millions)	Life expectancy (years)	Net enrolment (primary)	Net enrolment (secondary)	GNI per capita in US$
Tunisia	410 (2.2)	9.8	73	97	68	1 990
Egypt	406 (3.5)	66.4	69	90	78	1 470
Morocco	387 (2.5)	29.6	68	88	31	1 170
Botswana	366 (2.6)	1.7	38	81	55	3 010
Ghana	276 (4.7)	20.3	55	60	30	270
South Africa	264 (5.5)	45.3	46	90	62	2 500

Sources: UNDP 2003, cited in Mullis et al. (2004)

Table 3.1 illustrates the differences, in the six African countries, on indicators which could influence education outcomes. For example, the population of Botswana is 1.7 million, whereas the number of students in the South African education system is 12 million; in Ghana, 30 per cent of the secondary learners of the age cohort who are supposed to be in secondary school are in school, whereas in South Africa the net enrolment rate in secondary schools is 62 per cent. However, it is worrying that South Africa has one of the highest gross national incomes (GNI in US dollars) per capita of the group, yet has the lowest average mean score in mathematics. Table 3.1 suggests that the explanations for learner achievement cannot be provided by a single indicator – it is the interaction of a number of variables that produces a particular outcome.

Changes in mathematics achievement between TIMSS 1999 and TIMSS 2003

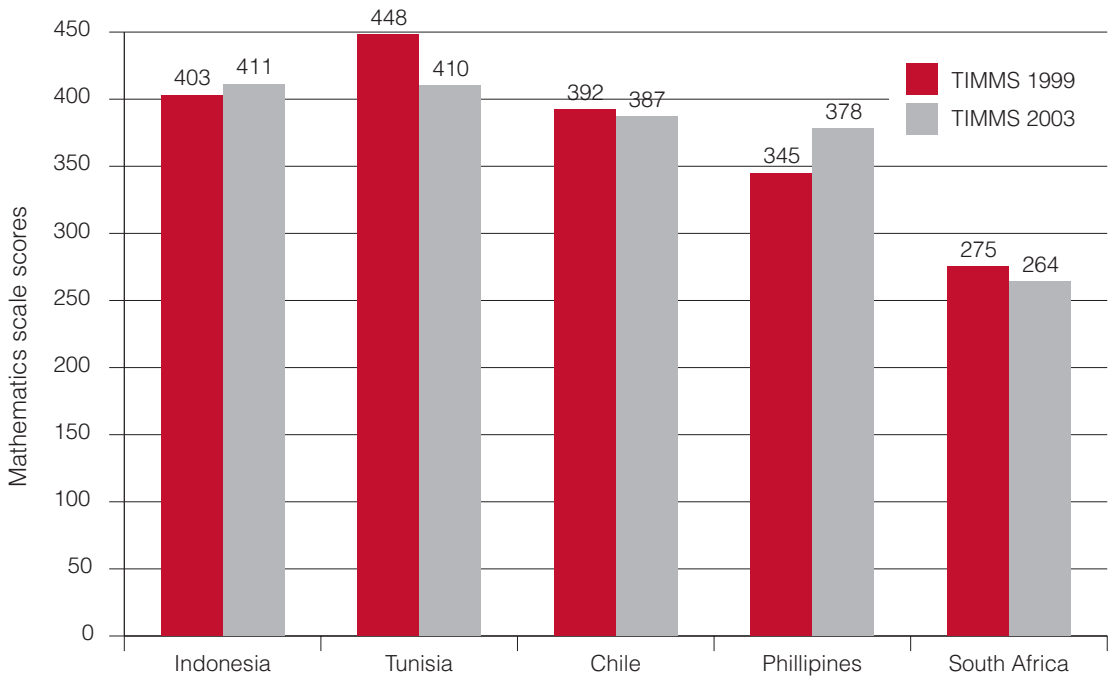
There are some countries who participated in both TIMSS 1999 and TIMSS 2003. For these countries it was possible to track the changes in performance over these two time periods. The international mathematics average score in TIMSS 1999 was 487 (SE = 0.7) and in TIMSS 2003 it was 467 (SE = 0.5).[2]

Figure 3.2 presents national comparisons for the two assessment periods for the five lowest performing countries. The mathematics scale scores for Tunisia were significantly

2 One cannot compare the international averages because there were different countries who participated in the different years.

lower (by 38 points) between TIMSS 1999 and TIMSS 2003. The Philippines, however, scored significantly higher in TIMSS 2003 than TIMSS 1999. For Indonesia, Chile and South Africa, there was no significant difference in the average mathematics scores between the two assessment periods.

Figure 3.2: Change in mathematics performance from TIMSS 1999 to TIMSS 2003, by country



Gender analysis

Participation rates

In most countries there was an almost equal participation between girls and boys, with rates located between 48–52 per cent. In South Africa, the TIMSS sample was 51 per cent girls and 49 per cent boys. Table 3.2 indicates the countries where the difference between girl and boy participation rates was 6 per cent or more.

Table 3.2: Countries where the difference in Grade 8 participation rates between girls and boys was 6 per cent or more

Girl participation > boy participation		Boy participation > girl participation	
Philippines	(by 16%)	Iran, Islamic Rep of	(by 20%)
Lebanon	(14%)	Saudi Arabia	(14%)
Palestinian Nat'l Auth	(10%)	Ghana	(10%)
Belgium	(8%)	Egypt	(8%)
Armenia	(6%)		
Tunisia	(6%)		

Performance by gender

Figure 3.3 presents the distribution of average mathematics achievement by gender. The international mathematics average score for girls (M = 467, SE = 0.6) and boys (M = 466, SE = 0.6) is not significantly different. In South Africa, the girls had a mathematics average scale score of 262 (SE = 6.2) and the boys had an average scale score of 264 (SE = 6.4). The difference is not statistically significant. There was also no significant gender difference in mathematics scale scores in TIMSS 1999.

There were 27 countries where the mathematics average scores were not significantly different between boys and girls, while in 18 countries there was a significant difference (see Table 3.3). Figure 3.3 also illustrates the average mathematics scores for girls and boys, as well as the difference. The horizontal bar for each country in Figure 3.3 shows the level of 'difference' between girls and boys.

Table 3.3: Countries where there was a significant difference between the average mathematics scale scores of girls and boys

Girls score statistically > boys	Boys score statistically > girls
Serbia	United States
Macedonia	Italy
Armenia	Hungary
Moldova	Lebanon
Singapore	Belgium (Flemish)
Philippines	Morocco
Cyprus	Chile
Jordan	Ghana
Bahrain	Tunisia

Figure 3.3: Average mathematics achievement by gender

Countries	Girls		Boys		Difference (absolute value)	Gender difference	
	Percent of students	Average scale score	Percent of students	Average scale score		Girls scored higher	Boys scored higher
Slovak Republic	48 (1.3)	508 (3.4)	52 (1.3)	508 (4.0)	0 (3.5)		
Sweden	51 (0.9)	499 (3.0)	49 (0.9)	499 (2.7)	1 (2.2)		
Indonesia	50 (0.7)	411 (4.9)	50 (0.7)	410 (5.3)	1 (3.0)		
Egypt	46 (2.7)	407 (4.4)	54 (2.7)	406 (5.0)	1 (6.4)		
Bulgaria	48 (1.3)	476 (5.5)	52 (1.3)	477 (4.3)	1 (4.7)		
International avg.	50 (0.2)	467 (0.6)	50 (0.2)	466 (0.6)	1 (0.6)		
Hong Kong, SAR	50 (2.4)	587 (3.8)	50 (2.4)	585 (4.6)	2 (5.1)		
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)		
Japan	49 (1.2)	569 (4.0)	51 (1.2)	571 (3.6)	3 (6.4)		
South Africa	51 (0.9)	262 (6.2)	49 (0.9)	264 (6.4)	3 (5.8)		
Norway	50 (0.8)	463 (2.7)	50 (0.8)	460 (3.0)	3 (2.8)		
Russian Federation	49 (1.2)	510 (3.5)	51 (1.2)	507 (4.4)	3 (2.8)		
Slovenia	50 (0.9)	495 (2.6)	50 (0.9)	491 (2.6)	3 (2.8)		
Botswana	51 (0.7)	368 (2.6)	49 (0.7)	365 (2.9)	3 (1.8)		
Romania	52 (0.9)	477 (5.1)	48 (0.9)	473 (5.0)	4 (3.3)		
Lithuania	50 (0.9)	503 (2.9)	50 (0.9)	499 (3.0)	5 (2.9)		
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)	473 (2.9)	7 (2.8)		
Chinese Taipei	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)		
Israel	52 (1.6)	492 (3.3)	48 (1.6)	500 (4.5)	8 (4.0)		
Palestinian Nat'l Auth.	55 (2.4)	394 (3.9)	45 (2.4)	386 (4.7)	8 (5.9)		
Macedonia, Rep. of	49 (0.9)	439 (4.0)	51 (0.9)	431 (3.9)	9 (3.5)		
Iran, Islamic Rep. of	40 (4.1)	417 (4.3)	60 (4.1)	408 (4.2)	9 (7.2)		
Lebanon	57 (1.8)	429 (3.6)	43 (1.8)	439 (3.9)	10 (4.0)		
Armenia	53 (0.7)	483 (3.3)	47 (0.7)	473 (3.4)	10 (3.0)		
Moldova, Rep. of	51 (0.8)	465 (4.1)	49 (0.8)	455 (4.8)	10 (3.5)		
Singapore	49 (0.8)	611 (3.3)	51 (0.8)	601 (4.3)	10 (2.9)		
Saudi Arabia	43 (2.3)	326 (7.9)	57 (2.3)	336 (5.5)	10 (9.7)		
Belgium (Flemish)	54 (2.1)	532 (3.5)	46 (2.1)	542 (3.8)	11 (4.8)		
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)		

Notes:
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 statistically significant.
□ Gender difference not statistically significant.

Performance at international benchmarks

TIMSS identified four benchmark scores on the achievement scale to describe what learners know, and can do, in mathematics. Selected to represent the range of performance shown by learners internationally, TIMSS identified four points on the scale for use as international benchmarks. The four benchmarks were defined as: the Advanced International Benchmark (AIB), set at 625 and above; the High International Benchmark (HIB), set between 550 and 625; the Intermediate International Benchmark (IIB), set between 475 and 550; and the Low International Benchmark (LIB), set between 400 and 475. The descriptions of the levels are cumulative, so that a learner who has reached the higher benchmarks can demonstrate the knowledge and skills achieved at the lower levels (see Table 3.4).

Table 3.4: Descriptions of TIMSS 2003 international benchmarks for mathematics

Low (400)	Intermediate (475)	High (550)	Advanced (625)
Learners have some basic mathematical knowledge. Learners can: • do basic computations with whole numbers without a calculator; • select the two-place decimal closest to a whole number; • multiply two-place decimal numbers by three-place decimal numbers with calculators available; and • recognise some basic terminology and read information from a line on a graph.	Learners can apply basic mathematical knowledge in straightforward situations. Learners can: • add, subtract or multiply to solve one-step word problems involving whole numbers and decimals; • identify representations of common fractions and relative sizes of fractions; • understand simple algebraic relationships and solve linear equations with one variable; • demonstrate an understanding of properties of triangles and basic geometric concepts, including symmetry and rotation; and • recognise basic notions of probability. They can read and interpret graphs, tables, maps and scales.	Learners can apply their understanding and knowledge in a wide variety of relatively complex situations. Learners can: • order, relate, and compute with fractions and decimals to solve word problems, operate with negative integers, and solve multi-step word problems involving proportions with whole numbers; • solve simple algebraic problems, including evaluating expressions, solving simultaneous linear equations, and using a formula to determine the value of a variable; • find areas and volumes of simple geometric shapes and use knowledge of geometric properties to solve problems; and • solve probability problems and interpret data in a variety of graphs and tables.	Learners can organise information, make generalisations, solve non-routine problems, and draw and justify conclusions from the data. Learners can: • compute per cent change and apply their knowledge of numeric and algebraic concepts and relationships to solve problems; • solve simultaneous linear equations and model simple situations algebraically; • apply their knowledge of measurement and geometry in complex problem situations; and • interpret data from a variety of tables and graphs, including interpolation and extrapolation.

A scale-anchoring technique was used to develop descriptions of achievement for the TIMSS 2003 benchmarks. Scale anchoring describes learners' performance at different points on the achievement scale. The scale-anchoring technique involved an empirical component (in which items that discriminate between successive points on the scale were identified), and a judgemental component (in which experts in mathematics examined item content and used this to generalise learners' knowledge and understanding). In the scale-anchoring technique, results of all learners were pooled, so that the benchmark descriptions refer to all learners achieving at *that* level.

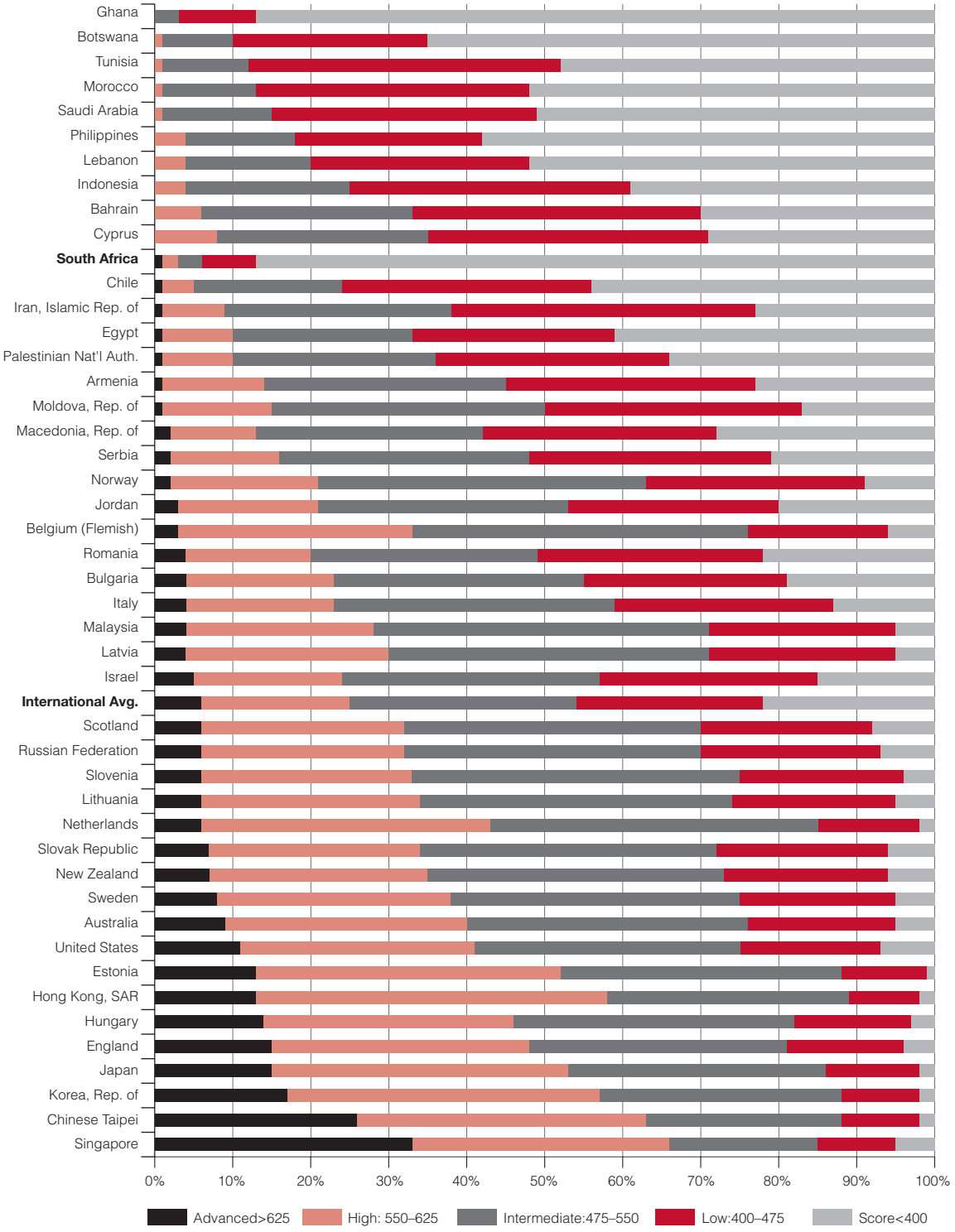
Figure 3.4 indicates how the different countries performed in respect of reaching the different international benchmarks in mathematics. The chart is arranged in rank order of performance at the AIB. While the chart is organised to draw particular attention to the percentage of high-achieving learners in each country, it also conveys information about middle and low performers.

The profile of performance in each of the countries varied widely. Singapore had 99 per cent of its learners achieve a score above the LIB (that is, scored higher than 400). Of these, 44 per cent of Singaporean learners performed at above the AIB (that is, scored higher than 625). The Netherlands had 97 per cent of its learners perform above the LIB – of these, 10 per cent performed at the AIB. Norway had 81 per cent of its learners achieving a score above the LIB, and under 0.5 per cent had scores above the AIB (that is, higher than 625).

South Africa had 10 per cent of its learners achieving a score higher than 400. Of these, 0.3 per cent of learners scored above the AIB level; 1.3 per cent scored at the HIB level; 3.2 per cent scored at the IIB level; and 5.3 per cent scored at the LIB level. These scores are cumulative, indicating that 90 per cent of South African learners scored lower than 400 scaled points. In Botswana, 32 per cent of the learners achieved a score higher than 400, and, in Ghana, 9 per cent of the learners scored higher than 400. South Africa and Ghana have the highest percentage of learners with a score lower than 400.

The mathematics score profile for South Africa indicates that there are very few high-performing mathematics learners at Grade 8. The implication of this is that there would be very few learners graduating from the school system with results in mathematics good enough to permit access to tertiary studies in the science or engineering fields. South Africa has committed itself to a science and technology pathway for the development of the individual and the social and economic development of the country. In order to achieve those goals, the country would have to achieve higher performance in mathematics at the lower levels of the schooling system.

Figure 3.4: Percentage of learners reaching the different benchmarks for mathematics in TIMSS 2003 by country



Examples of performance at different benchmarks

The following section provides examples of items from the TIMSS tests, classified at the different benchmarks. These examples provide an indication of the skills and abilities that the learner at each level could demonstrate. Each item is described and accompanied by the percentage correct for South Africa; for the five top performing countries; for the few lower-performing countries; and the international average percentage.

Performance at the Low International Benchmark (400)

Learners who reached this benchmark on TIMSS had some basic mathematical knowledge.

Which of these numbers is closest to 10?

Ⓐ 0.10
Ⓑ 9.99
Ⓒ 10.10
Ⓓ 10.90

Content area: number	Performance of selected countries	
Selects two-place decimal closest to a given whole number. Internationally, about 75 per cent of learners scored correctly on this item. In South Africa, 30 per cent of learners answered this item correctly.	Netherlands	97 (1.0)
	Sweden	96 (1.1)
	Estonia	96 (1.2)
	Singapore	95 (1.1)
	Lithuania	95 (1.0)
	International average	77 (0.3)
	Egypt	48 (2.5)
	Philippines	42 (2.8)
	Botswana	40 (2.6)
	Saudi Arabia	35 (2.6)
	South Africa	30 (2.7)
	Ghana	24 (2.4)

Performance at the Intermediate International Benchmark (475)

Learners who reached this benchmark could apply basic mathematical knowledge in straightforward situations.

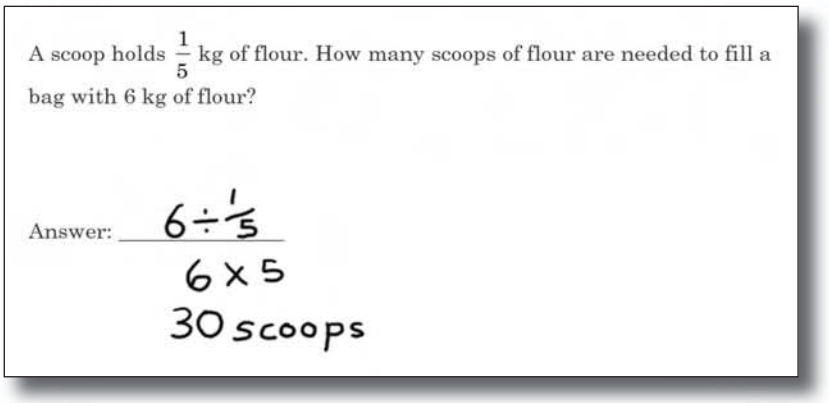
Alice ran a race in 49.86 seconds. Betty ran the same race in 52.30 seconds.
How much longer did it take Betty to run the race than Alice?

Ⓐ 2.44 seconds
Ⓑ 2.54 seconds
Ⓒ 3.56 seconds
Ⓓ 3.76 seconds

Content area: number	Performance of selected countries	
Learners are expected to solve a word problem involving subtraction of a two-decimal number from another. Internationally, 61% of the learners scored this problem correctly. In South Africa, 29% of the learners scored correctly.	Singapore	88 (1.0)
	Korea, Rep. of	87 (1.1)
	Malaysia	81 (1.4)
	Netherlands	81 (2.0)
	Botswana	61 (1.7)
	International average	61 (0.3)
	Chile	42 (1.8)
	Palestinian Nat'l Auth.	37 (1.7)
	Ghana	32 (2.0)
	South Africa	29 (1.8)
	Saudi Arabia	19 (2.3)

Performance at the High International Benchmark (550)

Learners who reached this benchmark could apply their understanding and knowledge in a wide variety of relatively complex situations.



Content area: number	Performance of selected countries	
This is an example of a constructed-response question. Learners have to solve a one-step word problem involving division of a whole number by a unit fraction. The international average indicates that 38% of all learners answered correctly and in South Africa, 7% answered correctly.	Singapore	79 (1.9)
	Hong Kong, SAR	76 (1.8)
	Chinese Taipei	75 (1.9)
	Netherlands	74 (2.1)
	Korea, Rep. of	68 (1.5)
	International average	38 (0.3)
	Botswana	11 (1.1)
	Palestinian Nat'l Auth.	10 (1.2)
	Morocco	8 (1.5)
	South Africa	7 (1.3)
	Saudi Arabia	7 (1.9)
	Ghana	6 (1.0)

Performance at the Advanced International Benchmark (625)

Learners who reached this benchmark could organise information, make generalisations, solve non-routine problems, and draw and justify conclusions from data.

The three figures below are divided into small congruent triangles.

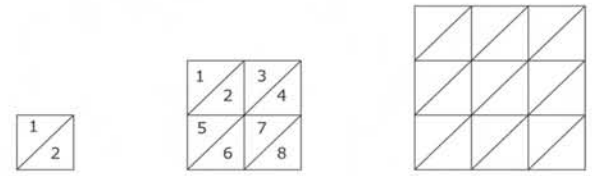


Figure 1 Figure 2 Figure 3

A. Complete the table below. First, fill in how many small triangles make up Figure 3. Then, find the number of small triangles that would be needed for the 4th figure if the sequence of figures is extended.

Figure	Number of Small Triangles
1	2
2	8
3	18
4	32

B. The sequence of figures is extended to the 7th figure. How many small triangles would be needed for Figure 7?

Answer: 98

$7^2 \times 2$
49×2

C. The sequence of figures is extended to the 50th figure. Explain a way to find the number of small triangles in the 50th figure that does not involve drawing it and counting the number of triangles.

$50^2 \times 2$
2500×2
5000

Content area: algebra	Performance of selected countries	
This is an example of a constructed-response question. Generalising from the first several terms of a sequence growing in two dimensions, explains a way to find a specified term e.g. the 50th. The international average was 14% and 1% of South African learners scored correctly.	Chinese Taipei	49 (2.0)
	Korea, Rep. of	48 (1.8)
	Hong Kong, SAR	45 (2.0)
	Singapore	44 (2.0)
	Japan	44 (2.1)
	International average	14 (0.2)
	Botswana	2 (0.5)
	South Africa	1 (0.5)
	Tunisia	1 (0.3)
	Ghana	1 (0.3)
	Saudi Arabia	0 (0.1)

Summary

There were 50 participating countries in TIMSS 2003. The five highest performing countries in mathematics were Singapore, Republic of Korea, Hong Kong (SAR), Chinese Taipei and Japan. The five lowest performing countries were the Philippines, Botswana, Saudi Arabia, Ghana and South Africa. The mathematics average scale score for South African Grade 8 learners was the lowest, at 264 (SE = 5.5), and this was significantly lower than the international average score (M = 467, SE = 0.5). The South African scores displayed the widest range when compared against any other country.

In most countries there were equitable participation rates, with participation of girls and boys varying from 48 to 52 per cent. The international mathematics average score for girls (M = 467, SE = 0.6) and for boys (M = 466, SE = 0.6) is not significantly different. In South Africa, the girls had an average scale score of 262 (SE = 6.2) and the boys had an average scale score of 264 (SE = 6.4). The difference is not statistically significant. In nine participating countries the mathematics scores of boys were statistically higher than those of the girls; and nine participating countries revealed the girls' scores to be statistically higher than the boys.

South Africa had 10 per cent of the population achieve a score higher than the LIB (that is, a score higher than 400). This means that 90 per cent of the learners scored less than 400 scale points. South Africa and Ghana were the weakest performers, with the highest number of learners scoring below the LIB.