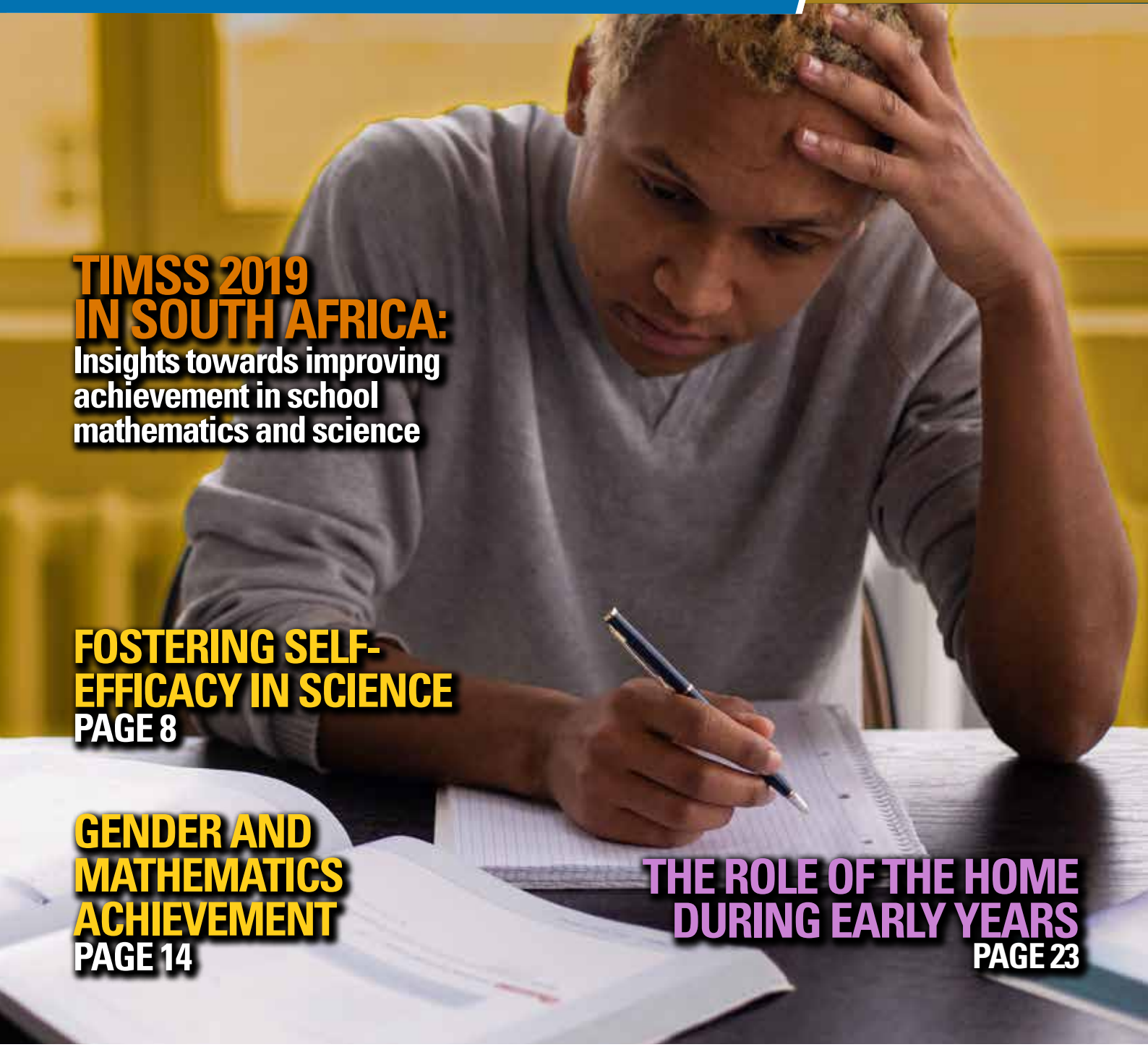
Review

PUBLICATION OF THE HUMAN SCIENCES RESEARCH COUNCIL

VOL. 19 | NO. 2 | **JUNE 2021**



TIMSS 2019 IN SOUTH AFRICA:
Insights towards improving achievement in school mathematics and science

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science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

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THIS ISSUE

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Production: The *HSRC Review* is produced by the HSRC's Impact Centre.

Layout and design: Antonio Erasmus

Cover: *Designed by Antonio Erasmus with photo by Monstera, Pexels*

EDITOR'S NOTE

By Antoinette Oosthuizen

South Africa's education system has battled historic challenges related to stark socioeconomic inequality and great disparity in life chances, a chasm deepened by the COVID-19 pandemic, according to a report released by Amnesty International in February 2021.

HSRC education experts warned of this risk in May 2020, mere weeks after school closures had become part of a hard lockdown to contain the pandemic in South Africa. The learning losses resulting from the disruption would be more severe for disadvantaged learners, wrote Dr Vijay Reddy, a distinguished research specialist at the HSRC; Prof Crain Soudien, former HSRC CEO; and Dr Lolita Winnaar, recently appointed as a chief education specialist at the National Assessment Directorate of the Department of Basic Education.

Having led South Africa's Trends in International Mathematics and Science Study (TIMSS) for 20 years, Reddy was well aware of the significant challenges that had to be overcome to make small but steady performance improvements in these subjects. The TIMSS team must have pondered this while analysing the TIMSS 2019 results during the height of the pandemic disruption in 2020.

Starting with Reddy's article on the history of TIMSS in South Africa, this edition of the *HSRC Review* features a selection of articles on the TIMSS 2019 results, which is a snapshot of the education system's performance in mathematics and science. It also covers several factors that have influenced achievement in this survey, which is conducted every four years. Mathematics and science are required subjects for learners who intend to pursue careers in science, technology, engineering and mathematics – careers that ultimately feed innovation and technological advancement to grow economies. These subjects also equip them to function in an increasingly technology-oriented society.

The articles examine factors such as gender differences, language, school leadership, classroom practice, learners' self-efficacy, homework, home environment and school climate.

Analyses of the TIMSS 2019 results are ongoing. Please feel free to contact the researchers at the email addresses provided below each article, or visit the TIMSS South Africa website. You can also contact the *HSRC Review* team at the email below.

Antoinette

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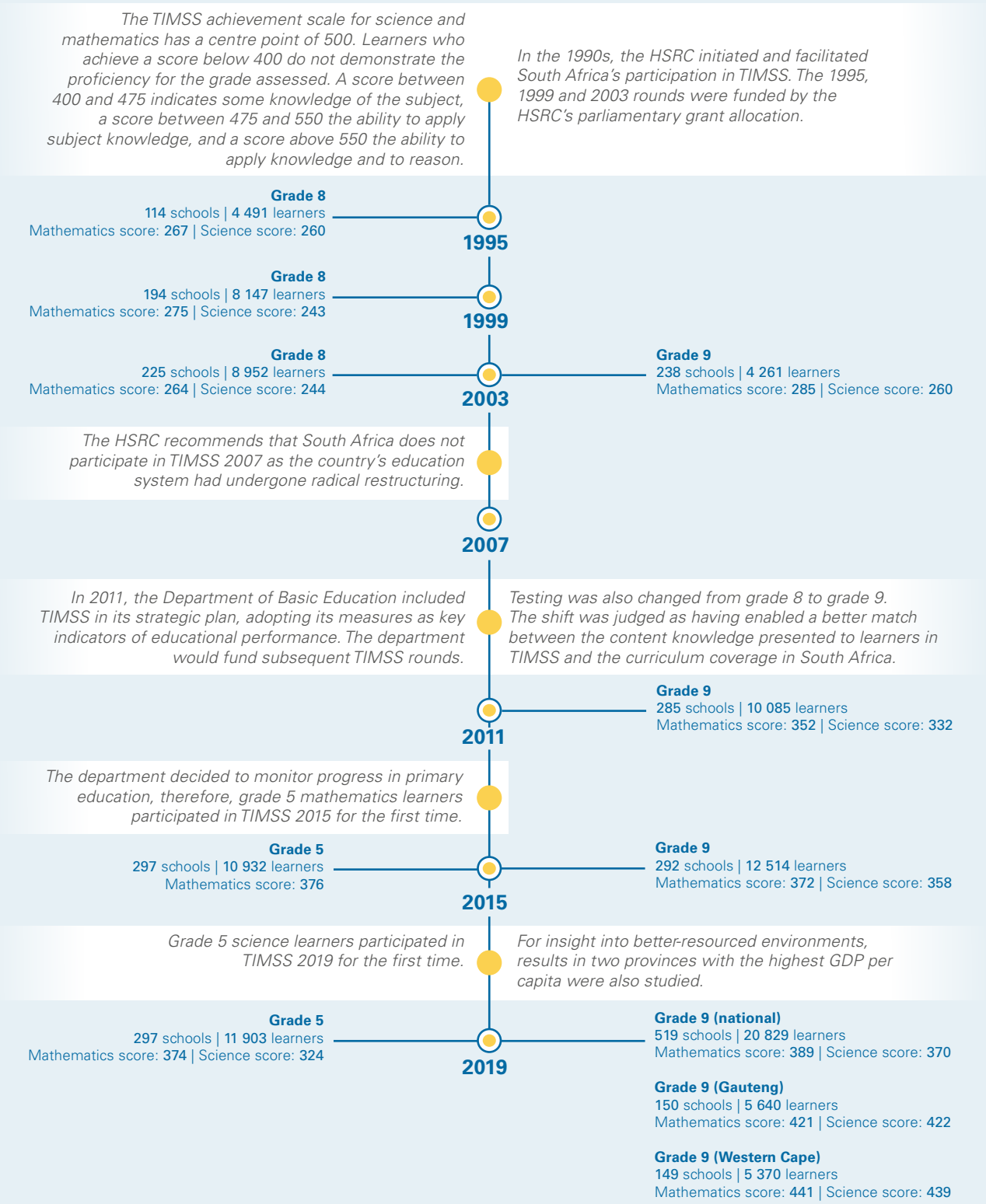
25 years of TIMSS in South Africa: Improved achievements but pace of improvement is slowing

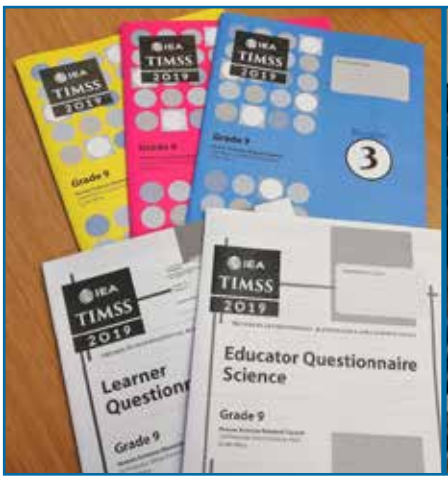
Over the past decades, South African learners have made strides in improving their educational achievement in mathematics and science. However, the rate of this improvement has shown signs of slowing and there is much work to do, especially after the disruption caused by the COVID-19 pandemic in 2020. *Vijay Reddy* looks at the history of South Africa's participation in the Trends in International Mathematics and Science Study (TIMSS) and how the country has fared.

In the context of the political changes of the 1990s in South Africa, the Human Sciences Research Council (HSRC) revised its research agenda in relation to the new democratic government and society. The HSRC reconnected with social science and education communities in South Africa and took a strategic decision to conduct large-scale survey research, which universities may have found difficult to undertake. TIMSS was developed by the International Association for the Evaluation of Educational Achievement to allow participating nations to compare their learners' educational achievement across borders. The late HSRC researcher Dr Derek Gray identified TIMSS as an important study in relation to the South African Reconstruction and Development Plan and to the future planning of the education system in the country. In addition to estimating South African learners' achievement in relation to other countries, TIMSS provided the opportunity to monitor changes in educational achievement over time.

The HSRC conducted TIMSS in South Africa for the first time in 1995, followed by TIMSS 1999 and 2003, funded by the HSRC's parliamentary grant allocation. In 2011, the Department of Basic Education adopted TIMSS as one of the key indicators of educational performance in its strategic plan. The HSRC subsequently conducted TIMSS 2011, 2015 and 2019 at the grade 9 level and TIMSS 2015 and 2019 at the grade 5 level, on behalf of the department. The following infographic summarises the historical timeline of TIMSS in South Africa, which is also detailed in *Society, Research and Power: A history of the Human Sciences Research Council from 1929 to 2019* (published in 2021).

Figure 1: The history of TIMSS in South Africa





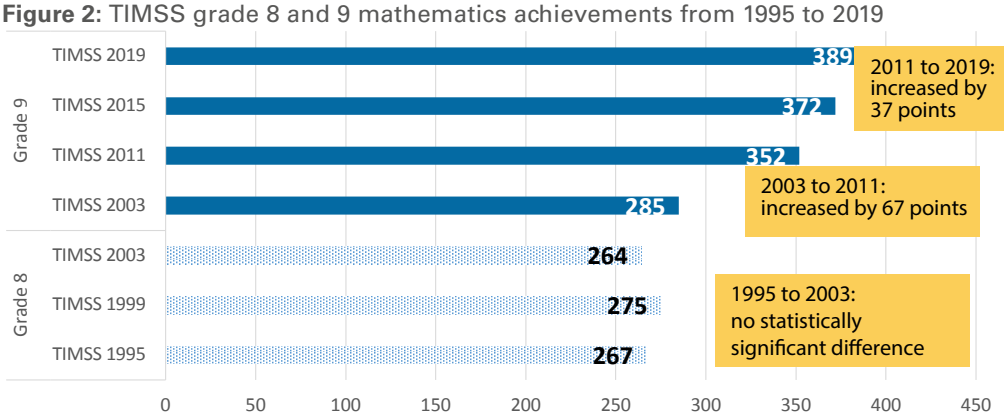
TIMSS 2019 test materials
Photo: *HSRC*

Learners writing TIMSS 2019
Photos: *HSRC*

Grade 5 and 9 mathematics achievement

South African education, and by extension mathematics and science achievement, has been described as being of a lower quality, with its two unequal systems of education. In this article, we use the 25 years of grade 9 TIMSS data to examine this statement. We will describe South Africa's performance using the mathematics achievement scores and mathematics proficiency levels. Figure 2 plots the mathematics achievement scores from 1995 to 2019.

Figure 2: TIMSS grade 8 and 9 mathematics achievements from 1995 to 2019



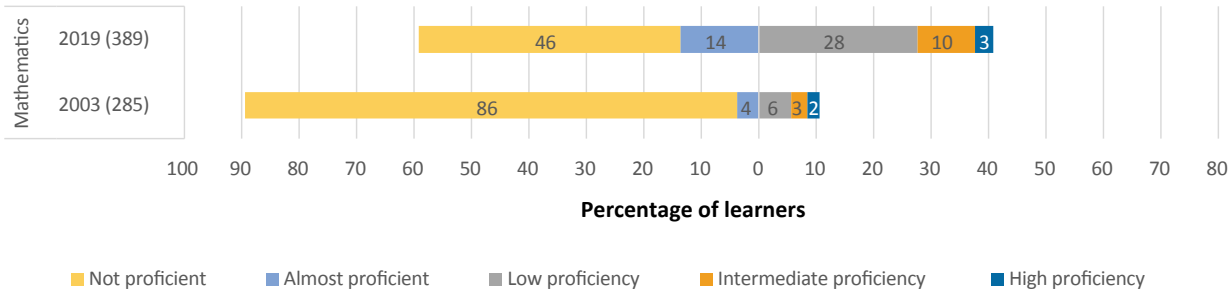
National achievement scores have been way below the TIMSS centre point of 500 since 1995, and South Africa continues to perform at the lower end of the rank order table of participating countries (around 40 countries in each round). The trend analysis shows that, during the 25 years since democracy from 1995 to 2019, South Africa improved in mathematics achievement by one standard deviation or just over 100 TIMSS points – a remarkable achievement.

Drilling down to the changes in three phases over the 25-year period shows us the contours of this improvement: from 1995 to 2003 the achievement scores were very low and stagnant and we did not measure any achievement changes. This is probably due to the massive administrative restructuring to form a single education department and multiple curriculum reforms, like the ill-fated outcomes-based education, during this period. In the second phase, the improvement from 2003 to 2011 was 67 points. These improvements were largely due to the improved home and school conditions effected through social protections like social grants, school nutrition schemes and fee subsidies. In the third phase from 2011 to 2019, the improvement was a lower 37 points. The changes during this last phase could be due to factors like improved home conditions, school resources and instructional materials, improved teacher knowledge, and changes inside schools and classrooms.

In addition to achievement scores, we can describe the abilities that learners demonstrate at a particular score using proficiency level benchmarks. Learners who achieve a score between 400 and 475 are described as being at a 'low' proficiency level (have some mathematical knowledge); those between 475 and 550 are at an 'intermediate' proficiency level (can apply mathematical knowledge); and those scoring above 550 points are at, 'high' proficiency (can apply knowledge and reason). Learners who achieve below a TIMSS score of 400 do not have the mathematical

proficiency for the grade assessed: 'almost proficient' learners score between 375 and 400 points and those 'not proficient' score less than 375. Learners who score over 400 points are more likely to progress to grade 12, succeed in the matriculation examinations and possibly pursue qualifications in science, technology, engineering and mathematics.

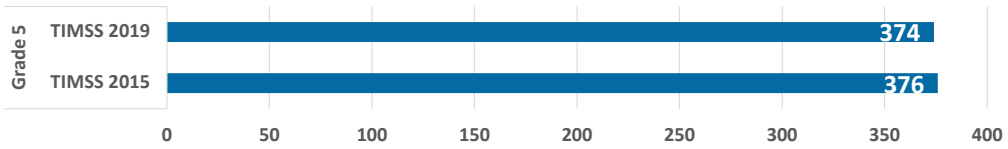
Figure 3: TIMSS grade 9 mathematics proficiency levels and achievement score for 2003 and 2019



In 2003, only one in 10 learners were mathematically proficient. The mathematical proficiency increased over time and in 2019, one in four learners were mathematically proficient. The tipping point for the system is when more than 50% of the learners are mathematically proficient.

South Africa participated at the grade 5 level in TIMSS 2015 and 2019 in order to monitor educational progress in the primary education system. The mathematics achievement over the period remained the same (Figure 4).

Figure 4: TIMSS grade 5 mathematics achievement in 2015 and 2019



This lack of improvement, in contrast to results at the secondary school level, signals the need for greater attention to be paid to the primary education sector.

In conclusion

While we applaud the improvement in grade 9 educational achievement, the rate of achievement improvement is decreasing. For the 2003 to 2011 period, the average rate of mathematics improvement was 7.4 points a year, and for the 2011 to 2019 period these figures dropped to 4.6 points a year. The Medium-Term Strategic Framework (2019–2024), which outlines South Africa's developmental objectives, expects that in 2023 South Africa will achieve a grade 9 mathematics achievement score of 420 and at grade 5 a score of 426. The TIMSS 2019 achievement scores are a distance away from that target. In the pre-COVID-19 environment, this would have meant strategically targeted interventions and additional effort from all education role players to accelerate the pace of improvement. However, with the learning losses as a result of school closures due to the coronavirus pandemic, this task will be more difficult.

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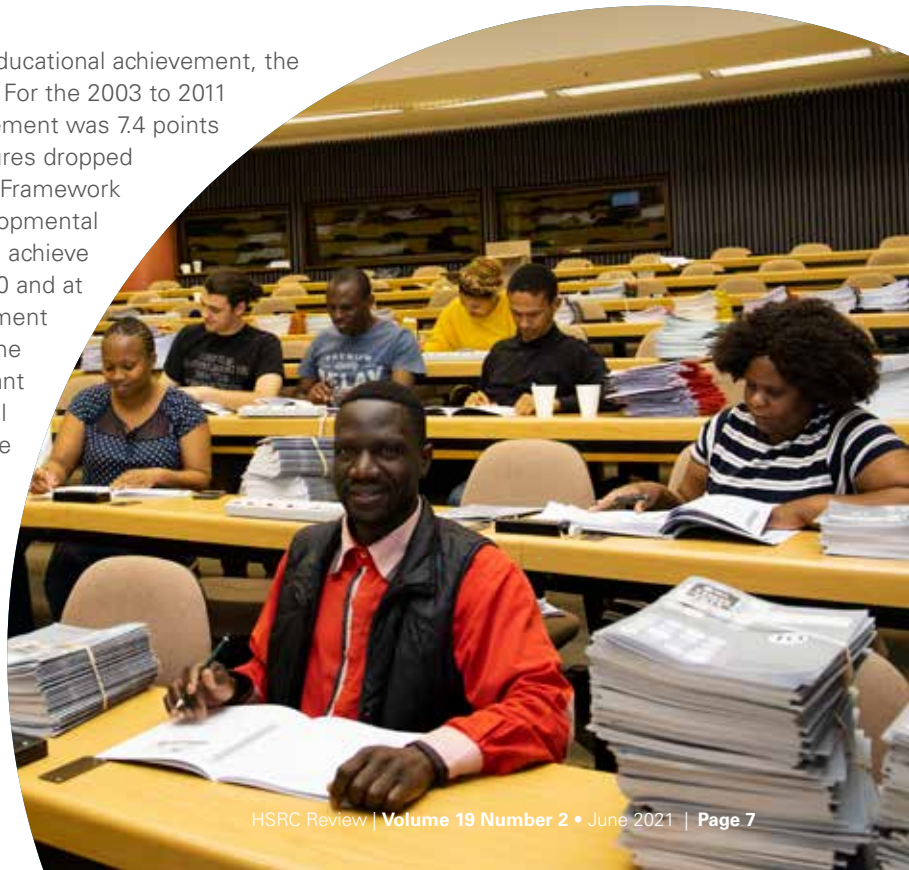
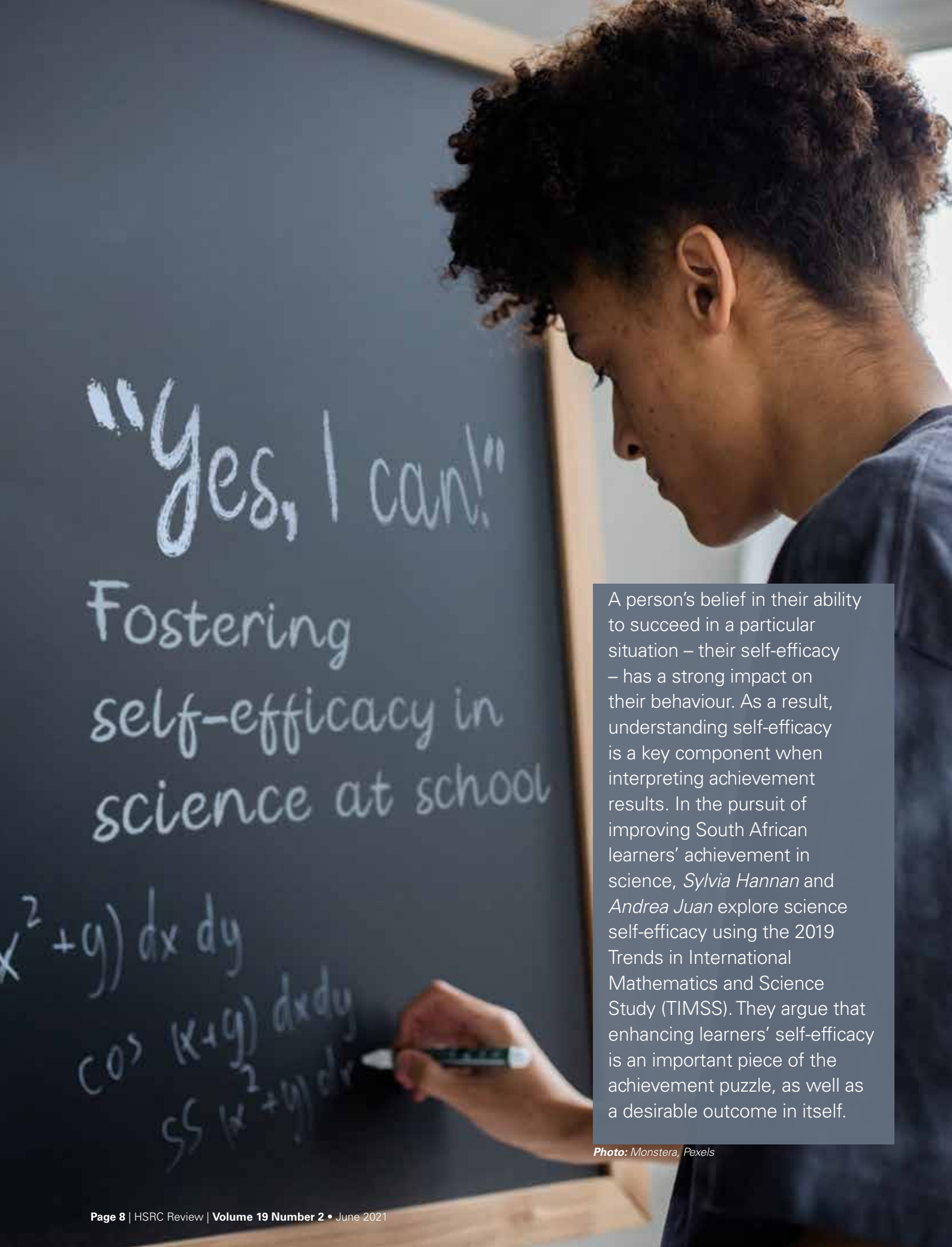


Marking TIMSS 2019 tests
Photo: *HSRC*



A person's belief in their ability to succeed in a particular situation – their self-efficacy – has a strong impact on their behaviour. As a result, understanding self-efficacy is a key component when interpreting achievement results. In the pursuit of improving South African learners' achievement in science, *Sylvia Hannan* and *Andrea Juan* explore science self-efficacy using the 2019 Trends in International Mathematics and Science Study (TIMSS). They argue that enhancing learners' self-efficacy is an important piece of the achievement puzzle, as well as a desirable outcome in itself.

Photo: *Monstera, Pexels*

Given the importance of science for the development of this country, it is concerning that limited numbers of South African learners are choosing to pursue science subjects in grades 10 to 12. In addition, the TIMSS 2019 results showed that South African learners performed poorly in science at the grade 9 level, which is the year before subject choices have to be made. A significant amount of research seeks ways to improve the quality of science education and increase science enrolments, by focusing on the cognitive determinants of science achievement. However, an area that is often missing in these studies is the role of non-cognitive psychosocial factors, such as self-efficacy. Science self-efficacy has an effect on learner motivation, thereby facilitating or hindering the learning process.

What is self-efficacy?

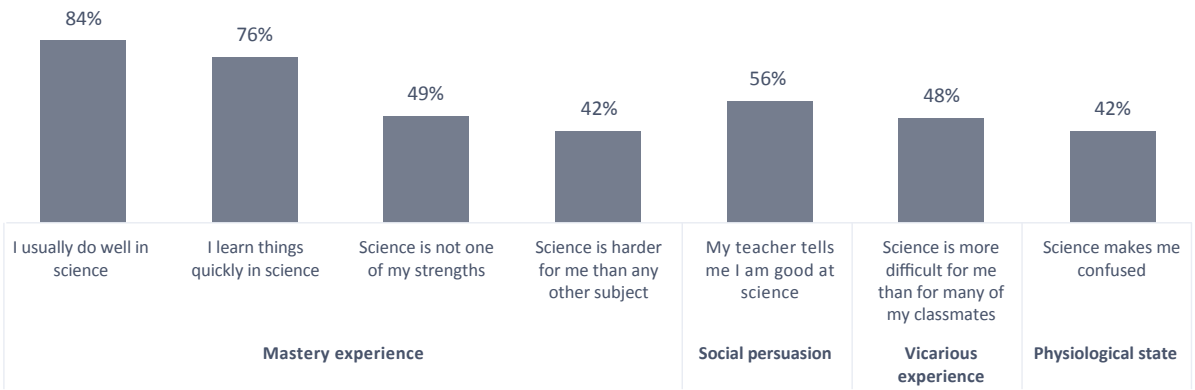
Self-efficacy relates to a person's belief in their ability to perform in order to reach specific goals. When applying this to school science, this belief affects learners' motivation, interest and performance in the subject. Efficacy beliefs therefore affect how much effort learners apply to an activity, how long they will persist when encountering obstacles, and how resilient they are when confronted with difficult problems. Individuals with high self-efficacy consider difficult tasks as challenges to be mastered, set themselves ambitious goals, maintain strong commitment, and increase or sustain their efforts when faced with failure.

Albert Bandura, the seminal writer on self-efficacy, offered some insight into the sources of self-efficacy, which he grouped into four categories: 1) mastery experiences – successful experiences boost self-efficacy, while failures corrode it; 2) vicarious experience – witnessing others similar to oneself succeed through sustained effort can translate to a belief that one has the ability to master similar activities; 3) social persuasion – persuading someone verbally that they have the capacity to master particular activities so that they are more likely to put in a sustained effort to succeed; and 4) physiological state – a positive mood can increase one's self-efficacy, while anxiety can reduce it. Mastery experience is the most robust source of self-efficacy. Using this theoretical framing, we used TIMSS 2019 data from 20 829 grade 9 learners to investigate their science self-efficacy and the relationship with achievement.

Science self-efficacy in TIMSS 2019

TIMSS learners completed a questionnaire that asked about their perceptions and attitudes towards science. Learners were scored according to their responses to eight statements that measured self-efficacy. The responses to the eight statements, categorised by the four sources of self-efficacy, appear in Figure 1.

Figure 1: Learners' agreement with science self-efficacy statements



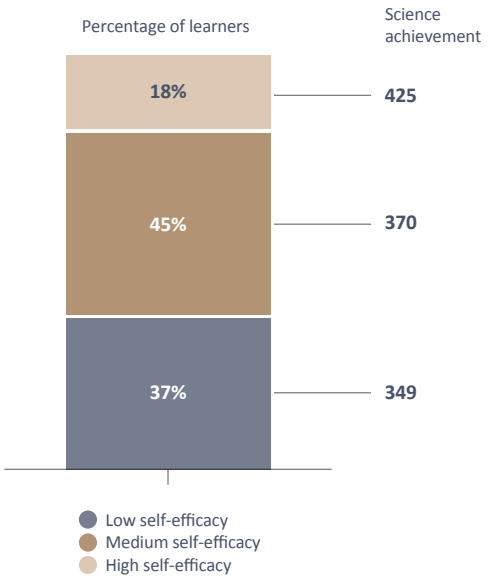
The statements that received the most positive responses were 'I usually do well in science' (84%) and 'I learn things quickly in science' (76%) and both relate to mastery experience. This is incongruent with the poor performance of the majority of learners in the TIMSS assessment. Only 36% of learners were categorised as 'proficient in science', suggesting a disconnect between perception and actual ability. However, the other five statements elicited more circumspect responses. Around half of the learners felt that science was harder for them than any other subject, and more difficult for them than for many of their classmates (vicarious experience), meaning that from observing peers performing tasks, they evaluated their own prospect of success as low. Understandably, 42% of learners experienced negative physiological states when doing science, having reported that science 'made them confused'. These findings are more consistent with performance – where 64% of learners were not proficient in the TIMSS science assessment.

The importance of educators as a source of social persuasion is also highlighted by the findings. Just more than half of learners (56%) received positive judgements from educators regarding their science capabilities. When many learners perform poorly, positive persuasion may be limited.

Self-efficacy and achievement

Learner responses to the self-efficacy items were combined to form a single self-efficacy scale – with categories of low, medium, or high self-efficacy. The percentage of learners in each category, as well as their average science achievement, are shown in Figure 2.

Figure 2: Self-efficacy and achievement



The average national TIMSS science score is **370 points**.

Almost one in five learners had high levels of self-efficacy, while about one in three were categorised as having low self-efficacy. Learners with high self-efficacy had higher average science achievement scores than those with lower self-efficacy. Grade 9 learners with the highest levels of self-efficacy performed 76 points above those with low levels, showing a positive and statistically significant difference. This suggests that generally, learners were able to honestly appraise their ability, which could be the first step towards identifying what is required to improve their achievement.

Fostering self-efficacy

Research has not determined the direction of association between self-efficacy and achievement. Does higher achievement lead to higher levels of self-efficacy, or is it the other way around? What the TIMSS results do show is that there is a positive, significant relationship between self-efficacy and achievement. The implication is that learners' science self-efficacy must be encouraged and nurtured and learners must be able to honestly reflect on their abilities. Beyond science achievement, self-efficacy should be a goal in and of itself as it influences an individual's effort, persistence and resilience, and therefore has a role to play in other aspects of life.

Based on Bandura's insights, we recommend that in order to improve self-efficacy, educators must promote repetitive problem solving activities until learners feel that they have mastered the subject matter (mastery experience); highlight the successes of learners in science tasks and emphasise how others could achieve the same success (vicarious experience); provide constructive feedback, guide learners through tasks and motivate them to try harder (social persuasion); and attempt to limit learners' anxiety around science tasks, such as exams and presentations, by minimising performance pressure (physiological states). Developing the necessary skills to encourage learners' self-efficacy, and their accurate self-reflection on their abilities, should form a core component of educator training programmes.

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LANGUAGE development and SCIENCE achievement

Photo: *Iudi, Pixabay*

While there is clear agreement that proficiency in the language of testing will influence educational outcomes, we know less about how this relationship is influenced by the socioeconomic status of learners and the schools they attend. *Vijay Reddy* and *Jaqueline Harvey* use grade 9 data from the 2019 Trends in International Mathematics and Science Study (TIMSS) to explore language dynamics in South Africa – nationally and in the Gauteng and Western Cape provinces. They look at how the different conditions influence science achievement, a subject where language skills are important.

It is widely understood that learners who are proficient in the language of the test are better able to successfully answer the questions and achieve higher scores. That is, learners perform best in their home languages. However, simply administering tests in learners' home language in South Africa, with its high levels of poverty and inequality, will not necessarily lead to improved results. While language proficiency is a contributor to higher performance, there are other factors at play. Using the TIMSS 2019 grade 9 data, we present further insight into the debate around language of instruction.

South Africa is a multilingual country where the Constitution enshrines the official status of 11 languages. Of these, the most common home languages reported by learners were isiZulu (28%), followed by isiXhosa (17%). The next most common languages were Afrikaans, English, Sepedi, and Setswana, which were each spoken in approximately 10% of homes. These figures correlate with other national statistics. Furthermore, provinces have their own unique

linguistic profiles. Here, we focus on two provinces that, while included in the South African sample, had additional schools sampled as part of standalone studies. In Gauteng, all 11 official languages are listed as home languages, with isiZulu spoken in 22% of households, followed by Setswana (16%), Sesotho (15%), English (11%), and Afrikaans (10%). Western Cape, on the other hand, is more linguistically homogenous, with 40% of learners listing Afrikaans as their home language, followed by isiXhosa (33%) and English (25%). The results for these provinces, which have the highest GDP per capita, provide insight into learner performance in better-resourced environments.

According to South Africa's official language policies, school governing bodies are responsible for determining the school language policy. The grade 1 to 3 literacy curriculum allocates 70% of the learning time to home language development and 30% to the development of a first additional language, generally English or Afrikaans. From grade 4 onwards, most schools choose English or Afrikaans as the language of learning and teaching.

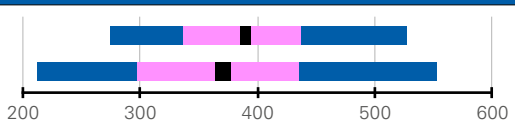
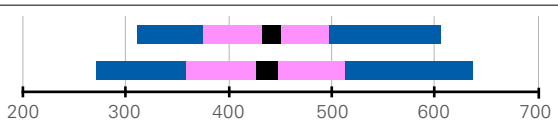
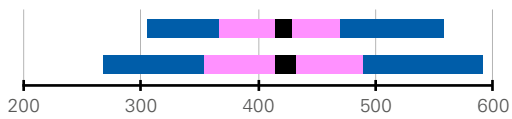
While English or Afrikaans is the prescribed language of instruction from grade 4, in reality, many teachers employ code-switching practices. This involves alternating and blending English with the African home language to assist learners in understanding concepts. English is often seen as a language of power with economic and social benefits. Many parents, therefore, prefer English for their child's education. This may explain why schools continue to choose a language that is at odds with learners' backgrounds and classroom practices.

According to the curriculum documents, the objective of language development is to promote '(i) Thinking and Reasoning and (ii) Language Structure and Use, which are integrated into all four language skills (listening, speaking, reading, and writing)'. School language development goes beyond the ability to communicate socially, aiming to enable learners to use language for academic purposes, such as reading for meaning. However, the level of South African language skills development is of concern. The 2016 Progress in International Reading Literacy Study (PIRLS) assessed learners' reading comprehension at the grade 4 and 5 level. Their results showed that only 22% of learners were able to read for meaning in their home language. Further, PIRLS reported that learners whose home language was English or Afrikaans achieved the highest scores and their achievement was significantly greater than that of learners who wrote the test in an African home language.

Factors other than proficiency in the language of the test contribute to low achievement. Previous reports show that South African educational outcomes are best described as low and socially graded. For example, about one-third of learners come from more advantaged backgrounds, attend better-resourced fee-paying schools, and generally attain higher achievement scores. An interpretation from the PIRLS results is that factors such as inadequate school resources, poor teaching and learning practices, and unsafe school environments, which are more common in the more disadvantaged no-fee schools, contribute to lower educational outcomes.

Against this backdrop, we explored the intersection of English (or Afrikaans) language proficiency and achievement. We first examined the mathematics and science achievement distributions in three 'case studies' – South Africa, Gauteng and Western Cape. Although the mathematics and science scores were constructed on different scales, the percentile graph patterns provide insights into the impact of language on achievement. In the graphs for all three case studies, distribution was wider for science achievement than for mathematics (Figure 1). This implies a higher level of variance for science scores. In addition, science scores at the fifth percentile were much lower than the mathematics scores at the same point.

Figure 1: TIMSS 2019 Grade 9 mathematics and science achievement and distribution in South Africa, Gauteng and Western Cape

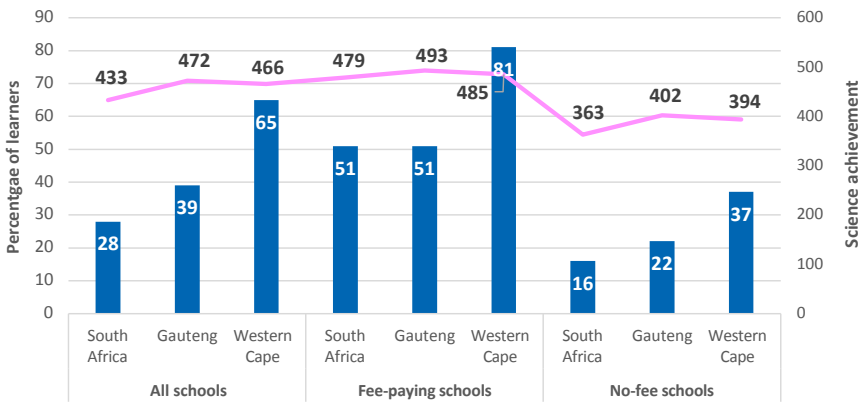
Case	Achievements	Achievement distribution
South Africa	Mathematics 389 (2.3) Science 370 (3.1)	
Western Cape	Mathematics 441 (4.4) Science 439 (5.1)	
Gauteng	Mathematics 421 (3.0) Science 422 (3.9)	

The lower performance in science could be due to many factors, including higher language proficiency requirements, higher difficulty levels of science items, and inadequate teacher knowledge or resources to teach science in schools.

We next explored how test language proficiency influenced science achievement scores. As expected, learners who never spoke the language of the test at home achieved a significantly lower score of 311 points on the science assessment, compared with the 433 points scored by their peers who spoke the test language at home more frequently. We then extended the analyses by examining science achievements for learners who indicated that they 'always' or 'almost always' (frequently) spoke the language of the test at home in our three case studies. We compared frequency patterns and science achievement for all schools, fee-paying schools, and no-fee schools (Figure 2).

The results showed that the frequency with which learners spoke the language of the test at home varied across contexts. Two-thirds of Western Cape learners frequently spoke the language of the test at home, compared with 39% in Gauteng and 28% for South Africa as a whole. Not unexpectedly, this was the case for more learners in fee-paying than in no-fee schools. Comparing the achievement scores for learners who frequently spoke the language of the test at home revealed that there were no significant differences in achievement for fee-paying schools across the three contexts. In the case of no-fee schools, learners in Gauteng and Western Cape achieved significantly higher scores than the countrywide average. This implies that fee-paying schools anywhere in the country are fairly similar and learners have the same chance of success. However, learners attending no-fee schools in the Gauteng or Western Cape province have an opportunity for better achievement. Better-resourced provinces offer a higher quality of education in no-fee schools.

Figure 2: Extent of the language of the test being frequently spoken at home and science achievement scores in different contexts



In conclusion

The TIMSS 2019 results for South African learners show that levels of language proficiency and development continued to impact learner achievement. Learners who were fluent in the test language and who were regularly exposed to this language outside of school were at an advantage. Steps should be taken to improve test language proficiency. This includes sound bilingual instruction in the foundation years to ensure that all learners are proficient in their home language and in a second language.

However, the socioeconomic context in which learners attend school is also a crucial aspect of the relationship between language development and achievement. Improved language proficiency in the language of the test alone will not lead to the desired results. To improve the education outcomes, all learners should receive a high-quality education. In no-fee schools, this will necessitate infrastructural and other resource improvements, as well as improved educator knowledge and pedagogy. Unless all learners can read with meaning, and write coherently (in any language), the impact will continue to be felt through low science achievement scores.

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Photo: *Randy Fath, Unsplash*

The **GENDERED COMPLEXITIES** of school mathematics achievement: Girls outperforming or boys underperforming?

Boys scored higher or the same mathematics averages as girls in most of the countries that participated in the 2019 Trends in International Mathematics and Science Study (TIMSS 2019). But this was not the case for South Africa. *Vijay Reddy, Catherine Namome* and *Palesa Sekhejane* explore gender achievement gaps in mathematics at grade 5 and grade 9 levels, also comparing secondary schools in the two most well-resourced provinces – Gauteng and Western Cape. They ask whether we should celebrate girls' higher performance or be concerned about boys' underperformance.

Global literature from high-income countries generally reports that boys outscore girls in mathematics. Using the TIMSS 2019 data, we explore the patterns for South Africa, a low-to-middle-income country with low and unequal educational achievement.

Gender educational inequalities intersect with race and social class. Historically, gender inequalities in education and labour markets have favoured boys and men. A recent study showed that girls' educational outcomes in relation to participation and performance, in both schools and universities, were higher than boys'. Nevertheless, in the labour market, women were still vastly under-represented in management, especially top management. African women, despite their educational successes, remained the most under-represented group at the higher occupational levels.

Internationally, the grade 5 TIMSS mathematics gender achievement patterns show that boys had higher average mathematics achievement than girls in almost half the participating countries, and there was gender equity in performance in almost half the countries. In four countries – Philippines, Saudi Arabia, South Africa and Oman, which are among the lower performers – girls achieved significantly higher mathematics scores than boys. At the grade 9 level, girls achieved significantly higher mathematics scores in seven countries, including South Africa (together with mostly Arabic-speaking countries), and gender equity in 25 countries. Boys had higher achievement than girls in six countries, which were mostly European.

In this article, we extend the analysis using TIMSS 2019 data to explore the gendered mathematics performance patterns at the grade 5 and 9 levels, and the intersection between gender and socioeconomic status in South Africa. We further report on the gender patterns by content and cognitive areas.

TIMSS 2019: gender and achievement

TIMSS 2019 collected nationally representative grade 5 and grade 9 data. In addition, we expanded the sample in the Gauteng and Western Cape provinces for more robust provincial estimates. The results for these provinces, which have the highest GDP per capita, provide insight into performance in better-resourced environments.

Nationally, there are about equal numbers of girls and boys in grade 5. Girls make up 52% of grade 9 learners, and the 4-percentage point difference between the number of girls and boys suggests that more boys may be dropping out of school. The gender participation gap is starker in Gauteng and the Western Cape, at 10 percentage points. It seems that more boys than girls drop out by grade 9 in these two better-resourced provinces.

Not only do girls generally stay longer in school, but they also outperform boys. At grade 5, girls outscore boys in mathematics by a statistically significant 20 points. At grade 9, for the first time in TIMSS 2019, we observed a significant gender achievement gap, with girls outscoring boys by six TIMSS points. The gender achievement gaps differ in each province. In the Western Cape, boys outperform girls, while in Gauteng girls outperform boys.

Extending the analysis to the intersectionality of gender and class, we used the school fee status (fee-paying or no-fee schools) as a proxy of socioeconomic status. Nationally, as well as in the two provinces, there are no significant gender differences in the better-resourced, fee-paying, schools. In no-fee schools, nationally in grade 5 and 9, and in Gauteng, girls outperform boys. This suggests that in low-resource contexts, boys are both dropping out of school at a higher rate and under-achieving in comparison to girls.

There are interesting, but as yet unexplained, gender achievement patterns by curriculum topic and the cognitive demand of the questions. The four case studies in Table 1 show inconsistent patterns in terms of gender advantage by content area. Similarly, gender differences related to the cognitive demand of the question were found. These areas require further research.

Table 1. TIMSS 2019 national and provincial mathematics achievement according to gender

	Grade 5 South Africa	Grade 9 South Africa	Grade 9 Western Cape	Grade 9 Gauteng
Gender participation patterns	• 50% girls • 50% boys	• 52% girls • 48% boys	• 55% girls • 45% boys	• 55% girls • 45% boys
Gender achievement gap	• Girls: 384* • Boys: 364 Girls score significantly higher	• Girls: 392* • Boys: 386 Girls score significantly higher	• Girls: 436 • Boys: 447* Boys score significantly higher (at 90% confidence level)	• Girls: 423* • Boys: 417 Girls score significantly higher
Gender achievement gap in fee-paying schools	• Girls: 455 • Boys: 449 No significant difference	• Girls: 445 • Boys: 439 No significant difference	• Girls: 461 • Boys: 472 No significant difference	• Girls: 448 • Boys: 443 No significant difference
Gender achievement gap in no-fee schools	• Girls: 352* • Boys: 332 Girls score significantly higher	• Girls: 341* • Boys: 329 Girls score significantly higher	• Girls: 396 • Boys: 396 No difference	• Girls: 387* • Boys: 383 Girls score significantly higher (90% confidence level)
Performance by curriculum topics	Girls score significantly higher in: • numbers • measurement and geometry • data	Girls score significantly higher in: • algebra • data and probability	Boys score significantly higher in: • numbers • geometry	Girls score significantly higher in: • algebra
Performance by cognitive demand	Girls score significantly higher in: • knowing • applying • reasoning	Girls score significantly higher in: • knowing • applying	Boys score significantly higher in: • reasoning	Girls score significantly higher in: • knowing

**Significance levels are reported at 95% confidence interval except where stated*

Conclusion

While we celebrate the successes of girls in the diverse South African educational landscape, we must raise a red flag about the extent to which boys are dropping out of school and underachieving in mathematics. The danger is that more boys will join the ranks of young people that educational and labour-market experts refer to as 'not in education, employment or training'. In other words, with dim life prospects. Schools, and the education system as a whole, must pay more attention to boys at risk.

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SCHOOL LEADERSHIP MATTERS:

THE IMPORTANCE OF EMPHASIS ON ACADEMIC SUCCESS

School principals are no longer seen only as managers and administrators but are expected to be instructional leaders – the facilitators of teaching and learning activities where the emphasis is placed on academic success. South African secondary schools function in disparate socioeconomic conditions, and principals in each distinct context face challenges that may require different leadership and management approaches. These challenges must be overcome while quality educational outcomes are strived for. *Andrea Juan* uses the Trends in International Mathematics and Science Study (TIMSS) 2019 grade 9 data for South Africa to examine instructional leadership and how its associated elements are expressed in different local contexts.

In the past, school principals have been encouraged to be transformational, distributive, managerial and participative, among other characteristics. The South African Department of Basic Education views principals as 'key delivery agents' and 'the most important partners in education'. The national education policy landscape reflects a growing consensus that a well-led schooling environment is critical for improving learner achievement. Hence, principals are required to be instructional leaders.

We use the TIMSS 2019 grade 9 data for South Africa to examine instructional leadership and how elements of it are expressed in different local contexts.

Instructional leadership

The quality of education in a school is an outcome of an effective principal. Simply put, for educators to instruct learners well, they need to be guided by competent instructional leaders who can create an environment where academic success is emphasised. Also, instructional leadership is one of the key areas covered in the Policy on the South African Standard for Principalship, which states that a school principal is required to:

- lead the learners and ensure that the school is a professional learning community;
- foster the success of all learners;
- promote a culture of achievement for all learners by communicating and implementing a common vision and mission;
- recognise good instructional practices that motivate and increase learner achievement; and
- encourage educators to implement these practices.

A common thread running through the requirements listed above is the high degree of emphasis placed on academic success. We, therefore, argue that schools that place a high emphasis on academic success are led by principals who are considered instructional leaders.

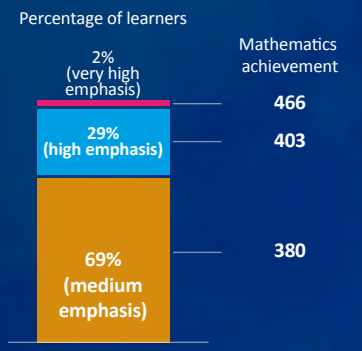
What TIMSS 2019 tells us

School principals completed a TIMSS questionnaire, and 13 items from this were used to create a scale that quantifies the emphasis placed on academic success. For

our purposes, we equate this scale to the instructional leadership of a principal. The responses were then combined and schools were rated as 'very high', 'high' or 'medium' on the emphasis on academic success index.

In Figure 1, we see that 2% of grade 9 learners attended schools that placed a 'very high' emphasis on academic success, 29% attended schools with a 'high emphasis', and 69% attended schools with a 'medium' emphasis. The pattern is different internationally, where on average more learners attended schools that placed a 'very high' (8%) or 'high' emphasis (49%) on academic success. In line with international patterns, the higher the emphasis on academic excellence, the better the achievement of learners. South African learners who attended schools that placed a 'very high' emphasis on academic success had the highest average mathematics achievement, followed by the 'high' and 'medium' emphasis categories. We found a statistically significant relationship between the level of emphasis placed on academic success and achievement.

Figure 1: Emphasis on academic success index and mathematics achievement



Source: *TIMSS 2019 South African dataset*

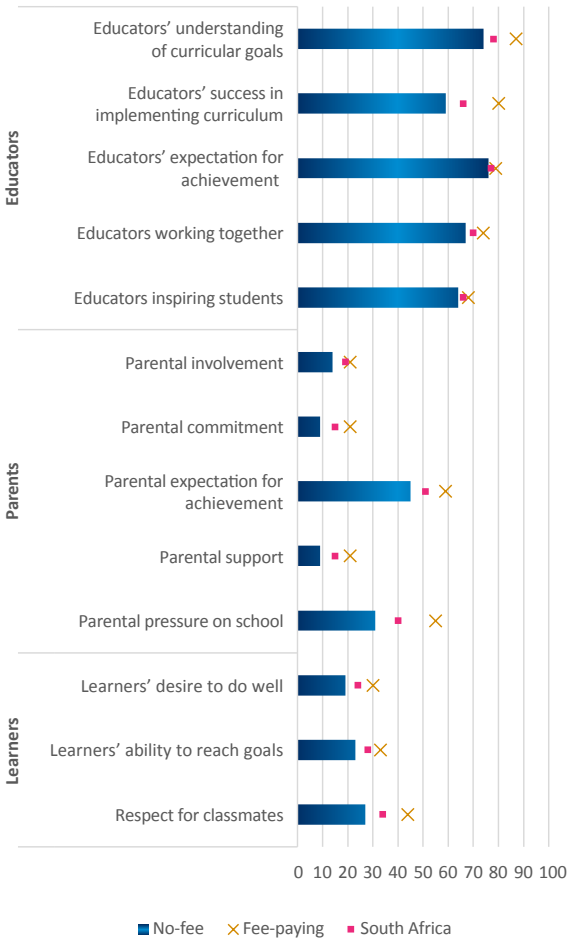
TIMSS score explained
The TIMSS achievement scale for science and mathematics has a centre point of 500. Learners who achieve a score below 400 do not have the proficiency for the grade assessed. A score between 400 and 475 indicates some knowledge of the subject, a score between 475 and 550 the ability to apply subject knowledge, and a score above 550 the ability ability to apply knowledge and to reason.

We examined what was driving these findings by looking at how principals responded to each of the questions used to derive the TIMSS index (Figure 2). We also examined

Photo: *Sydellewillowsmith, Wikimedia Commons*

the differences between public no-fee and public fee-paying schools to explore the different South African contexts. Learners in no-fee schools generally come from lower-income households, live in poorer communities, attend schools with fewer resources, and are largely taught by educators with less specialist knowledge. Conversely, learners in fee-paying schools come from largely middle-class families and better-resourced homes, as well as attend schools with better-qualified teachers.

Figure 2: Principals' perceptions of emphasis on academic success nationally and by school type



Source: *TIMSS 2019 South African grade 9 dataset*

When comparing the principals' views relating to the three groups of educators, parents, and learners, we see that principals have more positive views about educators than parents or learners. Nationally, between 60% and 80% of learners attended schools where their educators' understanding of the school's curricular goals, success in implementing the curriculum, expectation of learner achievement, and tendency to work together to improve learner achievement were 'high.' Principals felt that parents have high levels of expectations for learner achievement (51%) but their involvement (19%), commitment (15%), or support (15%) in and of school affairs is low. Views about learner attributes were all below 35%.

When disaggregating the results by school type, we found that while the patterns for the three groups were similar – principals' views were more positive about educators than parents' or learners' views about educators – there were some differences. Views from fee-paying schools' principals were consistently more positive in comparison with those from principals from no-fee public schools. The widest gaps between the school types were found on views about parents and learners. According to principals, parents from fee-paying schools showed greater support for learner achievement, ensured that learners were ready to learn, and were more actively involved in supporting the school. They also placed greater pressure on schools to ensure academic standards were met. Whereas 21% of fee-paying school principals reported that parental commitment was high, only 9% of principals in no-fee schools viewed parental support in the same way. Similarly, more than 55% of principals at fee-paying schools reported high levels of parental pressure in contrast to 31% of principals from no-fee schools. These differences are statistically significant.

Conclusion

About a third of South African grade 9 learners attended schools that placed a high emphasis on academic success – far below the international average of 57%. In addition, learners' access to a school environment where a high emphasis was placed on academic achievement was largely dependent on whether they attended a fee-paying or no-fee school. This is concerning given the positive, significant relationship between the emphasis placed on academic success and achievement. As part of continuous professional development activities, the Department of Basic Education should prioritise training principals to become instructional leaders, by focusing on the elements that constitute academic leadership.

Our analysis suggests that although a strong leader is important, effective leadership also relies on support from multiple role players both within the school (educators and learners) and beyond (parents). The contributions of parents and learners must be encouraged and fostered, and principals can do this by facilitating open communication between themselves, educators, parents and learners. They should also articulate a common vision of success for the school and inspire educators, parents and learners to work towards shared goals.

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Photo: *Ashraf Hendricks/GroundUp*

The effect of school climate:

How feelings of **safety** and **belonging** support learners' **achievement**

School climate can be thought of as the 'quality and character of school life' and has been positively associated with learners' social-emotional adjustment and self-esteem, which is strongly linked to academic achievement. Based on data from the 2019 Trends in International Mathematics and Science Study (TIMSS), *Lolita Winnaar* looks at how principals, teachers and learners perceive the climate of their schools and how this is associated with mathematics achievement.

School should be a place where learners feel safe and where they belong, so they can learn effectively and thrive academically.

'School climate' is a widely used term that generally refers to the quality and character of school life, not just for learners but for all members of the school. Researchers have found strong links between school climate and learner behaviour problems like absenteeism, bullying, aggression and victimisation. In recent years, school climate has been targeted for improvement for promoting learner well-being and thus academic success. Therefore, it is vital to understand school climate, not just as a concept but how it relates to learners' achievement.

School climate and academic achievement

Factors related to school climate are among the many predictors of achievement that can be directly affected by school policies and practices, and a school climate might be labelled positive or negative. A positive climate is said to be friendly and collegial and characterised by effective interpersonal communication between all members of the school. School climate has a significant positive impact on academic achievement in both primary and secondary schools, researchers reported in a 2019 study in the *Journal of School Health*.

School climate as measured by TIMSS

TIMSS assesses school climate using a collection of characteristics that have been shown to affect how schools function. This includes the schools' focus on academic achievement, a healthy and orderly atmosphere, school discipline and safety, teacher job satisfaction and learner perceptions of bullying.

Principal, teacher and learner perceptions of school climate

Figure 1 provides the responses of principals, teachers, and learners to the softer or intangible school climate constructs. There was little difference between the grades. Principals said that schools were very safe and orderly (86% in grade 5 and 76% in grade 9) and teachers in both grades seemed to be satisfied with their jobs (64%). However, much less than half of teachers and principals agreed that high emphasis was placed on academic success in their schools.

Figure 1: Principal, teacher and learner responses to the intangible school climate constructs

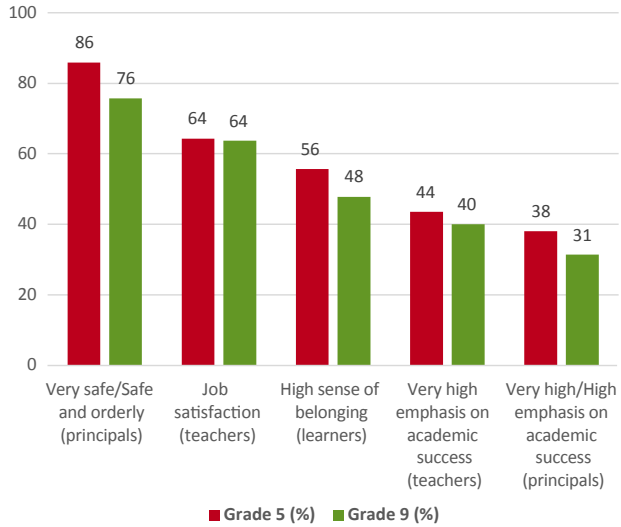
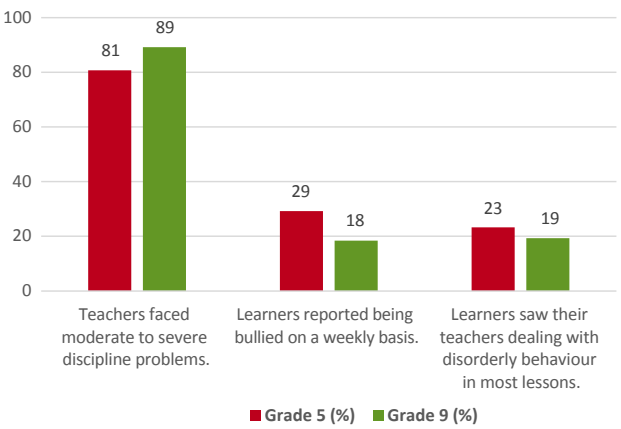


Figure 2 is focused on more tangible aspects of school climate related to learner behaviour, issues of discipline and incidences of bullying. More than 80% of teachers of grade 5 and grade 9 learners said that they were faced with moderate to severe discipline problems. Twenty-nine per cent of grade 5 learners and 18% of grade 9 learners reported experiencing some form of weekly bullying. At the grade 5 level, 23% of learners were taught by teachers who had to deal with disorderly behaviour in most of their lessons, compared with 19% of grade 9 learners.

Figure 2: Teacher and learner responses to the tangible aspects of school climate



School climate affects achievement

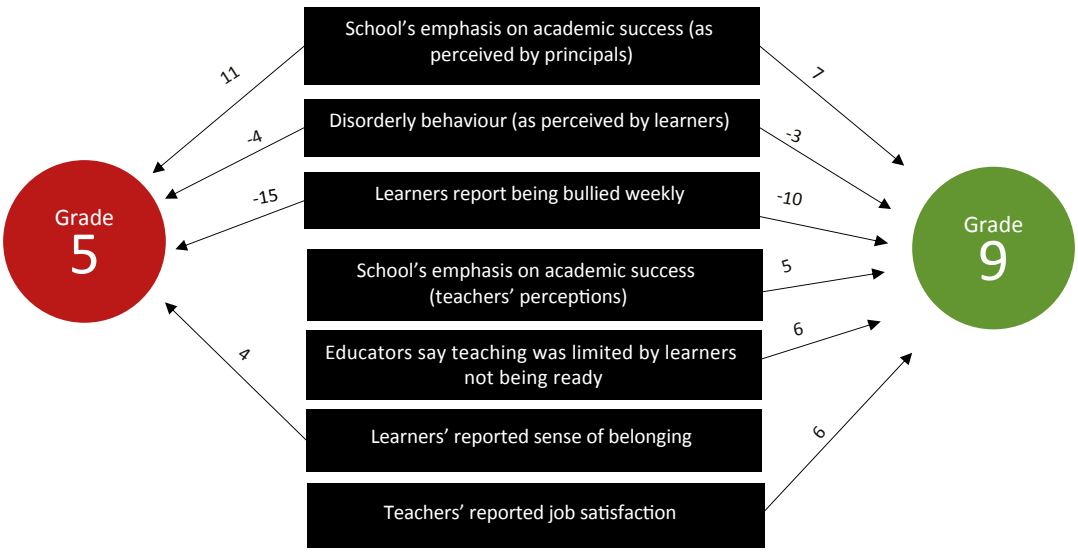
Analysis (Figure 3) shows that of the seven school climate constructs included in the models, four were significantly associated with achievement at the grade 5 level and seven in the case of grade 9.

The values in Figure 3 indicate the score difference in achievement between high and low values on each of the school climate constructs. A negative value is an indication of a negative association between achievement and the school climate construct.

At the grade 5 level, higher academic scores are linked to learners who attended schools that placed a high emphasis on academic success, where behaviour was not a problem, where learners were not bullied weekly and where learners felt they belonged.

At the grade 9 level, learners excelled when they attended schools where bullying was not a problem, where an emphasis was placed on academic success, where learners arrived at school ready to be taught, and where teachers were satisfied with their jobs.

Figure 3: Relationship between school climate and achievement (grade 5 and grade 9)



Conclusion

All school climate constructs had a significant effect on achievement and differed between primary and secondary school learners. Learner incidences of bullying had the strongest (negative) association with achievement for both primary and secondary schools. Interestingly, teacher job satisfaction was significant at the grade 9 level only. Research has shown that job satisfaction is strongly linked to intrinsic motivation and a safe and orderly environment. At the grade 5 level, teachers reported high levels of safety in schools where they taught.

The findings indicate that school climate is related to academic achievement in both primary and secondary schools. Correctly defining the key aspects of school climate by grade level can result in more effective and developmentally appropriate recommendations for the delivery of instruction and school-based interventions that promote positive school well-being and learner success.

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Photo: National Cancer Institute on Unsplash

Our first educational building blocks – the role of the home

Learners' success does not begin on the first day of school – it is founded on early engagements facilitated by parents and caregivers. The learning environment that is created at home shapes children's social and cognitive development, as well as their achievement and attitudes towards education. *Sylvia Hannan* and *Andrea Juan* use grade 5 data from the 2019 Trends in International Mathematics and Science Study (TIMSS) to explore the home context of South African primary school learners.

The family represents the first, and likely most influential, learning context for children's acquisition of language, knowledge, skills, and behaviour. The home learning environment is linked to children's cognitive and social development and plays a role in shaping their school readiness and attitudes towards learning. A 2015 study defined a cognitively stimulating home learning environment as one where a variety of interactions and activities are encouraged. Parental involvement is an important ingredient in supporting children's development. Furthermore, learners are more likely to succeed academically if they have a supportive home environment. However, not all caregivers can be involved in their children's learning due to the demands of daily life. This is particularly so for parents from lower socioeconomic backgrounds.

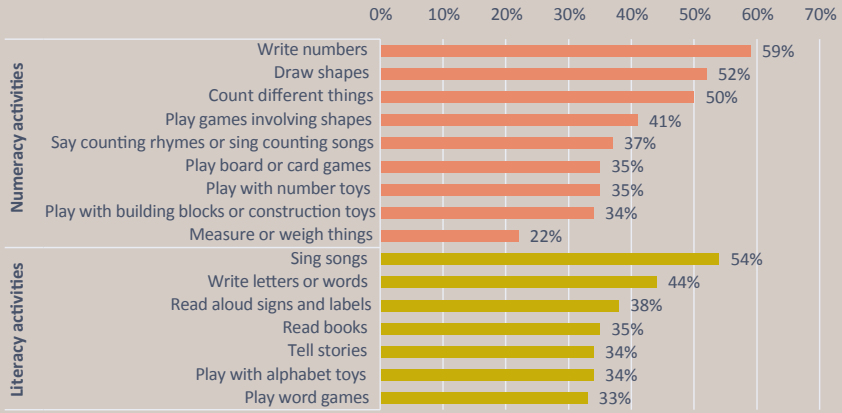
To understand more about the home learning environment in South Africa, we used TIMSS 2019 data from 11 903 grade 5 learners to look at the home context in relation to early learning activities, parental involvement in schoolwork and challenges to involvement.

Early learning activities

Parents' involvement in literacy and numeracy activities with children before they begin school has important implications for later achievement. TIMSS asked parents about what educational activities they involved their children in at home. Figure 1 shows the numeracy and literacy activities that parents conducted 'often'.

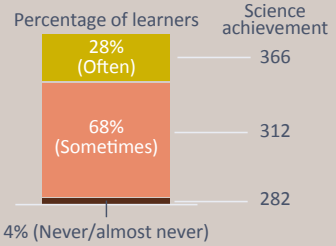
More parents reported often engaging in activities like writing numbers (numeracy) and singing songs (literacy) with their children (59% and 54% respectively). However, parents were far less likely to conduct more cognitively demanding literacy and numeracy activities. For example, only 33% reported often playing word games, and only 22% measured or weighed things often with their children.

Figure 1: Percentage of learners often involved in numeracy and literacy activities



Eighteen educational activities were combined to form a single scale (Figure 2). Sixty-eight per cent of learners were involved in these activities 'sometimes', while 28% did these activities 'often'. The frequency shows a relationship with learners' grade 5 science achievement: those learners who 'often' did these activities scored higher than those who 'sometimes' or 'never/almost never' did these activities. This highlights how important parental involvement is for children's educational success.

Figure 2: Frequency of early learning activities and achievement



The TIMSS achievement scale for science and mathematics has a centre point of 500. Learners who achieve a score below 400 do not have the proficiency for the grade assessed. A score between 400 and 475 indicates some knowledge of the subject, a score between 475 and 550 the ability to apply subject knowledge, and a score above 550 the ability to apply knowledge and to reason.

The TIMSS grade 5 results showed that parents of learners in fee-paying schools spent significantly more time with their children on early educational activities – with 36% conducting these activities 'often', compared with a quarter of parents of learners in no-fee schools. This has implications for the later academic success of learners attending different school types.

Parental involvement and support

Parental involvement helps extend teaching and learning outside the classroom, creates a more positive experience for children and can help children perform better at school. Seventy-one per cent of learners reported that someone at home asked them what they learned at school almost every day, while 65% had someone talk to them about the work they did at school with the same frequency.

Yet, despite these positive responses, learners were performing poorly. Perhaps learners were providing what they believed to be desirable responses, or the role of parents or guardians needs to extend beyond talking about schoolwork to include more interactive learning support.

Challenges parents experience with supporting schoolwork

As much as we would like all parents to be involved in their children's learning, this is not always possible. Many of these learners come from homes with limited educational attainment. Only 29% of grade 5 learners came from homes where the highest level of education completed was a post-secondary qualification. This was the case for 20% of learners in no-fee schools, while in fee-paying schools it was 46%. Additionally, about half of the learners came from homes where their parents reported that they were unable to help with their schoolwork due to it being too difficult (57%) or because the schoolwork was in a language they did not understand (51%). This is expected, as four in five learners (79%) attended school in a language that was not their home language. This would affect the support that parents could provide, as they would likely experience difficulties with the language of instruction (English or Afrikaans).

Conclusion

The involvement of parents at home is a crucial building block for learners' long-term success. However, wide disparities exist between the more and less advantaged homes in relation to the capacity of parents or caregivers to provide a stimulating home learning environment. It is promising that parents are involving their children in early learning activities from a young age, as this has important implications for their literacy and mathematics achievement; and that many parents are actively involved in their children's schoolwork, although this may be hindered by the difficulty of the subject matter and the language of instruction.

Research shows that parental involvement is most effective when parents are considered as partners in promoting educational success. In 2016, the Department of Basic Education released *Practical Guidelines: How parents can contribute meaningfully to the success of their children in schools*. Such interventions are required at the national, provincial, district, and school level, while the different contexts within which schools operate and in which children live must be taken into account. Education policies must reflect on the home environment and develop relevant interventions to encourage and support parental involvement in learning.

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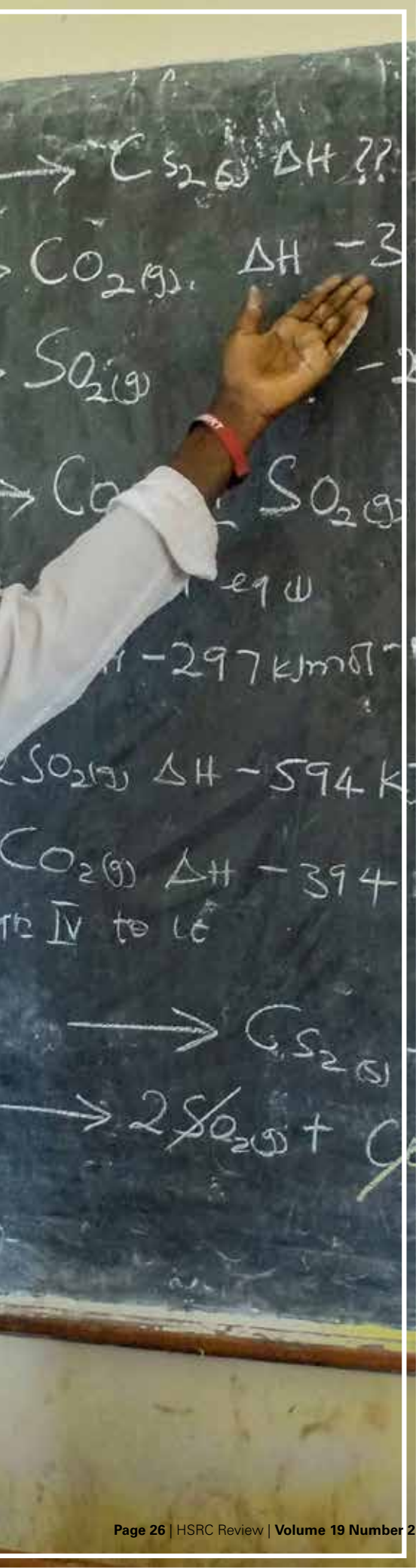
Who are our *educators* and what do they do in class?

Photo: *reteach92, Pixabay*

Most of us have memories of that one, stand-out educator who sparked our love for a particular subject. The role that such educators play in providing quality education cannot be overemphasised. How educators interact with learners is critical to learners' conceptual understanding and to their overall performance in mathematics. *Fabian Arends* discusses educator instructional quality and practices, looking at data related to grade 9 mathematics educators from the Trends in International Mathematics and Science Study (TIMSS) 2019.



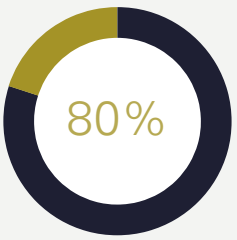
Several South African studies have shown evidence of a relationship between educators' knowledge and learners' academic performance.

Policymakers and researchers measure educator quality based on teachers' academic credentials and educational practices in the classroom. In the next section, we explore grade 9 educators' credentials and preparation, as well as classroom practices and how these relate to learners' mathematics achievement.

Educator qualification and preparation

Figure 1 shows the qualifications of grade 9 mathematics educators based on TIMSS 2019. The sample is not representative of all educators but represents the number of learners taught by educators.

Figure 1: Grade 9 educator preparation



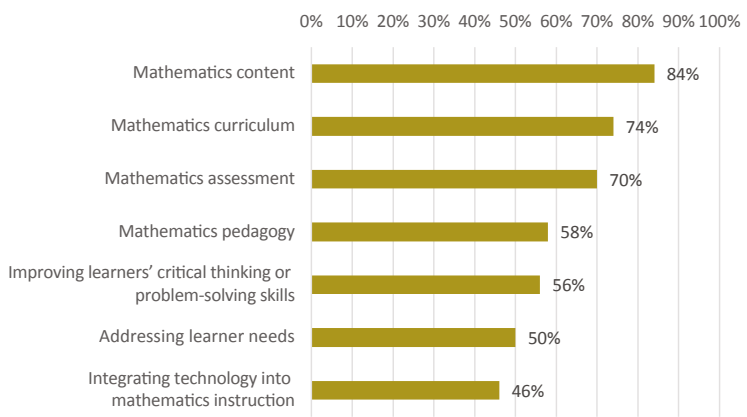
of learners were taught by mathematics educators with at least a bachelor's degree.

Four of five learners were taught by educators with a mathematics specialisation.

Eighty per cent of learners were taught by mathematics educators with at least a bachelor's degree, and 83% of learners were taught by teachers with a mathematics specialisation in their qualification. Qualifications were similar in fee-paying and no-fee schools. It is important to acknowledge that the TIMSS grade 9 mathematics educators had the subject knowledge qualifications that should equip them to contribute to higher mathematics achievements.

Figure 2 shows the professional development activities attended by these educators. The most common recent professional development activities for mathematics educators related to content, curriculum, and assessment. The lowest levels were reported for professional development activities focusing on integrating technology into instruction, addressing individual learners' needs, and improving learners' critical thinking or problem-solving skills.

Figure 2: Grade 9 educators' professional development participation



However, despite educators' qualifications, learners performed poorly. More than half of the mathematics learners (59%) scored below 400 points, implying that they had not acquired basic mathematics knowledge. More focus is therefore needed on raising achievement levels, for example by integrating technology into instruction, addressing individual learners' needs, and improving learners' critical thinking and problem-solving skills.

Instructional practices

To improve learner performance, it is important to understand how educators use classroom instruction to engage learners, how they adapt their teaching and interaction strategies, whether they apply classroom discussion as a learning tool, and how effective their feedback strategies are in enriching the learning environment.

Our focus considers two dimensions of instructional quality, namely cognitive activation and supportive climate. Cognitive activation refers to the educators' ability to challenge learners cognitively and includes instructional activities in which learners must evaluate, integrate, and apply knowledge to solve problems. Educators can create a supportive climate by providing positive feedback, listening, responding to learners' questions, and being empathetic to learners' needs, and by providing extra help when needed.

The TIMSS grade 9 educators responded to questions regarding how frequently they applied instructional practices, with responses ranging from 'every or almost every lesson' to 'never'. Table 1 shows the responses of educators where these practices were applied in every or almost every lesson.

Knowledge acquisition is important in mathematics, but learners must also be able to apply knowledge and conceptual understanding in different contexts and to analyse and reason to solve problems. Table 1 shows that, in terms of the cognitive activation instructional practices, educators did not create sufficient classroom conditions for learners to be cognitively challenged and activated.

In terms of a supportive climate, it seems that educators were engaging with learners – for example by connecting new and old topics and encouraging learners to express their ideas in class – but were not encouraging classroom discussion. However, there is a disconnect between what educators reported with regard to connecting new and old topics (77%), and what grade 9 mathematics learners reported (46%) (see article on instructional clarity on page 33). Further investigation is required to understand this disconnect between educator and learner perception in terms of educators implementing this instructional practice in class.

Table 1: Educators report on applying instructional practices during every or almost every lesson

Cognitive activation	
Ask learners to explain their answers	51%
Relate the lesson to learners' daily lives	38%
Ask learners to decide their own problem-solving procedures	29%
Ask learners to complete challenging exercises	25%
Bring interesting materials to class	18%
Supportive climate	
Link new content to learners' prior knowledge	77%
Encourage learners to express their ideas in class	58%
Encourage classroom discussion	39%

Of the eight cognitive activation and supportive climate variables included in the models, 'Link new content to learners' prior knowledge' was significantly associated with mathematics achievement. Learners taught by educators who applied this practice for half the lessons or more scored on average 17.6 TIMSS points more than learners taught by educators who did not.

Prior knowledge is considered the most important factor influencing learning and learner achievement. Research has shown that trying to learn something without having adequate prior knowledge or while having misconceptions may result in rote memorisation or surface learning. The amount and quality of prior knowledge positively influence knowledge acquisition and the capacity of the learner to apply higher-order cognitive problem-solving skills. Therefore, a good foundation-phase education is of paramount importance.

What can educators do?

The items as they appear in the TIMSS educator questionnaires (Table 1) are good examples of educator behaviour that can assist learners in making sense of information. At the district and school level, education stakeholders should ensure that more time is spent on improving instructional practices that lead to higher learner engagement and subsequent higher levels of achievement. Our findings also show that more instructional time must be dedicated to assist learners in developing higher-order cognitive skills to apply knowledge and conceptual understanding in different contexts, and to analyse and reason to solve problems.

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PARENTAL INVOLVEMENT IN HOMEWORK AS AN ENABLER OF ACHIEVEMENT

Homework has been found to influence achievement positively and improve the development of key learning skills. It is a crucial instructional practice for mathematics and science domains, where knowledge in these areas provides a foundation for lifelong success. Findings from the 2019 Trends in International Mathematics and Science Study (TIMSS) confirm the importance of homework and parental support for homework. *Jaqueline Harvey* and *Vijay Reddy* discuss the findings for grade 9 learners.

Giving learners homework to do after school carries several benefits, including extending opportunities to learn, refreshing learners' knowledge and skills, and supporting their progress through the subject content. It also allows educators to evaluate whether their instruction methods were effective and can assist learners to develop independent learning, time-management skills, and perseverance.

Studies have found that parents helping with homework is also beneficial. Expressing interest in school-related activities such as homework shows children that education and learning are important. Furthermore, homework gives parents the opportunity to assist their children in developing beliefs and behaviour that contribute to effective study skills, academic resilience, and self-regulation. The latter is critical to school success. Many parents provide support by creating homework routines, removing distractions, expressing expectations, giving encouragement, and helping children to manage their time.

The ability of parents to help with homework can, however, be limited by parental levels of education, language difference, and the complex nature of the homework. While certain affluent countries (e.g. Finland) have debated whether or not homework should be given, in South Africa, with its high levels of poverty and inequality and low achievement, homework may be enabling.

To understand the relationship between homework and parental support, we looked at homework frequency and the time spent on homework as reported by grade 9 learners who participated in the 2019 TIMSS assessment. We will examine the national data as well as the data specifically related to the Gauteng and Western Cape provinces.

Homework frequency and time spent on homework

TIMSS 2019 questionnaires asked learners how often their educator assigned them homework. Over 80% of learners reported receiving homework at least once a week. Learners were also asked the approximate time spent on homework per day. There was again a clear pattern in the national data, which was echoed in the two provinces of Gauteng and the Western Cape. More than 80% of learners spent up to an hour on homework per day and about 1 in 10 spent more than an hour per day on it. These patterns were fairly consistent in both fee-paying and no-fee schools.

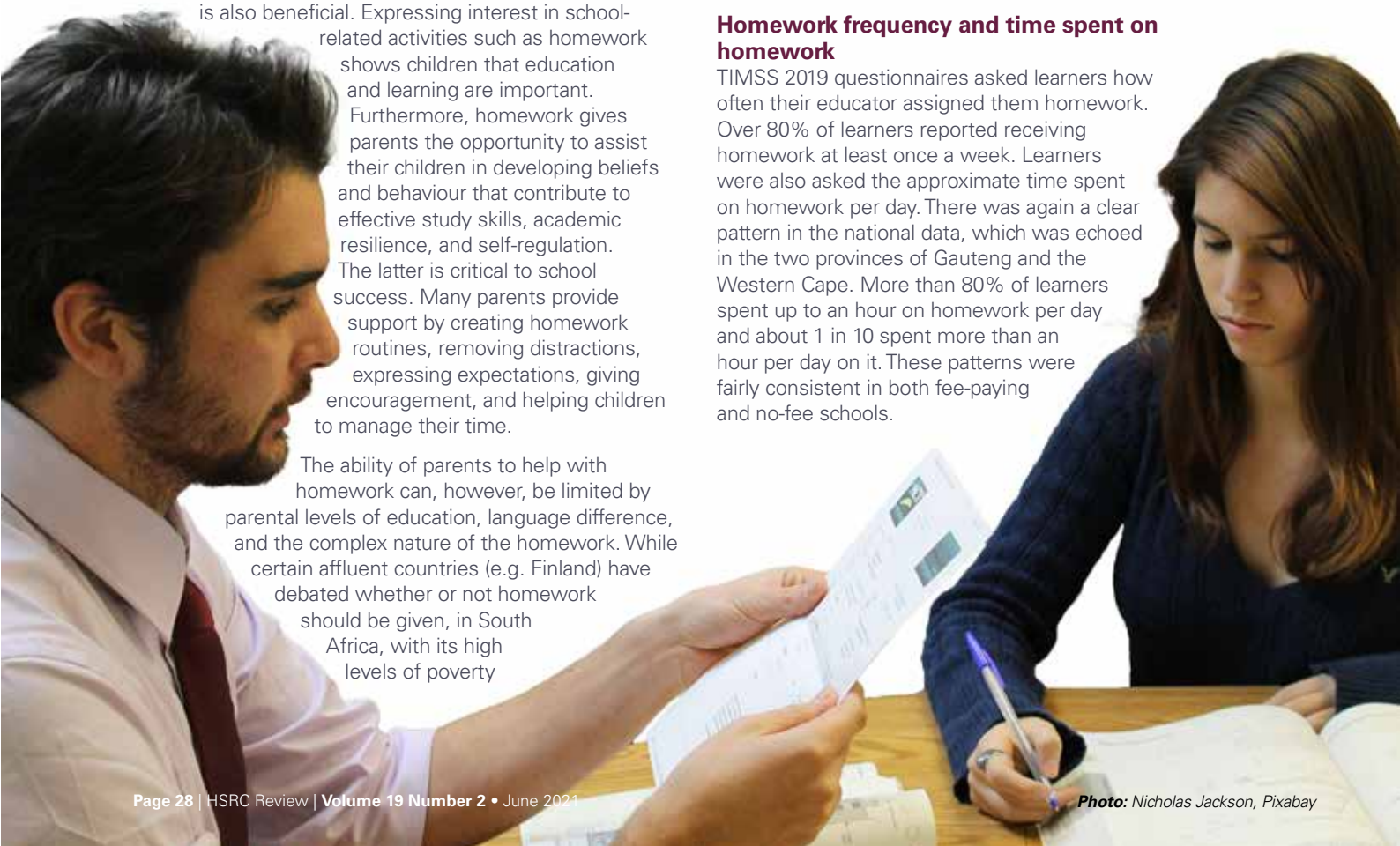


Photo: *Nicholas Jackson, Pixabay*

The positive responses were encouraging, but we need to view these self-reported data with caution, especially where grade 9 learners responded that they regularly spent about an hour a day doing both mathematics and science homework.

Parental support regarding homework

TIMSS assessed parental support for homework by asking learners if their parents checked if they set time aside for homework and if their parents checked their homework. According to responses, more than 80% of parents performed both checks at least once a month and more than half of parents did so almost every day. This trend was consistent across the national dataset and the Western Cape and Gauteng datasets.

The data showed that, in general, in both low-resource and high-resource contexts, parents provided a high level of caring and support to their children to ensure that time was spent on homework and that it was completed.

Barriers to parental assistance with homework

Certain barriers may preclude parents from substantially assisting their children with their homework. TIMSS 2019 asked learners to indicate the extent to which their parents struggled with (i) understanding the language in which their homework was provided, and (ii) the difficulty of the homework content.

Approximately two-thirds of learners (62%) nationally reported that language was at least sometimes a barrier. When these results were disaggregated into fee-paying schools and no-fee schools, there was a notable difference. A smaller proportion of learners who attended fee-paying schools (46%) reported that their parents struggled to understand the language of instruction, compared to 70% of learners who attended no-fee schools. These patterns were also reflected in the Western Cape and Gauteng provinces.

Responding to questions related to content complexity, nationally, 65% of learners reported that their parents struggled to assist them because their homework was too difficult. Responses differed slightly between learners from fee-paying schools (59%) and no-fee schools (68%). These patterns were also reflected in the Western Cape and Gauteng provinces.

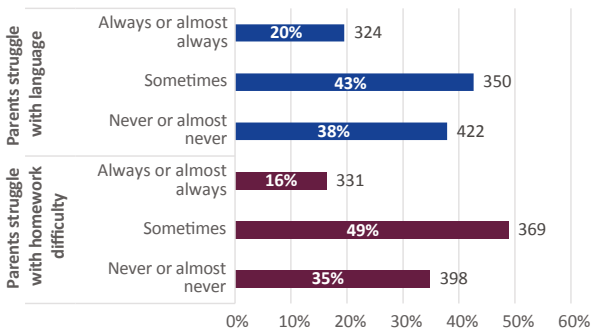
Despite parents' interest in their children's homework, the barriers that prevent South African parents from substantially assisting with homework may have implications for their children's achievement.

Barriers to parental assistance and achievement

Learners who reported that their parents struggled to understand the language or struggled with homework difficulty showed a lower achievement in the TIMSS 2019 mathematics and science assessments. Figure 1 illustrates these relationships for national learner achievement in science. Learners whose parents reportedly 'never' struggled with language achieved 422 TIMSS points, which was significantly higher than for those whose parents reportedly 'sometimes' (350) or 'almost always' (324) struggled with language. In addition, learners whose parents did not find the homework too difficult achieved 398 points, which was significantly higher than for those whose parents 'sometimes' (369) or 'almost always' (331) struggled with homework difficulty.

These results suggest that parents who can provide substantive assistance with homework content are important enablers of academic achievement. Language and content barriers are related to parental education, which has been shown to significantly impact achievement in previous TIMSS reports. It is less likely that parents who have obtained post-secondary education qualifications will experience these barriers in assisting their children with their homework.

Figure 1: Extent of barrier and relationship between barriers to parental support and science achievement



TIMSS score explained

The TIMSS achievement scale for science and mathematics has a centre point of 500. Learners who achieve a score below 400 do not have the proficiency for the grade assessed. A score between 400 and 475 indicates some knowledge of the subject, a score between 475 and 550 the ability to apply subject knowledge, and a score above 550 the ability to apply knowledge and to reason.

Conclusion

From learners' responses, it seems that homes, irrespective of their socioeconomic status, care about and are supportive of homework. However, input from parents with higher levels of education is associated with achievement. The homework support will be part of the home social capital that influences educational achievement. Nationally, 38% of learners came from homes where at least one parent had completed tertiary education. This disaggregates to half of parents of learners in fee-paying schools and one-third of parents of learners in no-fee schools. Learners whose households do not have this social capital are dependent on schools providing a high-quality education to assist them to achieve higher educational outcomes and break the cycle of low achievement and persistent poverty.

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The COVID-19 pandemic had a significant effect on learners in 2020 as school closures limited the time they spent in school and shaped their interactions with educators. It also adversely affected their well-being. *Sylvia Hannan* and *Fabian Arends* use data from the Department of Science and Innovation's Talent Development Programme (TDP) in 2020 to explore the impact of the pandemic on the learning and well-being of 568 grade 11 and 12 South African learners who participated in the programme.

Photo: *Monstera, Pexels*

Learner voices:
Learning experiences and well-being amidst COVID-19

The disruption of young people's education during the COVID-19 pandemic has been extensive and will likely have profound long-term consequences. Learners' educational attainment and progress have been negatively affected, as have their social and emotional development. School closures have also raised challenges for the most vulnerable and marginalised, worsening existing disparities within the unequal South African education system. In this article, we investigate TDP learners' perceptions of educator support, home support and their psychosocial well-being during school closures. While, as a group, these learners are not nationally representative, their responses provide us with some insights into educational interactions and well-being during 2020.

The TDP is an out-of-school supplementary programme, usually conducted over three, week-long contact sessions with high-performing grade 11 and 12 learners from working-class backgrounds. In 2020, the programme was restructured and delivered through a digital platform – the TDP Smart Classroom – in response to the national lockdown. Two-thirds (67%) of the TDP learners were selected from low-socioeconomic or no-fee schools, and Figure 1 shows key demographics of the 568 learners who completed our survey.

Figure 1: Key demographics of TDP learners

Learning and well-being amidst COVID-19

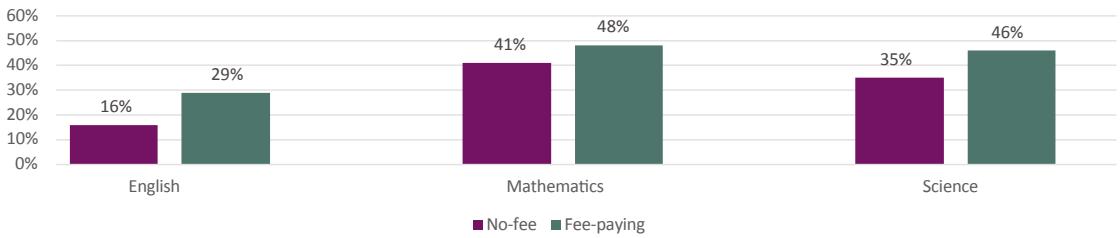
From the survey we conducted with TDP 2020 learners, we report on (i) educator support, (ii) home learning and support, and (iii) learner well-being.

Educator support to learners at home

The lockdown period presented numerous challenges to the basic education sector and served as a real-life laboratory for policy experimentation and implementation. Educators needed to be flexible and adapt their teaching and communication approaches. TDP learners were able to communicate with their educators via WhatsApp (87%), telephone (16%) and e-mail (14%), while 12% were unable to communicate with their educators.

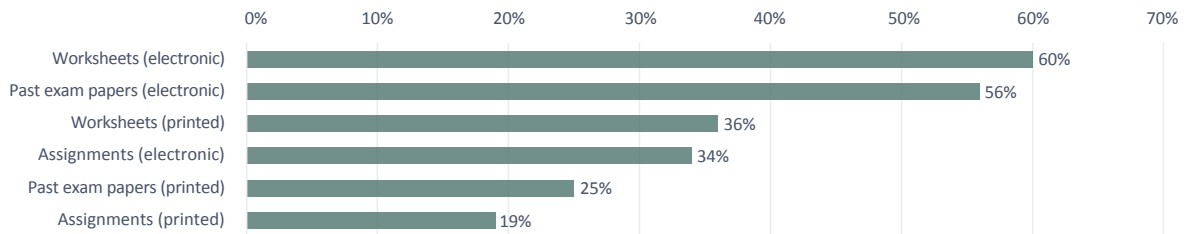
On average, about 45% of TDP 2020 learners were provided with either live or pre-recorded online lessons in mathematics, 41% in science and 22% in English. Further analysis (Figure 2) revealed that, as expected, TDP learners from fee-paying schools had greater access to both live and pre-recorded online lessons, although the access provided to learners from no-fee schools was not far behind.

Figure 2: Online lessons provided, by school type



During the school closures, the most common resources provided by educators were electronic worksheets, electronic past exam papers, printed worksheets, and electronic assignments (Figure 3). The electronic resources were accessed by more learners in fee-paying schools, while more learners in no-fee schools received printed resources. It is reassuring that educators found ways to support learners during school closures, either via e-mail or WhatsApp, or by providing printed materials.

Figure 3: Resource provision to learners

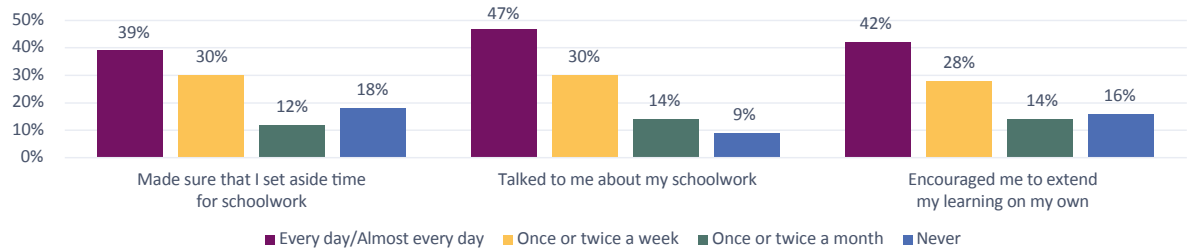


Home learning and support

We asked the TDP learners about the kind of learning activities they were involved in at home during closures. Seventy-seven per cent reported revising their schoolwork, 61% read their set schoolwork, and 58% completed past exam papers. These responses suggest that they continued with some learning activities while at home. These learners were high performers and may have been more self-motivated than other learners.

Research emphasises the importance of a supportive home environment in shaping learner achievement. Home support played an important role in keeping TDP learners on track with their learning. Figure 4 shows learner responses about interactions with someone at home: two-thirds reported that someone made sure they often set aside time for their homework, three-quarters had someone talk to them about their homework often, and 70% were often encouraged to extend their learning on their own.

Figure 4: Home involvement and support

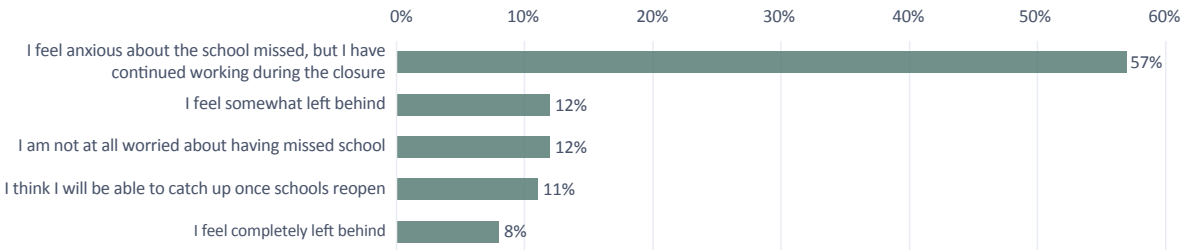


Most TDP learners reported that their families were equipped to cope with the impact of the pandemic, in terms of having sufficient information (79%) and resources (61%). However, a small percentage indicated that their families did not have sufficient information (4%) or resources (12%), which would likely be the case for many South African learners.

Learner well-being

Studies on learner psychology suggest that exposure to crises, such as public health emergencies, has enduring negative consequences for socioemotional and cognitive development. Figure 5 shows that more than half the TDP learners felt anxious about missing school during the pandemic but had continued working. A fifth felt 'somewhat' (12%) or 'completely' (8%) left behind. A quarter of learners reported not being worried at all or reported feeling they would be able to catch up when schools reopened. This was concerning, as it was unlikely that learners would catch up easily.

Figure 5: Views on learning impact



We asked learners whether they felt they required counselling or psychological support due to the impact of COVID-19. Seventeen per cent felt that they required counselling or psychological support and of these learners, a quarter felt they needed counselling to a 'high' extent.

Conclusion

COVID-19 has had a major impact on learning and well-being, and not all learners are equally equipped to deal with it. However, we have limited insights into how higher-performing learners from lower-income households navigated learning at home during school closures. This study sheds light on some aspects of learners' experiences and feelings. We have highlighted the importance of access to learning resources, home support and particularly online educator support during the pandemic.

Educators maintained communication with the TDP learners, mainly through WhatsApp, and provided access to electronic and printed resources. While it is encouraging that just under half the TDP group received online lessons, it is concerning that the rest had minimal learning engagements during this period. Continued and frequent communication between educators and learners was crucial to ensuring academic progress. According to TDP learners, they received a high level of support at home, which is a key ingredient to managing learning. Many learners were anxious about missing school but had continued working at home.

Moving forward, we need to understand more about learning experiences and well-being during this unusual time in learners' lives. Psychosocial support, increased resource provision by schools, and encouraging home support for learning will be crucial to mitigating the impact of the pandemic.

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HELP THEM UNDERSTAND:

The importance of instructional clarity in teaching and learning

An important quality of an effective educator is the ability to explain subject content clearly and to determine learners' understanding of the topic. Clear instruction enables learners to more effectively plan, set goals and acquire a stronger sense of how to judge their own progress. *Fabian Arends* uses grade 5 and grade 9 learner data from the Trends in International Mathematics and Science Study (TIMSS) to investigate instructional clarity from a learners' perspective and its impact on learning outcomes.

Classroom instruction and engagement are at the core of learning, and day-to-day classroom educational activities are likely to have a direct impact on mathematics learning. An important aspect of instructional clarity is the identification of clear teaching behaviour. The educator needs to employ instructional techniques and explanations to ensure learners' comprehension of challenging topics.

The TIMSS 2019 study provided us with the opportunity to examine the association between instructional clarity and academic achievement at the grade 5 and grade 9 levels.

The extent to which the learners in these grades agreed with statements linked to aspects of instructional clarity is indicated in Table 1.

Table 1: Grade 5 and 9 mathematics learners agreeing 'a lot' with the instructional clarity statements

	Grade 5	Grade 9
My teacher is good at explaining mathematics	77%	63%
I know what my teacher expects me to do	74%	60%
My teacher explains a topic again when we don't understand	73%	71%
My teacher does a variety of things to help us learn	70%	59%
My teacher has clear answers to my questions	68%	52%
My teacher is easy to understand	64%	49%
My teacher links new lessons to what I already know	Not asked	46%
Instructional Clarity Index	**70%**	**52%**

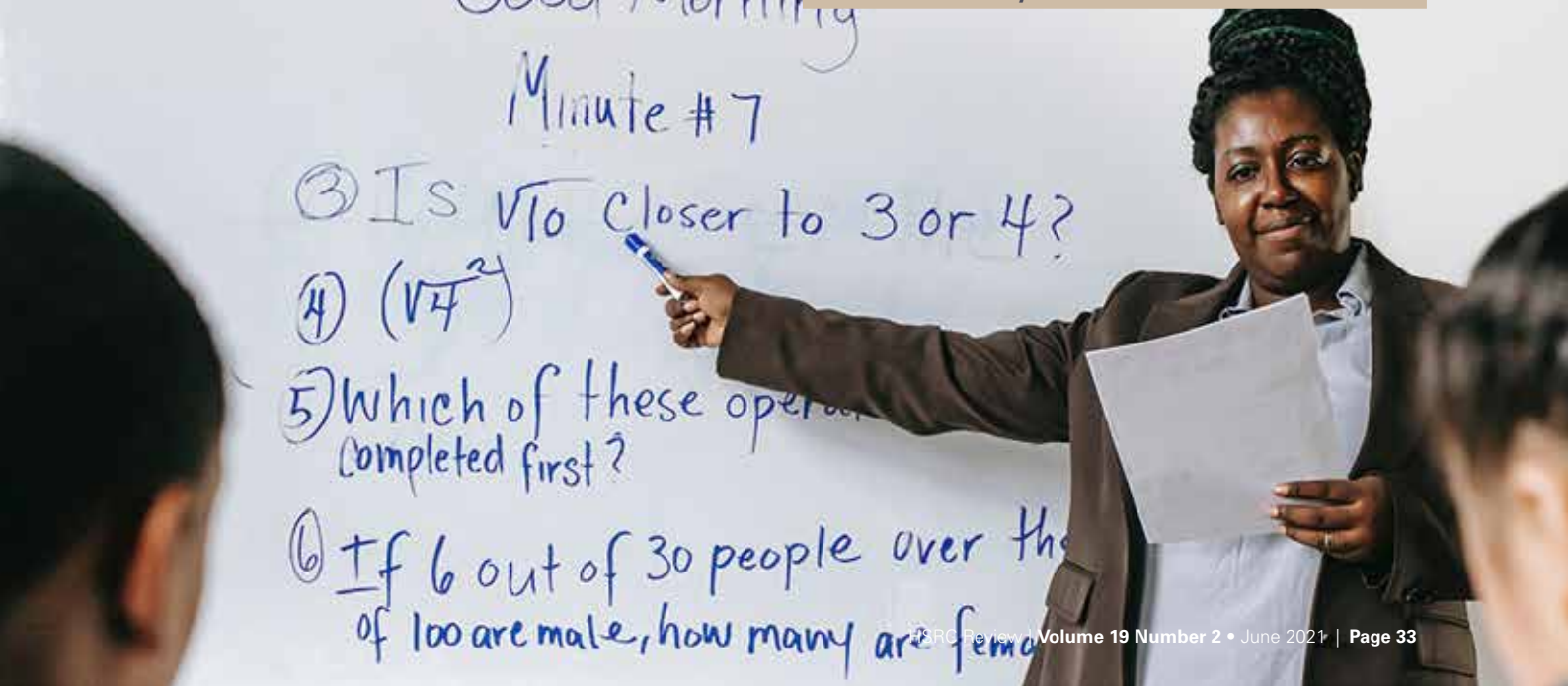


Photo: *Katerina Holmes, Pexels*

We found that grade 5 learners were more positive than grade 9 learners about the instructional practices their mathematics educators employed. At the grade 5 level, 77% of learners agreed 'a lot' that their educators were 'good at explaining mathematics'. Seventy-four per cent agreed 'a lot' that they understood what their educators expected of them, 73% that the educators repeated topic explanations, and 70% that the educators employed various techniques to help them learn.

At the grade 9 level, most learners agreed 'a lot' that their educator repeated topic explanations when they did not understand (71%), that their educator was good at explaining mathematics (63%), and that they knew what their educator expected them to do (60%). However, less than half of them agreed that their educator was easy to understand and linked new lessons to what they already knew (46%). This is worrying because new learning is constructed from prior knowledge: The more educators understand about what learners already think and the more they assist them in drawing on their prior understanding, the more likely learners are to learn well, and the less likely they are to misinterpret the subject content.

Figures 1 and 2 present the results of the Instructional Clarity in Mathematics Lessons Index for grades 5 and 9, using a composite index calculated from the seven statements linked to aspects of instructional quality in Table 1. On average, 70% of grade 5 learners reported high clarity of instruction, compared with 52% of grade 9 learners.

Figure 1: Grade 5 Mathematics Instructional Clarity Index

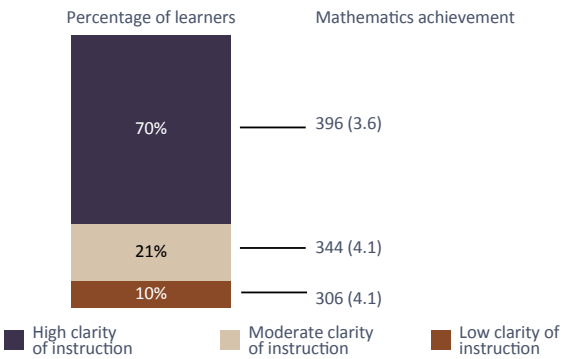
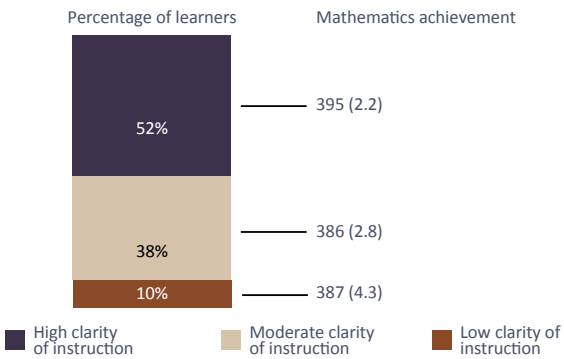


Figure 2: Grade 9 Mathematics Instructional Clarity Index



The TIMSS scale

The TIMSS achievement scale for science and mathematics has a centre point of 500. Learners who achieve a score below 400 do not have the proficiency for the grade assessed. A score between 400 and 475 indicates some knowledge of the subject, a score between 475 and 550 the ability to apply subject knowledge, and a score above 550 the ability to apply knowledge and to reason.

Grade 5 learners who reported higher clarity of instruction achieved significantly higher mathematics scores than those who reported moderate and low clarity of instruction. The achievement difference between learners who reported high clarity of instruction and those who reported low clarity of instruction was almost one standard deviation. We found a similar link at the grade 9 level, where learners who reported high clarity of instruction achieved significantly higher mathematics scores than those who reported moderate clarity.

The education ministry might well consider this finding useful when reviewing policy on educator training.

How do educators improve instructional clarity?

Our findings illustrate that clear instruction assists learners to understand the relationships between topics and concepts, and to connect what they are being taught with prior knowledge. The results of our findings suggest that the way educators interact with learners has a significant bearing on their performance. This is reflected in the significant achievement differences between grade 5 learners who reported high clarity of instruction and those who reported medium and low clarity of instruction. At the grade 9 level, where learners were more discerning regarding their educators' instructional practices, nearly half the learners reported moderate to low instructional clarity.

Educators should pay particular attention to grade 5 and 9 learners and adapt their instructional practices according to learners' needs.

The instructional clarity items in Table 1 are examples of methods of instruction that are effective at maintaining learner engagement and activate them cognitively. Learners require their educators to be clear about what they want them to know and be able to do. The teachers should explain the subject content plainly and use a variety of techniques to help them grasp the subject content.

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Miriam Tlali:

Writing freedom

Author:	Pumla Dineo Gqola
Cover design:	Riaan Wilmans
Publication date:	January 2021
ISBN (soft cover):	978-0-7969-2562-6
Format:	A5 (210 mm x 148 mm)
Extent:	216

ABOUT THE BOOK

Miriam Tlali was one of the most prolific writers of her time, working as a novelist, short-story writer, playwright, essayist, and an activist against apartheid and patriarchal confinement. She worked consistently to build the literary and political community, was one of the founders of the magazine *Staffrider*, and actively promoted the work of younger writers. Tlali held the mantle of many firsts. She was the first black woman to publish a novel in English in South Africa under apartheid, and the first black woman to significantly impact the male terrain of South African short-story writing. Fiercely opposed to censorship, she went to great lengths to undermine the will and impact of apartheid censors, and wrote many essays exposing their violence and hypocrisy. Her plays were performed on two continents but Tlali was routinely banned in South Africa – once after a mere public reading of a story before it was even published. Tlali was recognised as an important South African literary voice, and her first novel was translated into Japanese, Dutch, German and Polish, while it remained banned in the country of her birth.

Miriam Tlali: Writing freedom, a new addition to the Voices of Liberation series, brings together select original writing by Tlali with analyses of the many ways in which she imagined freedom. Like the other books in the Voices of Liberation series, this title surfaces how Tlali's writing of freedom retains relevance beyond the specific site and conditions of its emergence.

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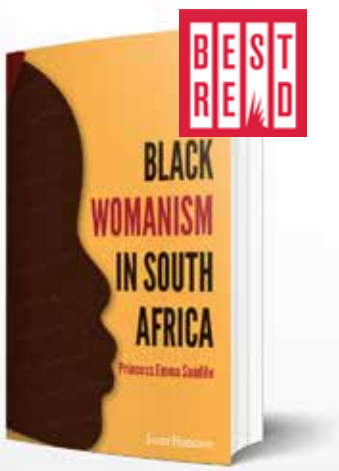

Price **R250**

Black Womanism in South Africa

Princess Emma Sandile

Author:	Janet Hodgson
Cover design:	Nazley Samsodien
Publication date:	February 2021
ISBN (soft cover):	978-1-928246-39-8
Format:	A5 (148 mm x 210 mm)
Extent:	216

ABOUT THE BOOK

Black Womanism in South Africa focuses on the life of Emma Sandile, or Princess Emma, as she was known in colonial circles in the 19th century. She was from the Rharhabe tribe and the eldest daughter of Mgolombane Sandile, leader of the Ngqika chiefdom – western amaXhosa.

Based on archival sources, press reports and fieldwork, the book focuses on her early years and adulthood. After the Cattle Killing in the mid-19th century, Governor Sir George Grey and Bishop Robert Gray planned to educate the children of the Xhosa elite as English gentlemen and women loyal to the British Empire. For this purpose, they set up the Zonnebloem College, which was run by the Anglican Church in Cape Town. Sandile and her brother Gonya were among those sent there in 1858 to undergo education. She stayed until 1863, a time described by her school mistress in an unpublished journal. In 1859, Grey granted Sandile and her brother farms in the Eastern Cape to cover their schooling.

As the first black woman landowner in Southern Africa, the earliest black woman writer in English, and the only woman to attend the Cape Colony Land Commission hearings, she was awarded another farm, which still bears her name. Sandile was one of the pioneers of black *womanism* in our country. Her courage in bridging her African tradition and the imposed Western culture was without precedence. This window into Sandile's world provides a glimpse of the problems involved in religious and social change. Her courage in fighting for her rights as she weathered the storms of fluctuating fortunes will be an inspiration to those who are following in her footsteps.

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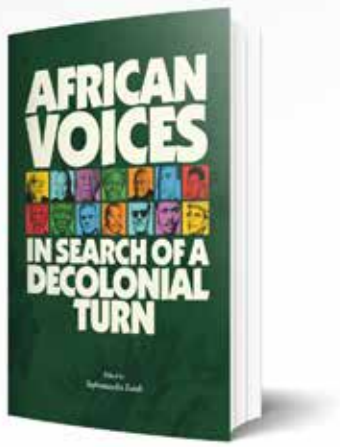

Price **R290**

African Voices:
In search of a decolonial turn

Author:	Siphamandla Zondi
Cover design:	Dudu Coelho
Publication date:	March 2021
ISBN (soft cover):	978-0-7983-0531-0
Format:	170 mm x 240 mm
Extent:	346

ABOUT THE BOOK

This book discusses the contributions of African thinkers and actors to what Paul Tiyambe Zeleza calls recentering Africa, in discussions about major African phenomena. It provides input into ongoing debates about what it means to decolonise knowledge, the university, the school, the library, the archive, and the museum. The book responds to the need for Africa-centred literature to be used by those who teach, discuss and implement the decolonisation and Africanisation of knowledge, power and being. The book aims to stimulate further conversations about many other African voices engaged in epistemic disobedience.

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Contemporary Campus Life:
Transformation, manic managerialism and academentia

Author:	Keyan G Tomaselli
Cover design:	Carmen Schaefer
Publication date:	March 2021
ISBN (soft cover):	978-1-928246-26-8
Format:	A5 (148 mm x 210 mm)
Extent:	256

ABOUT THE BOOK

Contemporary Campus Life presents an argument that the COVID-19 pandemic has brought about an ecological correction that affects all of humanity, one that management theory can learn from. Tomaselli presents a cogent critique of managerialism with an incisive satirical humour that delves into the quirks of university academia. This analysis shows how these quirks affect lived relations in the academy's practice of science, teaching and reasoning. The academy is not a safe space, but given the truth that the COVID-19 pandemic has exposed, Tomaselli shows how it could become so.

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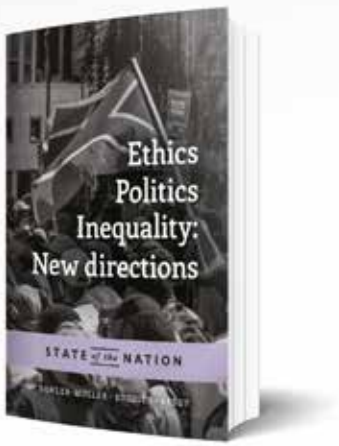

Price **R350**

Ethics, Politics, Inequality: New directions

State of the Nation

Authors:	Narnia Bohler-Muller, Crain Soudien and Vasu Reddy
Cover design:	Riaan Wilmans
Publication date:	March 2021
ISBN (soft cover):	978-0-7969-2596-1
Format:	240 mm x 168 mm
Extent:	448

ABOUT THE BOOK

Multi-layered inequalities and a sense of insecurity have long been the hallmark of South African life. However, the uncertainties of COVID-19 have led to greater shared experiences of vulnerability among South Africans. This volume of *State of the Nation* offers perspectives that may help us navigate our way through the 'new normal' in which we find ourselves. Foremost among the unavoidable political and socioeconomic interventions that will be required are interventions based on an ethics of care.

A democratic post-apartheid state with an ethics of care at its core will emphasise human connectedness and the value of human bodies. This requires the state to insert care as an essential attribute into all the diverse contexts that structure needs, desires, and relations of power. It requires of us, as individuals and as communities, the will and understanding to combat and counter poverty and inequality and thus to improve the state of the nation. Now, more than ever, we need to prioritise an ethics of care.

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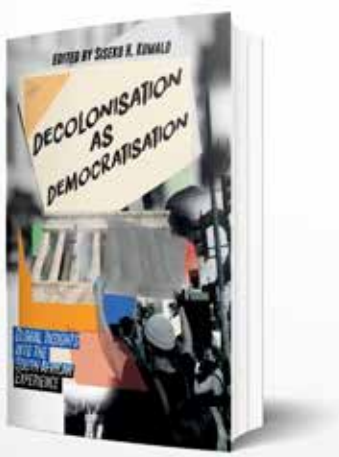

Price **R250**

Decolonisation as Democratisation:

Global insights into the South African experience

Author:	Siseko Kumalo
Cover design:	Shane Platt
Publication date:	February 2021
ISBN (soft cover):	978-0-7969-2600-5
Format:	A5 (168 mm x 240 mm)
Extent:	240

ABOUT THE BOOK

Decolonisation as Democratisation considers three factors that define the debate in South Africa on the decolonisation of the academy: educational aspiration, competing interests and political contestation. The book explores an academic system that attempts to serve two masters, the first being the historical beneficiaries of the academy (i.e. whiteness) and the second being those who pin their hopes on the system in order to escape abjection (i.e. blackness or indigeneity).

The book highlights how the recent thrust of decoloniality protects the ideal of academic freedom and presents an argument that this ideal should not be used to protect the interests of the historical beneficiaries.

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Making Institutions Work in South Africa

Author:	Daniel Plaatjies
Cover design:	Conor Ralphs
Publication date:	March 2021
ISBN (soft cover):	978-1-928246-36-7
Format:	235 mm x 168 mm
Extent:	248

ABOUT THE BOOK

Making Institutions Work in South Africa recognises that institutions are the pillars of a constitutional democracy; they evolve through the actions of persons; and as organisations they form structures of dynamic, shared social patterns of behaviour. The book offers interdisciplinary critical commentary by scholars, analysts and experts regarding strategic thinking, structural and functional impediments and facilitators to institutions.

Price **R350**

Migrants, Thinkers, Storytellers:

Negotiating meaning and making life in Bloemfontein, South Africa

Authors:	Jonatan Kurzwelly and Luis Escobedo
Cover design:	Nicolaas Jooste
Publication date:	March 2021
Cover illustration:	Jolanta Banowska
ISBN (soft cover):	978-0-7969-2598-5
Format:	240 mm x 168 mm
Extent:	256

ABOUT THE BOOK

Migrants, Thinkers, Storytellers develops an argument about how individual migrants, coming from four continents and diverse socioeconomic backgrounds are in many ways affected by a violent categorisation that is often nihilistic, insistently racial, and continuously significant in the organisation of South African society. The book also examines how relative privilege and storytelling function as instruments for migrants to negotiate meanings and shape their lives. It employs narrative life-story research as its guiding methodology and applies various disciplinary analytical perspectives, with an overall focus on social categorisation and its consequences. The featured stories stress how unsettled, mutable and in flux social categories and identities are – just as a messy pencil sketch challenges clear definitions.

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