



South African TIMSS learner profiles

Introduction

The background characteristics of learners play an important role in understanding learner achievement. To study the effect of learner characteristics, learners answered a 30-minute questionnaire giving background information on themselves.

This chapter uses information from these questionnaires to describe the South African Grade 8 TIMSS population and explore the association between learners' backgrounds and achievement scores. The chapter will include learner demographic characteristics, home background (learning resources at home, educational level of parents, and language of the home), and attitudes of learners (towards mathematics and science). In addition, comparative statistics on these factors for two other African countries (Botswana and Ghana) and two top-performing countries (Singapore and Norway) will be provided. The across-country analysis, encompassing a diversity of learners displaying similar characteristics, can be useful in generating or excluding hypotheses that might influence learner achievements. In the learner descriptions, statistics on indicators linked to the above – and the corresponding achievement scores – are included. Where the statistics between mathematics and science are comparable, only the mathematics statistics are used.

TIMSS is based on the assumption that home background factors influence achievement, and the type of background information collected is influenced by this. It has been argued that this applies more readily to richer countries (for example, see Fuller 1986). In poorer countries, many learners come from homes with little financial or educational resources. In these circumstances, the school plays the major role in influencing educational outcomes. However, it is still useful to describe learner characteristics as this provides a context for understanding achievement.

Demographic characteristics

Gender

In the South African sample there were almost equal numbers of boys and girls. This was also the pattern in all the provinces, except Eastern Cape and Gauteng where about 8 per cent more girls than boys participated.

Table 9.1: Participation rates by gender, and average age of TIMSS learners by province

	WC	NC	G	FS	M	NW	KZN	L	EC	Nat.
Girls (%)	49.9	48.5	54.3	49.0	49.7	51.5	50.3	50.5	53.9	49.3
Boys (%)	50.1	51.5	45.6	51.0	50.3	48.5	49.7	49.5	46.1	50.5
Sample size	775	866	732	867	962	945	1 631	1 143	921	8 840*
Average age (years)	14.6	14.8	14.8	15.4	15.2	15.3	15.0	14.9	15.5	15.1

*Notes: * This number is slightly lower than the total number of cases because some learners did not indicate their gender.
WC = Western Cape; NC = Northern Cape; G = Gauteng; FS = Free State; M = Mpumalanga; KZN = KwaZulu-Natal;
NW = North West; EC = Eastern Cape; L = Limpopo.*

Age

The average age of the national sample was 15.1 years and the age of the provincial sample ranged from 14.6 to 15.5 years. Provinces where the average age was above the national average were Mpumalanga (15.2), North West (15.3), Free State (15.4), and Eastern Cape (15.5).

Racial profile of learners in different types of schools

TIMSS 1999 data was collected in 1998 and TIMSS 2003 data in 2002. During this period, the racial composition of school learners changed. In both studies, learners were asked, in the learner questionnaires, to indicate their racial classification, but this could not be corroborated from other sources.¹ Table 9.2 indicates the racial composition of learners in the different school types. The unsubstantiated nature of the information, together with the small sample size in the ex-HoA, ex-HoR and ex-HoD schools, means these percentages should be considered as indicative rather than representative.

Table 9.2: Racial composition of learners in the TIMSS sample, by school type

	Races	Grade 8 in 1998	Grade 8 in 2002
National sample	African	75.7%	74.8%
	Coloured	13.0%	13.5%
	White	8.7%	8.3%
	Indian	2.6%	3.4%
Ex-DET	African	98.5%	96.1%
	Coloured	0.7%	2.4%
	White	0.4%	0.3%
	Indian	0.5%	1.1%
Ex-HoR	African	5.8%	43.3%
	Coloured	92.6%	56.0%
	White	0.4%	0.2%
	Indian	1.2%	0.5%
Ex-HoD	African	41.5%	54.0%
	Coloured	2.4%	3.2%
	White	0.5%	0.0
	Indian	55.6%	42.8%
Ex-HoA	African	18.9%	34.6%
	Coloured	12.7%	17.0%
	White	67.4%	47.2%
	Indian	1.0%	1.1%

1 Although the notion of racial discrimination is now legal history in South Africa, it is not always possible to gauge the effects of past practices, and the progress of policies designed to eradicate them, without some reference to population groups. For this reason, the HSRC continues to use the terms black/African, white, coloured and Indian/Asian where this is pertinent to the analysis of data.

There has been a migration of learners from ex-DET, ex-HoR and ex-HoD schools to ex-HoR, ex-HoD and ex-HoA schools. There has been almost no migration of learners from the other departments to the ex-DET schools, where the learner population is almost entirely African. Most of the African, Indian and coloured learners who have moved to the ex-HoA schools would have to be financially better resourced to afford the school fees and other opportunity costs. In each of the ex-HoR, ex HoD and ex-HoA school types, there has been an increase in the number of African learners attending these schools.

Home background

Home background provides an insight into learners' social and economic capital. The past IEA assessments (PIRLS and TIMSS) have demonstrated that in most countries, learners from homes with extensive educational resources have higher achievement scores than learners from less advantaged backgrounds. In this analysis there is a focus on the following variables: parental education; the number of books at home; the language spoken in the home. The associated achievement scores are also provided.

Parents' education

Parents are important educators in the lives of their children and can be an important educational resource in the home. Learners were asked to indicate the highest level of education attained by their parents. Table 9.3 displays the percentage of parents at the different educational levels (the parent with the higher education was chosen) and the corresponding average mathematics scale scores (and SE).

Internationally, learners had difficulty answering the question about their parents' education level. In South Africa, between 70–85 per cent of the learners responded to the question. Countries reporting the highest percentage (greater than 40 per cent) of

Table 9.3: Highest educational level of either parent and average mathematics scale scores

	Finished university or equivalent or higher	Finished post- secondary (not university)	Finished upper secondary	Finished lower secondary	Finished primary
South Africa	11% 352 (16.6)	13% 294 (10.0)	30% 266 (6.0)	18% 244 (4.0)	28% 223 (4.4)
Botswana	10% 411 (7.1)	14% 378 (4.0)	16% 361 (4.0)	20% 366 (3.5)	41% 356 (3.0)
Ghana	10% 320 (8.1)	17% 296 (6.7)	22% 292 (5.8)	37% 261 (5.7)	14% 246 (5.5)
Singapore	16% 651 (3.3)	4% 624 (5.9)	21% 621 (3.6)	48% 600 (3.9)	11% 571 (6.0)
Norway	66% 485 (2.6)	16% 459 (5.7)	12% 451 (4.9)	4% 419 (9.4)	2% 2 (–)
International average	28% 503 (0.9)	17% 480 (0.9)	28% 463 (0.7)	15% 434 (1.1)	12% 410 (1.4)

university-educated parents included Armenia, Estonia, Israel, Japan, Norway, the Russian Federation, and the USA. Countries reporting the highest percentage (greater than 40 per cent) of parents with no more than primary education included Botswana, Iran, Morocco, Saudi Arabia and Tunisia. The difference in achievement scores between children whose parents have completed university education and those with no more than primary education is around 90 internationally. This difference, however, varies from country to country. In South Africa the difference is 129 (the largest); in Botswana it is 55, in Ghana it is 74, and for Singapore it is 80.

Within a country there is an association, as expected, between higher educational levels of parents and achievement scores. Across countries, however, learners with the same background characteristics attain different achievement scores. For example, 11 per cent of South African learners have parents with a university qualification and these learners attained a mathematics achievement score of 352. In Botswana, 10 per cent of the learners have a parent with a university qualification and they attained a mathematics score of 411. In Singapore, 16 per cent of learners have parents with a university education and their average score was 651. These differences in across-country scores suggest that there may be other factors, interacting with the issue of parents' education, which produce the learner achievement scores.

Home education resources

Past IEA studies have shown that learners from homes with extensive literacy resources attain achievement levels higher than those from less advantaged backgrounds. The number of books in the home is used as an indicator of the educational capital in the home. The profile of learners indicating the number of books that they have, and their corresponding average mathematics score (and SE), is shown in Table 9.4.

In countries such as Australia, Estonia, Hungary and Sweden, over 30 per cent of the learners reported that they had more than 200 books in their home. On the other hand, in countries such as Botswana, Egypt, Ghana, Iran, Morocco, Philippines and South Africa, more than 30 per cent of the homes have 10 books or less. In fact, Botswana,

Table 9.4: Number of books in the home and average mathematics score

	200+ books	101–200 books	26–100 books	11–25 books	0–10 books
South Africa	6%	5%	14%	31%	44%
	324 (17.5)	325 (19.5)	304 (11.7)	261 (5.0)	241 (3.1)
Botswana	4%	5%	13%	30%	48%
	401 (12.5)	400 (6.9)	386 (5.8)	368 (4.1)	355 (2.6)
Ghana	10%	6%	16%	34%	34%
	275 (7.2)	300 (9.6)	294 (7.8)	285 (6.0)	264 (4.7)
Singapore	14%	16%	33%	24%	12%
	642 (3.5)	627 (3.7)	617 (3.2)	580 (5.1)	554 (5.2)
Norway	27%	22%	33%	11%	7%
	481 (3.2)	477 (3.1)	460 (3.0)	425 (4.2)	408 (7.2)
International average	15%	13%	27%	26%	18%
	498 (1.0)	492 (1.0)	476 (0.6)	449 (0.7)	429 (1.0)

South Africa and Palestinian National Authority are countries where more than 40 per cent of the homes have 10 books or less. Internationally, and in South Africa, the difference in mathematics achievement score between learners who have a large number of books at home and those who have a few books is around 80 score points. The South African achievement score, for both mathematics and science, of learners with more than 100 books (classifiable as a good set of educational resources) is still lower than Botswana, and considerably lower than the international mean.

Home languages

International assessment studies have shown that in countries where a large proportion of learners are from homes where the language of the test (and thus the language of teaching and learning in school) is not spoken at home, the mathematics and science achievement scores are generally lower. However, it is important when studying the effect of language to consider socio-economic factors, as these compound the impact on learner achievement scores. In the TIMSS learner questionnaire, learners were asked (on a four-point scale) to answer the question, 'How often do you speak the language of the test at home?'. Table 9.5 depicts the learners' responses. Since science teaching and learning is more dependent on language proficiency, the percentage response rates are shown separately for each subject.

Table 9.5: Extent to which the language of the test is spoken at home and mathematics and science average scores

		Always	Almost always	Sometimes	Never
South Africa		18%	9%	57%	15%
	Maths	349 (14.6)	319 (13.0)	247 (3.1)	192 (3.9)
	Science	347 (17.3)	310 (13.8)	225 (4.3)	153 (5.2)
Botswana		5%	6%	80%	9%
	Maths	375 (10.3)	402 (8.0)	367 (2.6)	329 (6.2)
	Science	374 (13.5)	412 (10.9)	366 (2.5)	316 (6.5)
Ghana		23%	10%	63 %	5%
	Maths	272 (5.3)	295 (8.7)	285 (4.6)	189 (12.2)
	Science	260 (7.0)	279 (10.9)	263 (5.8)	155 (11.5)
Singapore		23%	19%	49%	8%
	Maths	625 (3.8)	620 (3.5)	595 (4.3)	581 (5.7)
	Science	613 (3.9)	603 (3.9)	557 (5.1)	545 (6.7)
Norway		85%	10%	3%	1%
	Maths	463 (2.4)	463 (5.2)	427 (8.8)	–
	Science	498 (1.9)	489 (6.1)	435 (10.6)	–
International average		68%	11%	17%	4%
	Maths	472 (0.7)	477 (1.0)	441 (1.4)	396 (2.0)
	Science	482 (0.8)	483 (1.0)	442 (1.5)	389 (2.4)

Note: A dash (–) means that there is insufficient data to report achievement.

Internationally, 21 per cent of the learners were from homes where the language of the test is only spoken 'sometimes' or 'never'. Countries where a large number of learners speak the language of the test infrequently at home include Botswana, Ghana, Indonesia, Lebanon, the Philippines, Singapore and South Africa. As expected, in each of the participating countries the learners who 'always' speak the language of the test at home score higher than learners who 'never' speak the language of the test at home.

However, the interesting analysis is the across-country scores for the groups who have indicated similar language proficiencies. The difference in the international average mathematics score between learners who 'always' and 'never' speak the language of the test at home is 76 points. In South Africa that difference is almost double, at 157, and in Botswana the difference is 46. Achievement scores of learners, across countries, who indicated the same level of language proficiency varied widely. Learners from South Africa who indicated that they 'always' spoke the language of the test achieved an average mathematics score of 347, in Botswana the comparable group achieved a score of 374, and in Singapore this group achieved a score of 613. In Singapore, 57 per cent of the learners indicated that they 'sometimes' or 'never' spoke the language of the test at home and their average mathematics score was 581. It might be worth probing further why Botswana, a neighbour of South Africa, showed a very small difference in achievement scores between those who 'always' and those who 'never' speak the language of the test at home. It is possible that the quality of the school inputs contributes to higher achievement.

The difference between the average science score for learners who 'always' and 'never' speak the language of the test at home is higher than the difference for the average mathematics score. The difference in the international average science score between learners who 'always' and 'never' speak the language of the test at home is 93 points. In South Africa that difference is almost double, at 194, and in Botswana the difference is 58.

South Africa has 11 official languages. The schools sampled for TIMSS reported that the official language of teaching and learning is either English or Afrikaans. Of the South African learners who answered that they 'always' speak the language of the test at home, 4.7 per cent were from ex-DET schools, 8.5 per cent from ex-HoR schools, 1.5 per cent from ex-HoD schools, and 5 per cent attended ex-HoA schools. Of the learners who attend ex-HoA schools, about 60 per cent 'always' speak the language of teaching and learning at home. Even with 40 per cent of learners not always speaking the language of the test at home, the ex-HoA schools achieve an average score in mathematics and science that is close to the international average.

The above analysis shows that there is an association between lower achievement and not speaking the language of the test at home. However, the effect of language proficiency and achievement scores is not straightforward. While it is acknowledged that proficiency in the language of the test is a contributor to the average achievement score, the comparison of South African scores with the scores of other countries (involving the categories of 'language spoken' and different school types in South Africa) suggests that there are factors other than language that contributing to low achievement scores – factors such as socio-economic variables, the nature of teaching and, importantly, the level of cognitive demand in classroom interactions in whatever language is used.

The above three factors – parents' level of education, educational resources in the home, and the extent to which the language of the test is spoken at home – all indicate that even when these resources are available, the South African average TIMSS mathematics and science scores are lower than most other countries.

Attitudes towards learning mathematics and science

Creating a positive attitude in learners towards mathematics and science is an important goal of the education curriculum in many countries. Learners' motivation to learn can be affected by their self-confidence, whether they find the subject enjoyable, and the value they place on their subject. Learners were therefore asked questions relating to these aspects. TIMSS then created an index for each of these constructs. Interpreting responses to attitudinal questions in across-country contexts is difficult, as one would also need to consider the cultural contexts. Some learners respond with socially desirable answers; others with modest self-confidence, and it is thus difficult to ascertain a 'true' picture.

Self-confidence in learning mathematics and science

Four statements about learning mathematics were combined to form an index of learners' self-confidence in learning mathematics (SCM). Similarly, four statements were combined to form the index of learners' self-confidence in learning science (SCS). Table 9.6 shows the self-confidence and corresponding achievement scores for learners from several countries.

The SCM index is based on the responses to the following four statements:

- I usually do well in mathematics;
- Mathematics is more difficult for me than for many of my classmates;
- Mathematics is not one of my strengths; and
- I learn things quickly in mathematics.

The SCS index is based on the responses to the following four statements:

- I usually do well in science;
- Science is more difficult for me than for many of my classmates;
- Science is not one of my strengths; and
- I learn things quickly in science.

Table 9.6: Index of learners' self-confidence in mathematics (SCM) and self-confidence in science (SCS) and average mathematics and science scores

		High % Score		Medium % Score		Low % Score	
South Africa	SCM	37%	300 (8.3)	48%	242 (3.9)	15%	255 (9.9)
	SCS	45%	282 (8.3)	46%	215 (5.7)	9%	207 (10.2)
Botswana	SCM	38%	390 (2.8)	45%	361 (2.5)	17%	352 (3.4)
	SCS	46%	391 (2.9)	44%	353 (3.4)	10%	337 (5.3)
Ghana	SCM	43%	306 (5.6)	44%	265 (4.8)	12%	265 (7.5)
	SCS	57%	294 (6.1)	36%	224 (6.2)	7%	173 (11.7)
Singapore	SCM	39%	639 (3.0)	34%	594 (3.9)	27%	571 (4.6)
	SCS	45%	601 (4.4)	37%	562 (4.9)	18%	553 (5.0)
Japan	SCM	17%	634 (3.1)	38%	580 (2.7)	45%	538 (2.3)
	SCS	20%	595 (2.7)	46%	551 (1.8)	34%	529 (2.3)
International average	SCM	40%	504 (0.6)	38%	453 (0.6)	22%	433 (0.7)
	SCS	48%	490 (0.8)	38%	445 (0.90)	13%	430 (1.2)

Learners who agreed a lot or a little with all four statements were assigned to the high level of the index, while learners who disagreed a lot or a little were assigned to the low level. The medium level includes all other possible combinations of responses.

On average, internationally, 40 per cent of mathematics and 48 per cent of science learners had high self-confidence in learning their subject. In science, the percentages for self-confidence ranged from a high of 69 per cent in Tunisia to a low of 20 per cent in Japan. In mathematics, the percentages ranged from a high of 59 per cent in Israel to a low of 17 per cent in Japan.

Although there was a (slight) positive relationship within countries between self-confidence in science/mathematics to achievement scores (in South Africa the difference in the average achievement scores between those of high and low self-confidence is 45 for mathematics and 75 for science), the across-country level relationship is more complex. It is worth noting that the four countries with the lowest percentages of learners in the high self-confidence category – Chinese Taipei, Hong Kong SAR, Japan and Korea – all had high average mathematics and science achievement scores.

Enjoyment of mathematics and science

Learners were asked in the learner questionnaire to indicate (on a three-point scale) whether they liked mathematics or science. Table 9.7 shows how learners in South Africa and several other countries responded.

Table 9.7: Learners' response to the enjoyment of mathematics and science question

		Agree a lot % (SE)	Agree a little % (SE)	Disagree % (SE)
South Africa	Math	56% (1.2)	24% (1.0)	20% (1.0)
	Science	64% (1.0)	22% (0.8)	15% (0.6)
Botswana	Math	65% (1.0)	22% (0.8)	14% (0.7)
	Science	72% (1.0)	17% (0.8)	11% (0.5)
Ghana	Math	53% (1.2)	30% (0.8)	16% (0.9)
	Science	65% (1.2)	21% (0.9)	13% (0.8)
Singapore	Math	33% (0.7)	42% (0.7)	25% (0.8)
	Science	42% (0.9)	41% (0.7)	17% (0.6)
Japan	Math	9% (0.6)	30% (0.8)	61% (1.1)
	Science	19% (1.0)	40% (0.8)	41% (1.4)
International average	Math	29% (0.1)	36% (0.1)	31% (0.2)
	Science	44% (0.2)	33% (0.2)	23% (0.2)

Internationally, 29 per cent of the learners indicated that they enjoyed mathematics, while 44 per cent said that they enjoyed science. Interestingly, South Africa and Botswana are among the countries where the highest number of learners indicated they enjoyed mathematics and science and yet the performance is very low. Countries where the lowest number of learners indicated that they enjoyed mathematics are Japan (9 per cent), Republic of Korea (9 per cent), Slovenia (7 per cent) and Netherlands (6 per cent). With the exception of Slovenia, these countries are top-ten achievers.

Valuing mathematics and science

Learners' motivation to learn mathematics and science may be affected by whether they find the subject enjoyable; place value on the subject, and think it is important for success in school and for future career aspirations. To gain an understanding of the value that Grade 8 learners placed on mathematics and science, TIMSS created an index of learners valuing mathematics (SVM) and learners valuing science (SVS).

To create the SVM index, learners were asked to state their agreement with the following seven statements regarding mathematics:

- I would like to take more mathematics in school;
- I enjoy learning mathematics;
- I think learning mathematics would help me in my daily life;
- I need mathematics to learn other subjects;
- I need to do well in mathematics to get into the university of my choice;
- I would like a job that involved using mathematics; and
- I need to do well in mathematics to get the job that I want.

To create the SVS index, learners were asked to state their agreement with the following seven statements regarding science:

- I would like to take more science in school;
- I enjoy learning science;
- I think learning science would help me in my daily life;
- I need science to learn other subjects;
- I need to do well in science to get into the university of my choice;
- I would like a job that involved using science; and
- I need to do well in science to get the job that I want.

Learners who, on average, agreed a little or a lot with the seven statements were assigned to the high level of the index, while learners who, on average, disagreed a little or a lot with the statements were assigned to the low level. The medium level includes all other possible combinations of responses. Table 9.8 shows how learners in South Africa and several other countries responded.

Table 9.8: Index of learners valuing mathematics (SVM) and learners valuing science (SVS) and average mathematics and science scores

		High		Medium		Low	
		%	Score	%	Score	%	Score
South Africa	SVM	79%	271 (5.6)	17%	243 (9.1)	4%	241 (11.4)
	SVS	76%	242 (6.1)	19%	246 (11.6)	5%	270 (16.0)
Botswana	SVM	84%	378 (2.7)	14%	331 (2.8)	2%	—*
	SVS	85%	379 (2.7)	13%	315 (6.6)		
Ghana	SVM	82%	293 (4.8)	16%	227 (4.8)	1%	—*
	SVS	83%	279 (5.5)	16%	173 (8.4)		
Singapore	SVM	63%	616 (3.4)	32%	592 (4.0)	5%	558 (7.9)
	SVS	62%	599 (3.9)	33%	551 (4.6)	6%	505 (7.3)
Japan	SVM	17%	597 (3.1)	61%	574 (2.2)	22%	539 (3.3)
	SVS	17%	586 (3.3)	56%	555 (1.8)	27%	526 (2.8)
International average	SVM	55%	479 (0.6)	35%	458 (0.6)	10%	458 (1.0)
	SVS	57%	477 (0.8)	31%	450 (1.0)	12%	463 (1.6)

Note: A dash (—) denotes insufficient data to report achievement.

As shown in Table 9.8, internationally, on average, learners placed a high value on mathematics, with 55 per cent in this category, followed by 35 per cent in the medium category, and then 10 per cent in the low category. Countries who reported large percentages in the high valuing category included Morocco, Botswana, Ghana, Egypt, Jordan and South Africa. Among countries where few learners reported placing a high value on mathematics were Korea, Japan and the Netherlands.

Internationally, the difference in achievement scores between high-valuing learners and low-valuing learners for mathematics and science is less than 20. In South Africa, the difference between these two groups, for mathematics, is 30. The learners who reported low valuing of science achieved an average science score higher than those that indicated high and medium valuing.

Analysis of the learners' attitudes towards mathematics and science reveals that in many countries where positive attitudes were reported, the achievement scores were lower; while in many countries not reporting positive attitudes, the achievement scores were higher. In addition, the in-country difference between the groups was not high. Therefore, it is difficult to determine the association between attitudes to mathematics and science and the achievement scores in these subjects.

Summary

The parents' level of education, the existence of educational resources in the home, and the extent to which the language of the test is spoken at home were investigated, with the aim of determining what effect these factors have on mathematics and science achievement scores. The findings, as outlined in this chapter, indicate that within a country where learners have these resources, they perform better than those who do not have them. However, across-country comparisons show that even when these resources are in place, the South African average TIMSS mathematics and science scores are lower than the other countries. None of these factors on its own can explain performance – rather, it is the interaction of many factors, embedded within a context, which offers suggestions of why performance may be high or low.

In general, the attitude of South-African learners to mathematics and science is positive – they have high self-confidence; they enjoy and value the subjects. We must consider that these may be socially desirable responses, and that one would have to probe further to determine the 'real' attitudes of learners. Internationally, and within South Africa, there is no significant variation in achievement scores between learners who indicate positive attitudes towards mathematics and science and those who do not.