

EXECUTIVE SUMMARY: GAUTENG TIMSS 2019 GRADE 9 RESULTS

In the 2019 cycle of the Trends in International Mathematics and Science Study (TIMSS), the Gauteng Department of Education (GDE) sought more precise provincial achievement estimates and therefore increased the provincial sample size from 30 to 150 schools at the Senior Phase (Grade 9). The data from the Gauteng province sample form part of the overall South African results and are also reported separately as a self-standing entity called a 'benchmarking participant' in the international TIMSS report.

Participation in TIMSS allows countries and benchmarking participants to evaluate their learners' achievement and monitor the health of their education systems over time. TIMSS also allows participants to compare their achievement against other participants. In addition, the study allows the exploration of how contextual factors are associated with learners' mathematics and science achievement.

In August 2019, the Human Sciences Research Council (HSRC) collected achievement and contextual data in 150 secondary schools from 150 principals, 150 mathematics educators, 150 science educators, and 5 633 Grade 9 learners in the Gauteng province. The analysis of data was informed by a framework focused on how to build achievement and bridge achievement gaps.

MATHEMATICS AND SCIENCE ACHIEVEMENT, ACHIEVEMENT TRENDS AND ACHIEVEMENT GAPS

The Gauteng Grade 9 learners achieved an average scale score of 421 (SE 3.0) on the mathematics assessment and 422 (SE 3.9)¹ on the science assessment. The results showed that 58 percent of mathematics learners and 57 percent of science learners had acquired the basic content knowledge and skills in each subject. Furthermore, six percent of mathematics learners and 11 percent of science learners achieved at the higher levels (scores higher than 550 points) meaning that they were able to solve complex problems.

From 2011 to 2019, Gauteng's achievement improved by a statistically significant 24 points in mathematics and 26 points in science. The annual average achievement improvement rate from 2011 to 2019 was 3 points for mathematics and 3.3 points for science, both lower than the improvement rates for South Africa over the same period.

While the Gauteng province achieved the second highest score of the South African provinces, there was high achievement inequality within the province. The achievement difference, between the 5th and 95th percentiles, was 253 points for mathematics and a higher 324 points for science.

Figure 1 reports the achievement inequality when the scores were disaggregated by the quintile rank of the school. The average mathematics and science achievement scores of learners in Quintile 1 to 3 schools were not statistically different from each other, while learners in Quintile 4 schools achieved significantly different scores from all other quintiles. Learners in Quintile 5 and independent schools had similar achievement.

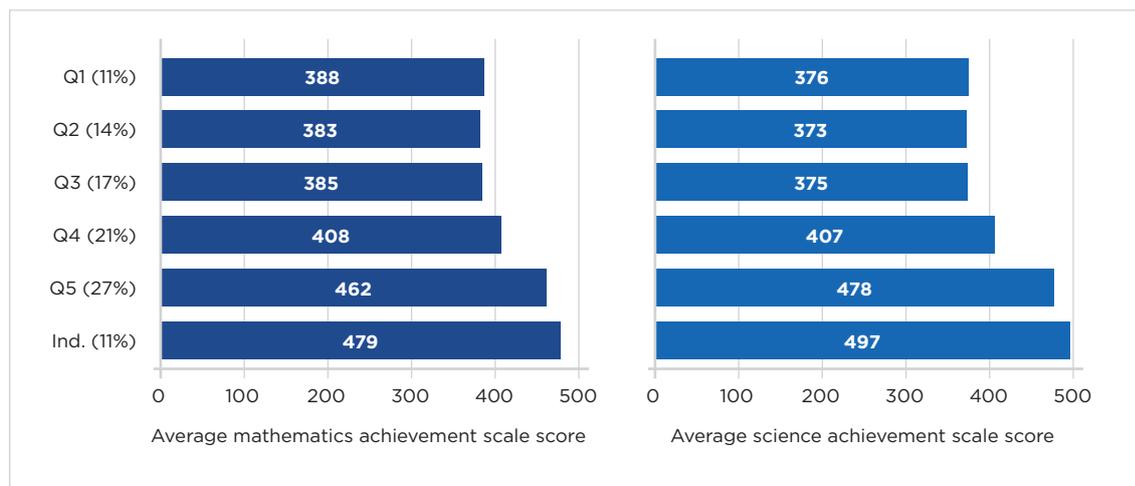
On average, close to 40 percent of learners in Quintile 1, 2 and 3 schools; 55 percent in Quintile 4 schools and 80 percent in Quintile 5 and independent schools demonstrated that they had acquired basic mathematical and scientific knowledge and skills.

Gauteng learners in no-fee schools achieve similar scores to the average national mathematics and science scores. As in previous TIMSS cycles, achievement scores were unequal and socially graded. Achievement gaps in the Senior Phase continued to be linked to where learners lived and learned: their socioeconomic background, gender and age, school fee-paying status and their proficiency in the language of the test.

The GDE is made up of two unequal systems of education. The achievement gap (average difference between no-fee and fee-paying schools) was 61 points for mathematics and 81 points for science.

1 The standard error (SE) indicates how accurate the mean of any given sample is likely to be compared to the true population mean.

Figure 1: Gauteng mathematics and science achievement scale scores by quintile rank of the school (% learners)



INDIVIDUAL CHARACTERISTICS AND ACHIEVEMENT

The learner characteristics of gender, age and proficiency in the language of the test explained 21 percent of the achievement variance.

The average age of girls was 0.5 years younger than boys, with 70 percent of boys at the correct age for the grade compared to 86 percent of girls. Although boys scored significantly higher achievement than girls, these results must be interpreted in line with the selection effects of staying in school.

One in five learners were overage for Grade 9 (26% in no-fee schools and 17% in fee-paying schools). Learners who were the correct age for the grade achieved significantly higher mathematics and science scores than those who were overage.

The Gauteng province is linguistically diverse with representation of all 11 official languages in schools. In TIMSS 2019, isiZulu was the most common language spoken at home (22%) followed by Setswana (16%) and Sesotho (15%).

Four in ten Grade 9 Gauteng learners (22% in no-fee schools and 51% in fee-paying schools) reported that they frequently spoke the language of the test at home, which is used as a proxy for proficiency in the language of the assessments. Learners who were more proficient in the language of the test achieved significantly higher mathematics and science scores than those who were less proficient.

THE HOME ENVIRONMENT AND ACHIEVEMENT

The Gauteng households where learners lived were categorised as 37 percent high socioeconomic status (SES), 34 percent as medium SES and 29 percent as low SES. Close to half the learners (46%) in no-fee schools, compared with 17 percent of learners in fee-paying schools, came from homes characterised as low SES.

The socioeconomic conditions (assets and parental education) in which learners live and learn explained 23 percent of the achievement variance. 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.

THE SCHOOL AND ACHIEVEMENT

The profile of learners by population group² in Grade 9 was: 83 percent Black African, eight percent White, seven percent Coloured, and two percent Indian/Asian. Learners attending Quintile 1, 2, 3 schools were, on average, 96 percent Black African; and Quintile 4 and independent schools were 80 percent Black African. Black African learners made up 64 percent of the Quintile 5 cohort. Almost all White and Indian/Asian learners attended Quintile 5 and independent schools.

The school climate matters for higher achievement. Most learners attended schools that were characterised by unsafe conditions, discipline problems in the school and classroom, learner bullying and low emphasis on academic success. Learners who were in safer schools, with hardly any discipline problems in the school and classroom, and who hardly experienced any form of bullying, achieved significantly higher mathematics and science scores.

There were significantly higher levels of ill-discipline, unsafe conditions and incidences of bullying behaviours in no-fee schools than in fee-paying schools. Parental expectations and support for learner achievement were significantly higher in fee-paying schools than in no-fee schools.

CLASSROOMS AND ACHIEVEMENT

The average class size of the Grade 9 TIMSS sample was 41 learners. In Quintile 1 to 4 schools, the average class sizes clustered around 45 learners, and in Quintile 5 schools the average was 36 learners. Learners in classes with fewer than 37 learners achieved significantly higher average mathematics and science scores than those in classes with more than 37 learners.

Over 80 percent of Gauteng learners had access to their own mathematics and science workbooks, while three-quarters of learners had access to their own textbooks. Access to one's own workbook or textbook influenced learners' achievement score.

While the Gauteng province has implemented plans to improve access to digital devices and introduce digital platforms for learning and instruction, the access and usage of computers in Grade 9 classrooms was very low. Two-thirds of Grade 9 learners had no access to a computer in their classes.

The educator and classroom characteristics explained 24 percent of the achievement variation.

LEARNER ATTITUDES TO MATHEMATICS AND SCIENCE

Positive attitudes and higher achievement go hand in hand, with each mutually reinforcing the other. Learner attitudes explained 13 percent of the achievement variation. Learners who liked learning mathematics and science and had a realistic self-reflection of their mathematical and scientific abilities (i.e. confidence in learning) achieved higher scores.

THE MATHEMATICS AND SCIENCE CURRICULUM AND ACHIEVEMENT

The TIMSS assessment had two-thirds of the items requiring learners to use the higher cognitive skills of application and reasoning. Comparatively, the South African Curriculum and Assessment Policy Statements (CAPS) has a higher focus on the skills of knowing and solving routine problems, and a limited emphasis on the skills of applying and reasoning.

Three-quarters of the TIMSS mathematics and science content was reported to have been taught in the CAPS before learners took the assessment. When compared to the Gauteng average mathematics scores, learners performed significantly better in algebra and experienced more difficulty in the data and probability as well as geometry content domains. When compared with the average provincial science score, learners scored significantly lower in the biology domain and significantly higher for the physics domain.

2 This is based on self-identification from learners reports. We use the term population group only to trace changes historically.

IMPLICATIONS AND RECOMMENDATIONS FROM THE TIMSS GAUTENG RESULTS

From the Gauteng TIMSS 2019 results we highlight four high-level recommendations to improve educational outcomes at the Senior Phase in Gauteng province.

1. **Continue monitoring achievement:** As a higher performing South African province, but lower in international comparisons, the Gauteng province must continue participation in the periodic international trend assessment to monitor its achievement standing in relation to other countries and to monitor the achievement changes over time.
2. **Improve school functionality and promote whole school development:** There is large achievement variation between no-fee and fee-paying schools, as well as within fee-paying schools. Our findings support the GDE strategic priority for whole school development and improving functionality. Schools and classrooms do have the capacity to positively improve educational outcomes. In Gauteng, the educator and classroom factors explained 24 percent of the achievement variance, while the principal and school factors explained 28 percent of the variance.
3. **Focus on school safety and academic climate:** Compared to most TIMSS countries, Gauteng schools experienced higher levels of safety problems, ill-discipline in schools, disruptive behaviour in classrooms and incidences of bullying. Similarly, there was a lower reported emphasis on academic success compared to most TIMSS countries. These school climate factors are positively associated with achievement. Improving on these characteristics and indicators includes examining what the school does to improve the school climate, as well as how it involves the learners, parents and the community in school matters. In implementing measures for safer schools, we recommend an additional performance indicator for school safety be included, namely 'the number of schools that have regular community fora and parent engagements related to school safety and learning'.
4. **Pay greater attention to the non-cognitive and attitudinal dimensions related to learning as a lever to improve learning:** Learner confidence is part of a virtuous cycle that should be fostered and developed: doing well in mathematics and science improves feelings about, and one's capability in, these subjects. The honest reflection of one's capability is a recognition of what needs to be done to improve achievements. We recommend that the GDE periodically administers short, validated instruments to obtain a profile of learners' attitudes and motivation. The results from this tool could be the basis of the conversation between the school and learners to improve their attitudes and behaviours towards learning.

CONCLUSION

The Gauteng education system, while one of the better performing South African provinces, is highly unequal with wide achievement gaps. The achievement patterns are reflective of both the lingering apartheid legacy as well as the present socioeconomic and sociocultural conditions. While many factors that influence learning outcomes may be outside of the control of schools (e.g. home SES or violence in the community), there are practices within the school that can be changed to improve achievement.

To improve the education level of Gauteng, there must be intentional and carefully targeted programmes for Quintile 1, 2 and 3 schools, as well as programmes to improve achievements in the better resourced schools. Raising the educational outcomes of these two groups of learners will contribute to raising the overall provincial achievement levels. These interventions are even more important in the wake of the coronavirus pandemic that has dealt the system a major blow – especially for the most vulnerable learners.

In 2019 only 37 percent of Gauteng learners sat for the mathematics matriculation (Grade 12) examination compared with 63 percent for the mathematical literacy subject. However, close to 60 percent of the Grade 9 learners achieved scores above 400 points in TIMSS, signalling that they had acquired the basic skills and competences in mathematics and science. These learners would more than likely succeed if they chose mathematics in the Further Education and Training phase, and it is therefore important to investigate why learners are not choosing to continue with mathematics after Grade 9.

TIMSS 2019 has provided an evaluation of the 2019 Gauteng education system, confirming that learners experienced multiple barriers to achievement. While there is no one 'silver bullet' that will fix low performance and remediate years of social imbalance throughout the education system, these provincial results highlight that there are many areas that can and must be improved.