## TIMSS 2019

## Highlights of Western Cape Province Grade 9 Results in Mathematics and Science

## Human Sciences Research Council, 11 December 2020



## Appreciation

- The MEC, HoD and WCED for recognizing the importance of evidence-based decision making and the bravery to measure achievements.
- WCED provincial coordinators and district officials who supported the TIMSS data collection.
- Principals, educators and learners who allowed us into your schools and classrooms.
- The HSRC research and administrative teams for going beyond the call of duty.


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## What is TIMSS?

- TIMSS is a cross-national assessment of the mathematics and science knowledge of 4/5th Grade and 8/9th Grade learners.
- TIMSS collects achievement data and contextual information from learners, schools, educators and parents in order to explain achievement.
- South Africa tested at grade 8 level in 1995, 1999, 2003 and at grade 9 level in 2003, 2011, $2015 \& 2019$. Only 25 years achievement dataset.
We tested at grade 5 from 2015



## TIMSS in Western Cape

- The South African provincial sample is around 30 schools each.
- Provincial achievement estimates are not precise and there is a high estimation error - referred to as the Standard Error.

For example, the Western Cape TIMSS 2015 mathematics achievement was 391 points with a Standard Error of 11. This means the WC score was somewhere between $391+/-22$.
Thus, the estimated score was between 366 to 413.

- For more precise provincial measures, two provinces, Gauteng and Western Cape, increased their sample size to 150 schools in TIMSS 2019.
- Called a "benchmarking" entity like Quebec, Moscow City, Dubai, Madrid.




## TIMSS Research Questions

What is the mathematics and science achievement and achievement gaps in TIMSS 2019?

What is the mathematics and science achievement trend from 2011 to 2019?

## What influences mathematics and science achievement in Western Cape?

## Who participated in TIMSS 2019?



## STORY 1: Achievements

- Achievement and Ability
- Achievement Trends
- Achievement for Provinces, Fee-status of schools, Gender
- Achievement Gaps and High Performing Learners
- Western Cape in relation to International Achievement
- Match between TIMSS and CAPS


## TIMSS Items: Grade 9 Mathematics

| Country | Percent full credit |
| :--- | :---: |
| Singapore | 90 |
| Japan | 89 |
| Cyprus | 63 |
| Portugal | 57 |
| International average | 56 |
| Italy | 55 |
| Malaysia | 52 |
| Lebanon | 51 |
| Iran, Islamic Rep. of | 51 |
| Israel | 46 |
| Western Cape (9) | 44 |
|  |  |
| United States | 39 |
| Gauteng (9) | 37 |
| France | 36 |
| Kuwait | 32 |
| Saudi Arabia | 30 |
| South Africa (9) | 27 |
| Chile | 26 |
| Morocco | 26 |

Content Domain: Geometry
Cognitive Domain: Applying
Description: Determines the value of an angle in an irregular quadrilateral given the values of the other angles


What is the value of $x$ ?


The answer shown illustrates the type of response that would receive full credit (1 point).

## TIMSS Items: Grade 9 Science

| Country | Percent full credit |
| :--- | :---: |
| Singapore | 85 |
| Chinese Taipei | 69 |
| Israel | 57 |
| Kuwait | 49 |
| International average | 48 |
| Jordan | 48 |
| Saudi Arabia | 40 |
| Iran, Islamic Rep. of | 40 |
| Georgia | 36 |
| Morocco | 34 |
| Western Cape | 33 |
| Malaysia | 33 |
| Gauteng | 32 |
| New Zealand | 30 |
| Lebanon | 29 |
| Chile | 24 |
| South Africa | 20 |

## Content Domain: Biology

Cognitive Domain: Reasoning
Uescription: txpiains now roor garaens in cities neip reauce the amount or carbon aıoxiae in the air

In some large cities, owners of large buildings and houses have installed gardens on the roofs. Having more gardens helps reduce the amount of carbon dioxide in the air.
How does increasing the number of gardens help reduce the amount of carbon dioxide in the air?

The trees and plants in the gardens take carbon dioxide out of the air during photosynthesis and give off oxygen.

The answer shown illustrates the type of response that would receive full credit (1 point).

## Western Cape Achievement 2011 to 2019



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## Achievement 2011 to 2019



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## Distribution of achievement scores, 2019

|  | Average <br> Scale Score (SE) |
| :---: | :---: |
| Mathematics | $441(4.4)$ |
| Science | $439(5.1)$ |

## Science has wider distribution and starts at lower scores than mathematics. Science needs attention.

## TIMSS 2011 to 2019



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## Achievement by Ability Benchmarks



## Science

Communicate understanding of concepts related to biology, physical, and earth sciences in a variety of contexts.

Apply knowledge and understanding of concepts from biology, physical, and earth sciences.

Have and apply basic knowledge of biology, physical, and earth sciences.

Have some knowledge of biology, physical, and earth sciences.


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## Grade 9 Mathematics Achievement, by Province, 2019

Link between achievement \& Provincial macro-economic indicators


Government

## Provincial Achievement, Grade 5, 2019


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## Grade 9 Achievement, by School Poverty Index




## Mathematics Achievement \& Ability by Fee-status



■ Advanced ■ High
$\square$ IntermediateLow$<400$

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## Science Achievement \& Ability by Fee-status



■ Advanced ■ High $\square$ Intermediate Low $\square<400$


## Achievement by Gender and Gap

## MATHEMATICS

447 (5.4)

SCIENCE
445 (6.2)


MATHEMATICS
436 (5.1)

SCIENCE
434 (6.1)

The achievement differences between girls and boys are not statistically significant

Boys had significantly higher achievements in Number, Physics and Earth Sciences and for items requiring applying and reasoning.

## Writing Gap: Multiple choice and Constructed response questions



## Match between TIMSS and CAPS

|  | Percentage items in TIMSS <br> Curriculum | Percentage Match between <br> TIMSS \& CAPS |
| :---: | :---: | :---: |

CONTENT DOMAINS

| Number | 30 | 97 |
| :--- | :---: | :---: |
| Algebra | 30 | 78 |
| Geometry | 20 | 86 |
| Data and Probability | 20 | 54 |
| COGNITIVE DOMAIN | 35 | 70 |
| Knowing | 40 | 20 |
| Applying | 25 | 10 |
| Reasoning |  |  |

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## Western Cape Grade 9 performance

 internationallv| Country | Math Score |
| :--- | :---: |
| Singapore | 616 |
| Chinese Taipei | 612 |
|  | 500 |
| Portugal | 500 |
| TIMSS Scale Centerpoint | 497 |
| Italy | 461 |
|  | 446 |
| Molaycin_\| | 443 |
| Iran, Islamic Rep. of | 441 |
| Qatar | 441 |
| Chile | 429 |
| Western Cape, RSA (9) | 421 |
| Lebanon | 420 |
| Gauteng, RSA (9) | 413 |
| Jordan | 411 |
| Egypt | 403 |
| Oman | 394 |
| Kuwait | 389 |
| Saudi Arabia | 388 |
| South Africa (9) |  |
| Morocco |  |

## Learnings from Achievement

- From 2011 to 2019, Western Cape achievement scores significantly increased by 33 TIMSS points for mathematics and 26 TIMSS points for science.
- The best achievement improvements were among the lowest performing learners.
- In 2019, just over six in ten learners demonstrated they had acquired basic mathematical and science knowledge and one in three achieved above the intermediate benchmark (apply mathematical knowledge)
- Educational policy focus on the twin imperatives of equity by decreasing the achievement gap and increasing proportions of learners at higher performance levels by improving the achievement standard for all learners.
- What are the achievement targets for the Western Cape for next 8 years?


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## From the bivariate analysis

- Unequal Home Conditions
- Educator Preparation and Professional Development
- School Climate and Achievement
- Educational Resources in Schools


## Home Assets and Educational Resources



## Unequal starting points: learners with higher levels of home educational resources tended to score higher than their counterparts with less resources.

## Language of Learning and Teaching

Percent of learners

| Percent of learners |  |  |  |
| :---: | :---: | :---: | :---: |
| Mathematics Achievement (SE) |  | Science <br> Achievement (SE) | Learners who speak the LOLT |
| 459 (6.0) | $\begin{gathered} 65 \% \\ \begin{array}{c} \text { (always/almost } \\ \text { always) } \end{array} \end{gathered}$ | 466 (6.7) | at home more often score higher than those who speak it less frequently, especially in language-intensive subjects like science. |
| 409 (3.8) | $\begin{gathered} 32 \% \\ \text { (sometimes) } \end{gathered}$ | 392 (5.0) | Only $37 \%$ of learners in no-fee schools speak the LOLT at home, in comparison to $80 \%$ of |
| 397 (8.6) | $\begin{aligned} & 3 \% \\ & \text { (never) } \end{aligned}$ | 370 (12.7) |  |


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## Educator Preparation and Experience

## Parents and society view schools as an equalizing opportunity for learners from low

 SES households
of learners were taught by mathematics and science educators with, at least, a

Bachelors degree

## 76\%

of learners were taught by
educators with a
mathematics specialisation

## 88\%

of the learners were taught by educators with a science specialisation
of learners were taught by mathematics or science educators with, more than 10 years of teaching experience

Mathematics and science educators with similar qualification and years of experience taught learners in fee-paying and no-fee schools.



## Professional Development Participation and Needs: Mathematics

| Professional activities | Educators Participation <br> in Professional <br> Development | Educators Indicating a <br> Need in Professional <br> Development |
| :--- | :--- | :--- |
| Content | 85 | 53 |
| Curriculum | 79 | 46 |
| Assessment | 62 | 50 |
| Pedagogy/ Instruction | 58 | 62 |
| Integrating Technology into Instruction | 58 | 80 |
| Improving Learners' Critical Thinking or Problem-Solving Skills | 47 | 80 |
| Addressing Individual Learner Needs | 40 | 75 |

Focus must be placed on translating these development activities into higher achievement levels

## Classroom engagement practices

- Classroom instruction and engagement are at the core of the learning process
- Classroom activities engaged in - likely to directly impact learning

| Independent problem solving in mathematics |  |  |
| :---: | :---: | :---: |
| Every or almost every lesson |  | 42\% |
| About half the lessons | 30\% |  |
| Some lessons | 26\% |  |
| Never |  |  |


| Conducting experiments in science |  |
| :---: | :---: |
| At least once a week | 30\% |
| Once or twice a month | 26\% |
| A few times a year | 28\% |
| Never |  |

## School Climate: Academic emphasis

## Positive and healthy school climates create conditions for effective teaching and learning

Mathematics
Achievement

Percent of learners
5\%

science \& innovation

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## School Climate: Safe and Orderly Schools

| Mathematics Achievement | Percent of learners | Science Achievement |
| :---: | :---: | :---: |
| 521 (14.9) | 19\% <br> (very safe and orderly) | 558 (13.9) |
| 437 (6.7) | $\begin{gathered} 49 \% \\ \begin{array}{c} \text { (somewhat safe } \\ \text { and orderly) } \end{array} \end{gathered}$ | 431 (8.2) |
| 401 (5.6) | $\begin{aligned} & 33 \% \\ & \text { (less than safe } \\ & \text { and orderly) } \end{aligned}$ | 382 (6.2) |

- $25 \%$ in fee-paying and $7 \%$ in no-fee schools reported 'very safe and orderly' schools
- Internationally $48 \%$ of learners attended very safe and orderly schools




## Learners Experiencing Bullying Behaviours



- $45 \%$ of learners in no-fee schools and $56 \%$ of learners in fee paying schools "never or almost never" experienced bullying at school
- Verbal bullying constituted the highest form of bullying followed by physical and low incidences of cyber bullying
- Internationally $63 \%$ of learners reported they were never or almost never bullied




## Resources: Textbooks and Workbooks



## Resources: Computers Available for Use by Learners



- Computer availability at the Grade 9 level is similar for fee-paying and no-fee schools
- Usage for instruction varied


## Conclusion

- Thank you for the opportunity to share the TIMSS Results with you
- We would like to continue this process with WCED as you make sense of the results and how you would like to infuse the results into your planning for mathematics and science subjects.

