

# The South African TIMSS 2019 Grade 9 Results

## Building Achievement and Bridging Achievement Gaps

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## EXECUTIVE SUMMARY: SOUTH AFRICAN TIMSS 2019 GRADE 9 RESULTS

The Trends in International Mathematics and Science Study (TIMSS) assesses mathematics and science knowledge of fourth and eighth grade learners around the world. South Africa has participated in six of the seven TIMSS cycles (1995–2019), at the eighth or ninth grade, providing a rich dataset spanning 24 years. Participation in TIMSS allows countries to evaluate their learners’ achievements and compare their achievements with other countries, as well as to monitor the health of their education systems over time. In addition, the study allows the exploration of how various contextual factors are associated with mathematics and science achievement.

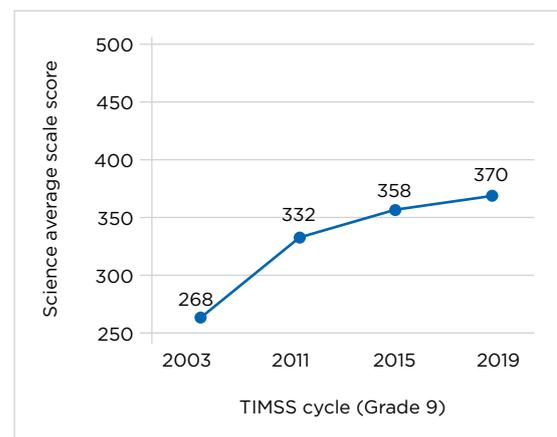
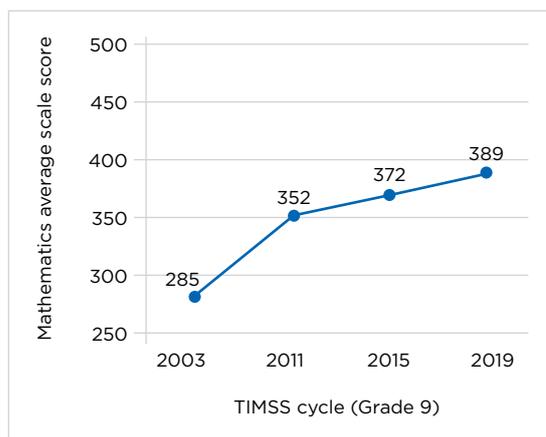
In August 2019, we collected achievement and contextual data in 519 schools from 519 principals, 543 mathematics and science educators, and 20 829 learners. The results of this TIMSS 2019 Grade 9 study are presented in this report.

Findings from previous TIMSS cycles show that South African educational performance outcomes have improved, although they are still low and unequal. Achievement gaps continue to be linked to socioeconomic backgrounds and school contexts. The TIMSS 2019 results extend our understanding of the achievement trajectory of our learners. We have retold the predictable story of advantage begetting advantage at one end of the distribution and compounding disadvantage at the other end. But schools have the capacity to positively change educational outcomes. In this report (using descriptive, inferential and multivariate analyses) we have teased out factors within schools that could promote improved mathematics and science achievement.

### MATHEMATICS AND SCIENCE ACHIEVEMENTS, ACHIEVEMENT TRENDS AND GAPS

In TIMSS 2019, South African Grade 9 learners achieved an average of 389 (SE 2.3) on the mathematics assessment and 370 (SE 3.1) on the science assessment. This amounts to an increase of one standard deviation (104 TIMSS points for mathematics and 102 points for science) between the 2003 and 2019 cycles.

In 2019, 41 percent of mathematics learners and 36 percent of science learners had acquired the basic subject knowledge and skills. This amounts to a fourfold increase for mathematics (from 11 percent to 41 percent) and a threefold increase for science (from 13 percent to 36 percent) from the TIMSS 2003 to 2019 cycles. The South African Gross Enrolment Rate for the secondary school phase increased from 83 percent in 2003 to 101 percent in 2018. Despite the expansion of the education system, and the challenges associated with accommodating and effectively teaching more learners, achievement still improved.



South African achievement continues to be unequal and socially graded. Achievement gaps, though decreasing, continue to be linked to socioeconomic backgrounds, gender, the spatial location of the school, proficiency in the language of the test, the extent of overage learners, attending fee-paying versus no-fee schools, and the province where the learner lives and attends school.

This confirms the well-known narrative that advantage begets advantage and home disadvantage continues to impede learning outcomes at school.

The distributional achievement inequality measured by the difference in achievement scores between the 5<sup>th</sup> and the 95<sup>th</sup> percentile decreased from the 2003 to the 2019 cycles: by 68 points for mathematics, and 64 points for science.

## THE MATHEMATICS AND SCIENCE CURRICULUM AND ACHIEVEMENT

TIMSS is not a simple assessment, with two-thirds of the assessment items requiring learners to use higher cognitive skills of application and reasoning. The South African Grade 9 Curriculum and Assessment Policy Statements (CAPS) has a higher focus on the skills of knowing and solving routine problems, and there is limited emphasis on the skills of applying and reasoning.

Three-quarters of the TIMSS mathematics and science content was taught in the South African curriculum before learners took the assessment. When compared to the average national mathematics and science scores, learners performed significantly better in the algebra and physics content areas, and experienced more difficulty in the content areas of geometry, data and probability, biology and Earth sciences. Learners achieved significantly lower scale scores for mathematics and science knowledge items, whereas the scale scores were significantly higher for mathematics reasoning items and science applying items.

## INDIVIDUAL CHARACTERISTICS AND ACHIEVEMENT

One in three learners were overage for Grade 9. Learners who were the correct age for the grade achieved significantly higher scores than those who were overage.

Just over one in four learners spoke the language of the test at home, which is used as a proxy for language proficiency. Learners who were more proficient in the language of the test achieved significantly higher mathematics and science achievement scores than those who were less proficient.

Girls significantly outscored boys in both mathematics and science achievement, but when there was an interaction between gender and age the relationship changed.

## HOME AND ACHIEVEMENT

The socioeconomic conditions in which learners live and learn explained 24 percent of the achievement variance. According to the *Home Asset Scale*, South African households were categorised as 20 percent high socioeconomic status (SES), 25 percent medium SES and 55 percent low SES. There was a significant, positive association between the SES of the household and learners' mathematics and science achievement, thus confirming the enduring finding in the literature that the circumstance of one's birth continues to be a predictor of a learner's educational and life trajectory.

Only one in three learners' parents were able to assist them with homework regularly as they could understand the language of the homework and the content (proxy for parental education level). There was a significantly positive association between the extent that parents were able to assist learners with homework, and their mathematics and science achievement scores.

## THE SCHOOL AND ACHIEVEMENT

There is a high achievement variation among schools. The poverty rank of the school (quintile) a learner attends explained 26 percent of the achievement variance. Learners in no-fee schools were almost exclusively Black African, and 99 percent of Indian and White learners and 70 percent of Coloured learners attended the better resourced and functioning fee-paying schools.

The majority of South African schools and learners reported a school climate that was unsafe, and had high levels of discipline problems, incidences of bullying and disorderly behaviour in classrooms. All three school climate factors (safe and orderly schools, school discipline, and learner bullying) were significantly associated with mathematics and science achievement.

There is a continuity of home to school conditions where learners from lower income households with fewer assets enter schools with limited access to resources and poorer teaching and learning cultures, perpetuating existing social inequality.

## CLASSROOMS AND ACHIEVEMENT

Resources matter for educational success. Learners achieved higher results in schools with better resources. Having their own textbook and workbook was significantly associated with higher mathematics and science achievement. Overall, 85 percent of mathematics learners and 54 percent of science learners had their own workbooks, and two-thirds of mathematics learners and half of the science learners had their own textbooks. The results provide clear evidence that learners with their own workbooks and textbooks achieved higher achievement scores than learners who either shared or did not have a textbook or workbook.

The number of learners in a class matters: 70 percent of TIMSS Grade 9 learners were taught in classes with more than 40 learners. Learners attending classes with less than 40 learners achieved significantly higher scores than those in classes with more than 40 learners.

The quality of instructional practices matters. Learners taught by educators rated as providing high instructional clarity achieved significantly higher on the mathematics and science assessments.

## LEARNER ATTITUDES TO MATHEMATICS AND SCIENCE

An interesting finding from the study relates to non-cognitive influences, e.g. self-reflection of ability. Learner attitudes and experiences at school explained 16 percent of the achievement variation. Learners who had high confidence in their mathematical and scientific abilities achieved higher scores.

## IMPLICATIONS AND RECOMMENDATIONS FROM THE TIMSS RESULTS

The South African state, society and labour market are all committed to ensuring that schools have better educational outcomes. Thus, we highlight five high-level recommendations to improve educational outcomes.

1. **Continue monitoring achievement:** Periodic assessment of educational achievement is important. TIMSS is the only 24-year achievement trend study that provides valuable information to monitor and evaluate the South African education system. South Africa must continue participation in international trend studies. We must continue participation in TIMSS 2023, especially at Grade 9 to maintain the trend achievement line.
2. **Well-functioning schools matter:** About 30 percent of schools (mostly fee-paying) are considered better functioning schools. The state should focus on whole school development with a key target being to increase the number of well-functioning schools. The focus should be on how to improve school climate by encouraging the emphasis on academic success and making schools safer places for learners and educators. Unsafe, disruptive classrooms, where bullying is frequent and discipline is a problem, disrupt the learning environment and hinder performance. School safety is a matter that needs to be tackled by the state, society, school and the home.
3. **Resource availability and how it is used matters.** In the short term, all learners must have their own mathematics and science workbook and textbook, especially in remote rural schools. Decreasing class sizes is also an important piece of the resourcing puzzle: learners should be taught in smaller classes measured by actual headcount rather than learner-educator ratios. The longer-term strategic interventions needed include increasing access to computers and Internet connectivity, and the availability of science laboratories.

4. We need to know more about **educators and their utilisation in schools**. We do not have definitive information about educators' qualifications, their subject specialisations, how they are utilised in schools and how classroom timetabling occurs. We need a national audit to have a better understanding of these matters and to identify the factors constraining educational outcomes.
5. Pay greater attention to the **non-cognitive dimensions** that are associated with achievement. Learners' self-reflection of their mathematics and science abilities (self-efficacy) was positively associated with achievement. In this bidirectional relationship, the honest appraisal by learners of their ability to learn mathematics and science should be the start of a conversation about the effort that learners need to put into the learning process, and the support they require, in order to improve their achievement.

## IN CONCLUSION

The South African education system remains a fragile one, and it has been dealt a major blow by the coronavirus pandemic. It is predicted that the country will not reach the achievement targets set out in Medium Term Strategic Framework if we continue on the current trajectory.

TIMSS 2019 has provided an evaluation of the current South African education system, indicating that our learners are still experiencing multiple barriers to achievement. As is the case with nearly all research investigating the influences on learner achievement, there is no 'silver bullet' that will fix low performance, remediate years of social imbalance throughout the system, and penetrate the indelible association between one's circumstances at birth and economic and social outcomes; but these results, like those of previous TIMSS studies, highlight that there are many areas that can and must be improved.