EXECUTIVE SUMMARY: WESTERN CAPE TIMSS 2019 GRADE 9 RESULTS

In the 2019 cycle of the Trends in International Mathematics and Science Study (TIMSS), the Western Cape Education Department (WCED) 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 Western Cape sample forms part of the overall South African results, and is 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 with other participants. In addition, the study allows the exploration of how contextual factors are associated with mathematics and science achievement.

In August 2019, the Human Sciences Research Council collected achievement and contextual data in 149 secondary schools from 149 principals, 170 mathematics educators, 162 science educators, and 5 351 Grade 9 learners in the Western Cape. The analysis of data was informed by a framework focused on how to build achievement and bridge achievement gaps. The results of the Western Cape analyses are presented in this publication.

MATHEMATICS AND SCIENCE ACHIEVEMENT, ACHIEVEMENT TRENDS AND ACHIEVEMENT GAPS

The Western Cape Grade 9 learners achieved an average scale score (refer to Reader's Guide) of 441 (SE 4.4) on the mathematics assessment and 439 (SE 5.1) on the science assessment. The results showed that 64 percent of mathematics learners and 60 percent of science learners had acquired the basic content knowledge and skills in each subject. Furthermore, 13 percent of mathematics learners and 17 percent of science learners achieved at the higher levels as their scores were higher than 550 points, meaning that they can solve complex problems.

From 2011 to 2019, the Western Cape's achievement improved by 33 points in mathematics (significant at the 95 percent confidence level) and 26 points in science (significant at the 90 percent confidence level). The average achievement improvement rate from 2011 to 2019 was 4.1 points per year for mathematics and 3.3 points per year for science, both lower than the improvement rates for South Africa over the same period.

While the Western Cape achieved the highest scores of the South African provinces, there was high achievement inequality within the province. The achievement difference, between the 5th and 95th percentiles, was 295 points for mathematics and a higher 366 points for science.

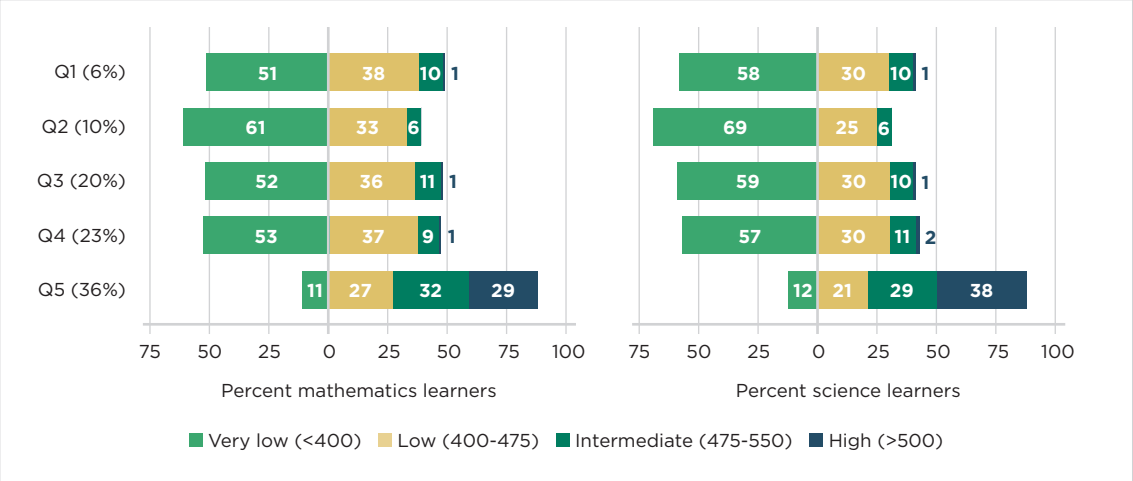
Figure 1 reports the achievement inequality when the scores were disaggregated by the quintile rank of the school (refer to Reader's Guide). The average mathematics and science achievement scores of learners in Quintile 1 to 4 schools were not statistically different. Learners in Quintile 5 schools achieved higher scores, with the average achievement difference between learners in Quintile 4 and 5 schools being 107 points for mathematics and 132 points for science.

The WCED is made up of two unequal systems of education. Learners in Quintile 1, 2, 3 and 4 schools scored, on average, over one standard deviation lower than learners in Quintile 5 schools.

On average, 54 percent of mathematics learners, and 60 percent of science learners in Quintile 1 to Quintile 4 schools had not acquired basic knowledge, compared with about 10 percent of mathematics and science learners in Quintile 5 schools.

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 live and learn: their socioeconomic background, gender and age, location of schools, school quintile rank and learner proficiency in the language of the test.

Figure 1: Percentage of Western Cape mathematics and science learners reaching international achievement benchmarks by quintile rank (% learners)



Note: Independent schools, which constituted five percent of the learners, are omitted.

INDIVIDUAL CHARACTERISTICS AND ACHIEVEMENT

The learner characteristics of gender, age and proficiency in the language of the test explained 22 percent of the achievement variance.

The average age of girls was 0.3 years younger than boys, but 67 percent of boys were at the correct age for the grade compared to 81 percent of girls. Although boys scored significantly higher than girls, these results must be interpreted in line with the selection effects of staying in school.

One in four learners were overage for Grade 9 (33% in no-fee schools and 21% 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 Western Cape is less linguistically diverse than other South African provinces with learners reporting speaking one of three languages at home: Afrikaans (40%), isiXhosa (33%) or English (24%). Two-thirds of Western Cape learners (37% in no-fee schools and 80% 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 most 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 Western Cape households where learners live were categorised as 39 percent high socioeconomic status (SES), 30 percent medium SES and 31 percent low SES. There was a different SES profile for learners in no-fee and fee-paying schools: One in two learners (54%) in no-fee schools, compared with one in five learners (18%) 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 29 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 group[1] in Grade 9 was: 43 percent Coloured, 41 percent Black African, 12 percent White and 1 percent Indian/Asian. Learners attending Quintile 1, 2 and 3 schools were predominantly Black African, while learners in Q4 and Q5 schools were predominantly Coloured. Coloured learners made up just over half of the Quintile 5 cohort and Black African learners' 15 percent. Most White and Indian/Asian learners attended Quintile 5 schools, making up just over a quarter and two percent of the Quintile 5 cohort, respectively.

There was high achievement variation among schools. The quintile rank of a school that a learner attended explained 37 percent of the achievement variance. Race and class characteristics intersect to influence achievement.

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 commitment and support for learner achievement, as well as learners respecting academic excellence, and having the ability and desire to do well in school, were higher in fee-paying than in no-fee schools.

CLASSROOMS AND ACHIEVEMENT

The average class size of the TIMSS sample was 40 learners. In Quintile 1 to 4 schools the average class sizes clustered around 46 learners, and in Quintile 5 schools the average was 35 learners.

Nine in ten Western Cape learners had access to mathematics workbooks, while two-thirds had access to their own science workbooks and textbooks. Three-quarters of learners were in Grade 9 classes with access to more than 20 computers and achieved higher scores than those in classes with less than 20 computers.

The educator and classroom characteristics explained 37 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 19 percent of the achievement variation. Learners who liked learning mathematics 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 average Western Cape mathematics scores, learners performed significantly better in algebra, experienced more difficulty in the data and probability as well as geometry content areas, and scored significantly lower for knowledge items. When compared with the provincial science average scores, learners scored significantly lower in the biology content and on knowledge items, whereas the scores were significantly higher for science applying items.

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

IMPLICATIONS AND RECOMMENDATIONS FROM THE TIMSS WESTERN CAPE RESULTS

From the Western Cape TIMSS 2019 results we highlight four high-level recommendations to improve Western Cape educational outcomes.

1. **Continue monitoring achievement:** As a higher performing South African province, but low in international comparisons, the Western Cape must continue participation in the periodic international trend assessments to monitor its achievement standing in relation to other countries and to monitor the achievement changes over time.
2. **Raise achievement levels of learners in Q 1, 2, 3 and 4 schools:** There are two educational systems in the Western Cape. The average achievement of learners in Quintile 5 schools masks the 'true' provincial achievement level. While the Quintile 1, 2, 3 and 4 schools had, on average, similar achievement scores, the demographic, socioeconomic and sociocultural characteristics of the schools and learners were different. Thus, there must be a set of intentional and carefully targeted programmes for schools within each of Quintile 1, 2, 3 and 4, as well as specific WCED indicators that measure performance in these schools. For example, WCED's strategic indicator OI 7.3. – "average percentage of learners in Grade 9 attaining acceptable outcomes in Language and Mathematics" should be changed to the "average percentage of Grade 9 learners in *Quintile 1, 2, 3 and 4 schools* attaining acceptable outcomes in Language and Mathematics".
3. **Focus on school safety and academic climate:** Compared to most TIMSS participants, the Western Cape 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 participants. These school climate factors were positively associated with achievement. Improving on these characteristics and indicators includes examining what the school does 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 forum and parent engagements".
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 WCED 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 Western Cape education system, while one of the better performing South African provinces, is highly unequal with wide achievement gaps. The achievement gaps were linked to socioeconomic backgrounds, gender and age, linguistic access, school location and the quintile rank of the school attended.

The present 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 the schools (e.g. home SES or violence in the community), there are practices within the school that can change to improve achievement.

To improve the education level of the Western Cape, there must be intentional and carefully targeted programmes for Quintile 1, 2, 3 and 4 schools. Schools in each of these quintile ranks need carefully calibrated interventions to improve teaching and learning, leading to raised educational achievements. Raising the educational outcomes for Quintile 1, 2, 3 and 4 schools will increase the overall provincial achievement. 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.

It is perplexing and concerning that only 30 percent of learners sat for the mathematics matriculation (Grade 12) examination compared with 70 percent for the mathematical literacy subject, as two-thirds of Grade 9 learners achieved scores above the TIMSS low achievement benchmark of 400 points. These learners would more than likely succeed if they chose mathematics in the FET phases. We must investigate why learners are not choosing mathematics in the FET phase, even though they demonstrated they have the mathematical abilities.

TIMSS 2019 has provided an evaluation of the 2019 Western Cape 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.