

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.

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?

Grade 4/5

- 58 countries and 6 benchmark participants
- South African sample is 300 schools
- Western Cape is part of the South African National sample

Grade 8/9

- 39 countries and 7 benchmark participants
- WC sample of 150 schools is part of both the National and Provincial study
- **Realised sample:** 149 schools; 171 Mathematics & 165 Science teachers; 149 principals; 5 351 learners

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

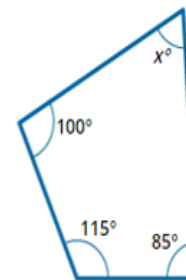
TIMSS Items: Grade 9 Mathematics

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 ?

$x =$

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

Description: Explains how roof gardens in cities help reduce the amount of carbon dioxide in the air

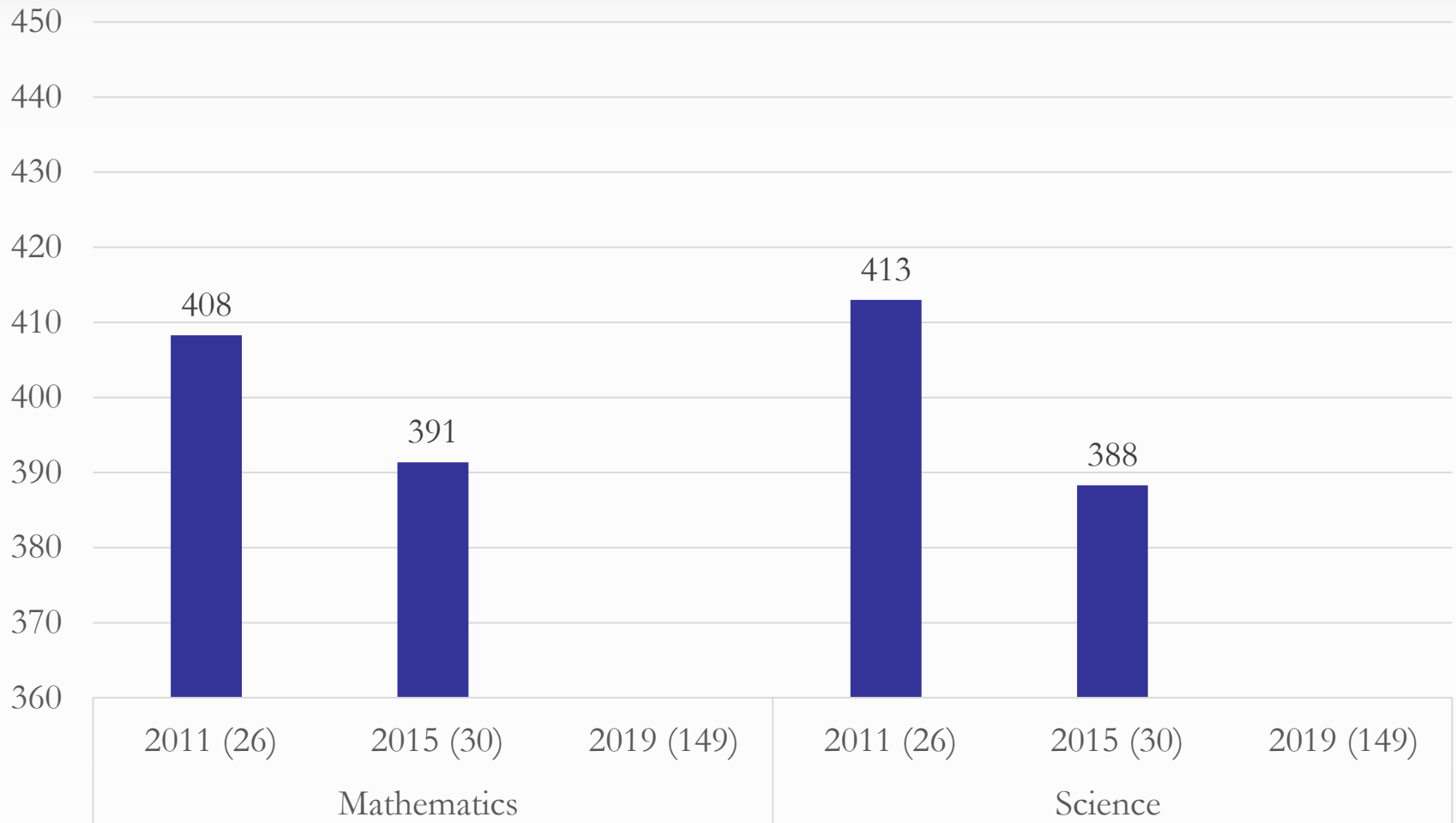
In some large cities, owners of large buildings and houses have installed gardens on the roofs. Having more gardens helps reduce the amount of carbon dioxide in the air.

How does increasing the number of gardens help reduce the amount of carbon dioxide in the air?

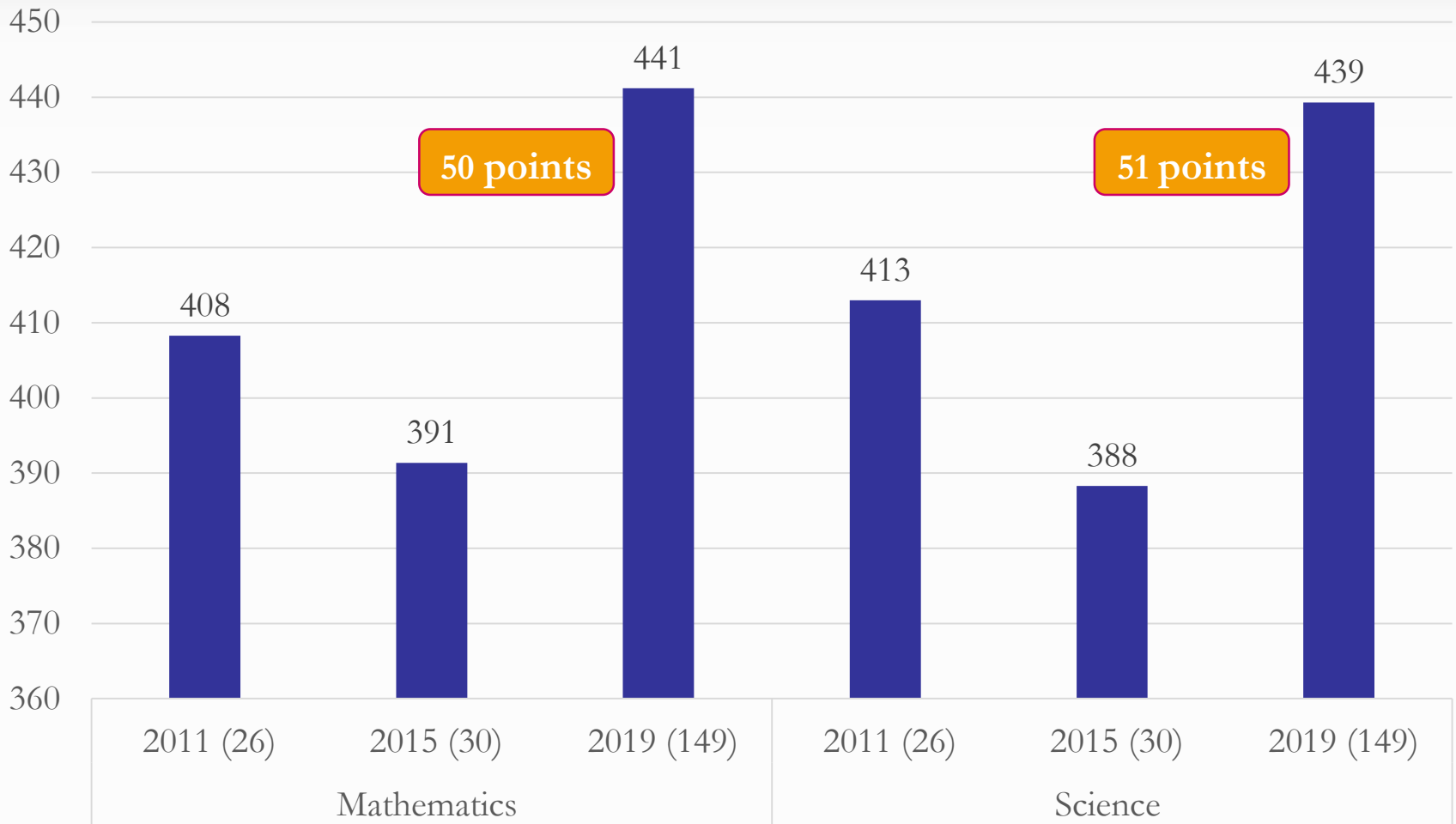
The trees and plants in the gardens take carbon dioxide out of the air during photosynthesis and give off oxygen.

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

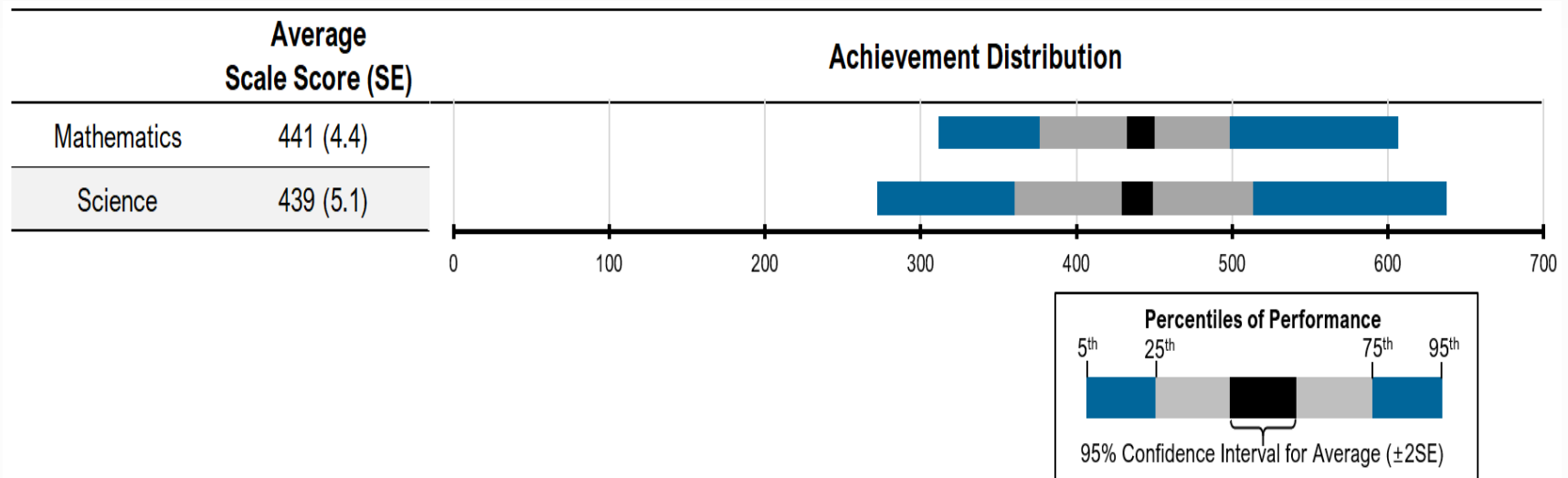
Western Cape Achievement 2011 to 2019



Achievement 2011 to 2019

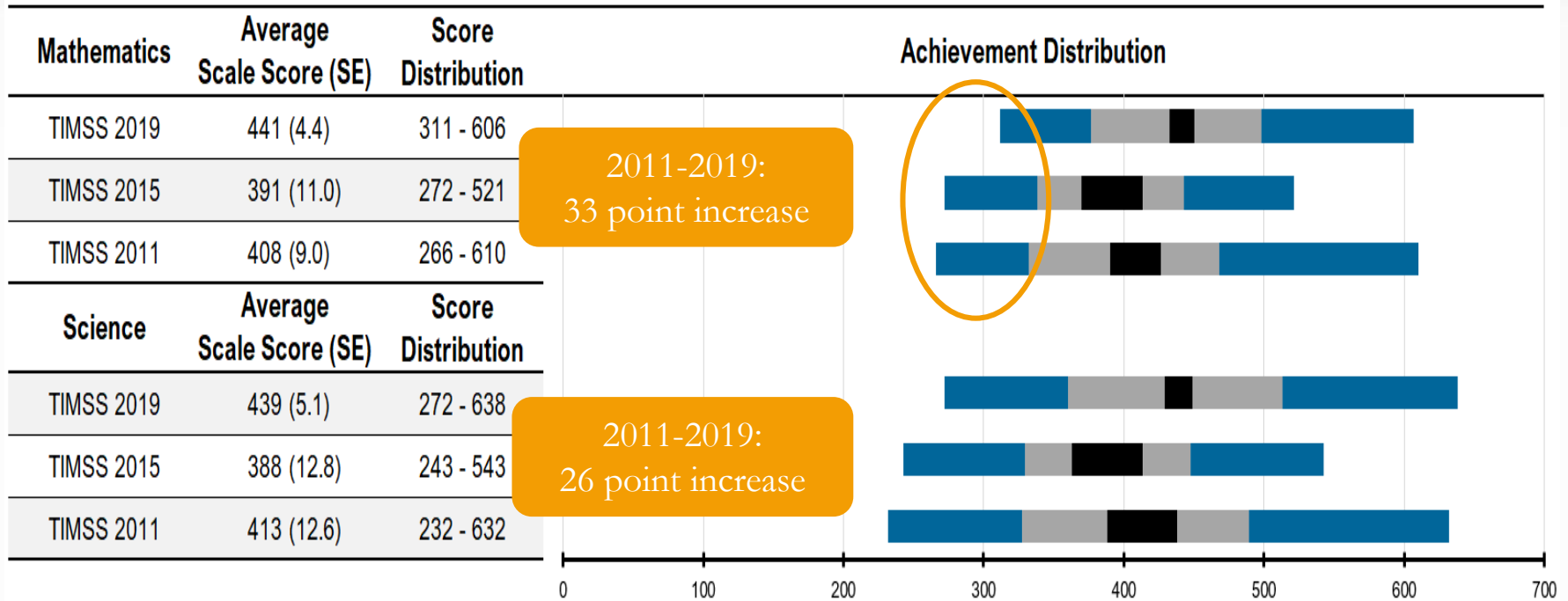


Distribution of achievement scores, 2019



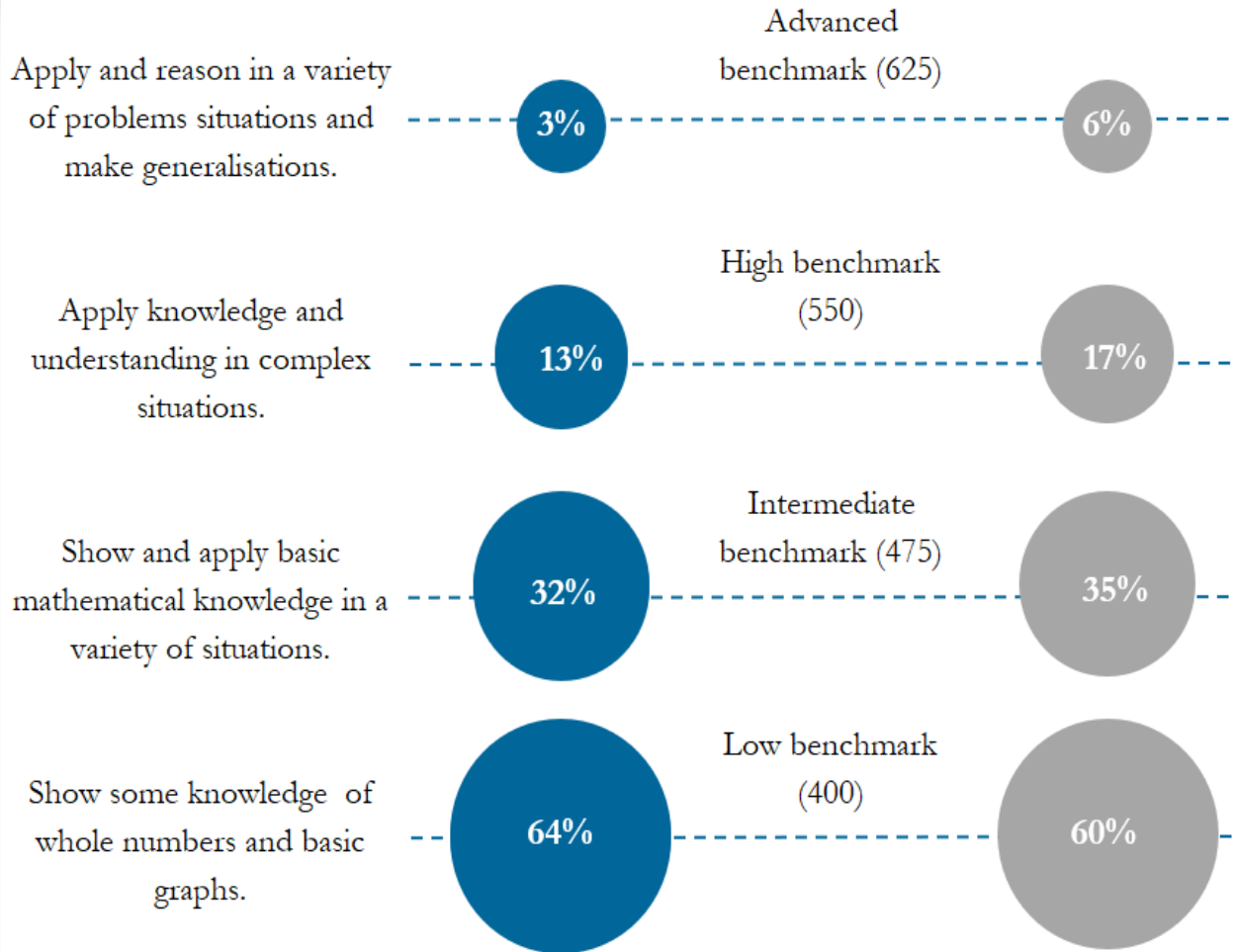
Science has wider distribution and starts at lower scores than mathematics. Science needs attention.

TIMSS 2011 to 2019



Achievement by Ability Benchmarks

Mathematics



Science

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

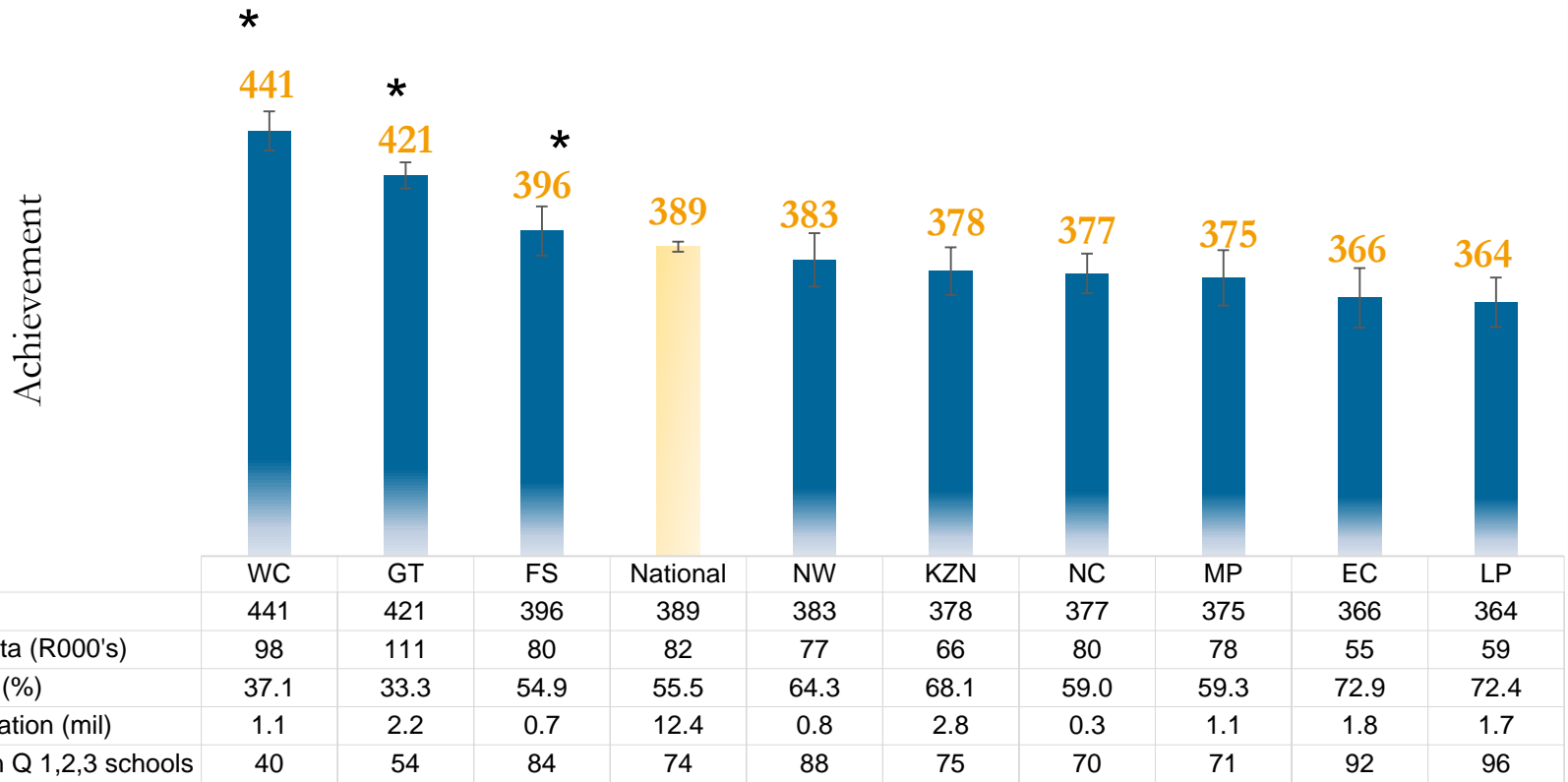
Apply knowledge and understanding of concepts from biology, physical, and earth sciences.

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

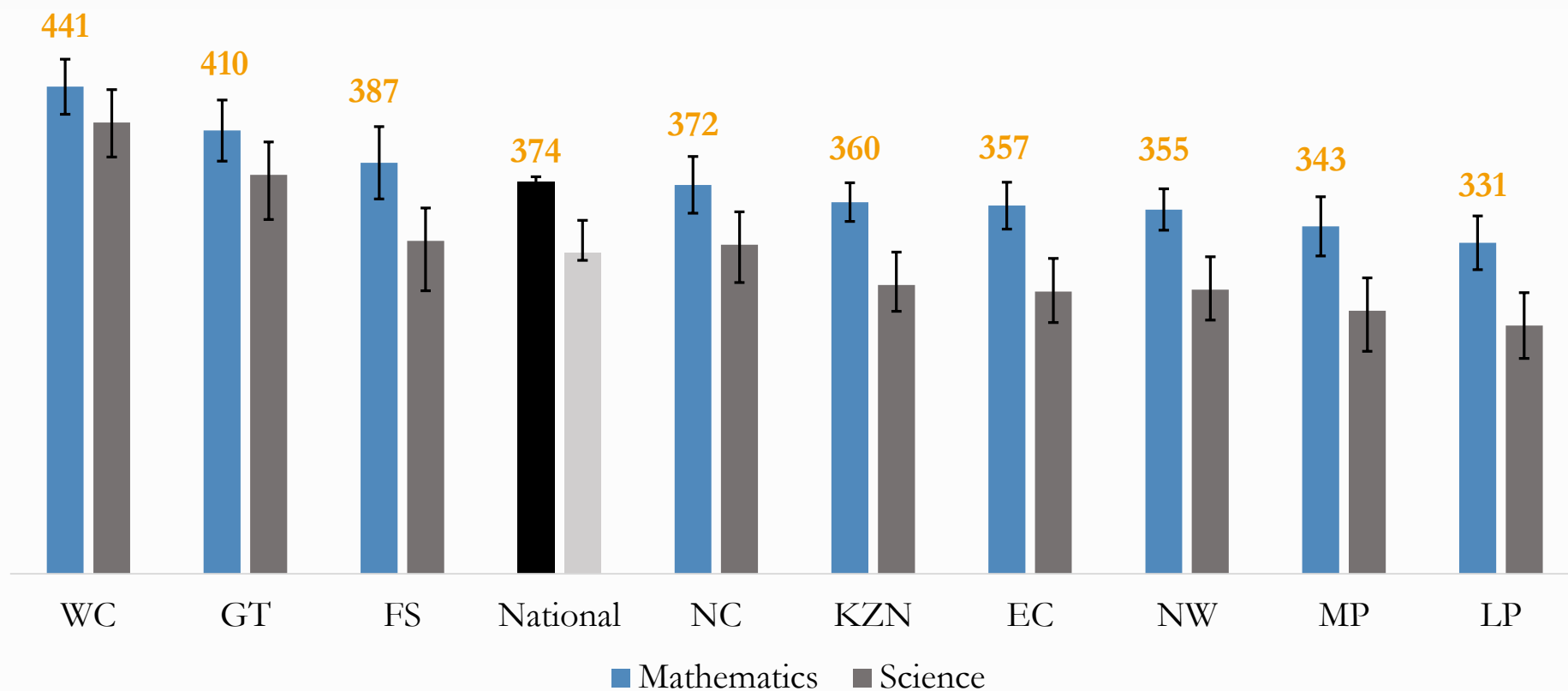
Have some knowledge of biology, physical, and earth sciences.

Grade 9 Mathematics Achievement, by Province, 2019

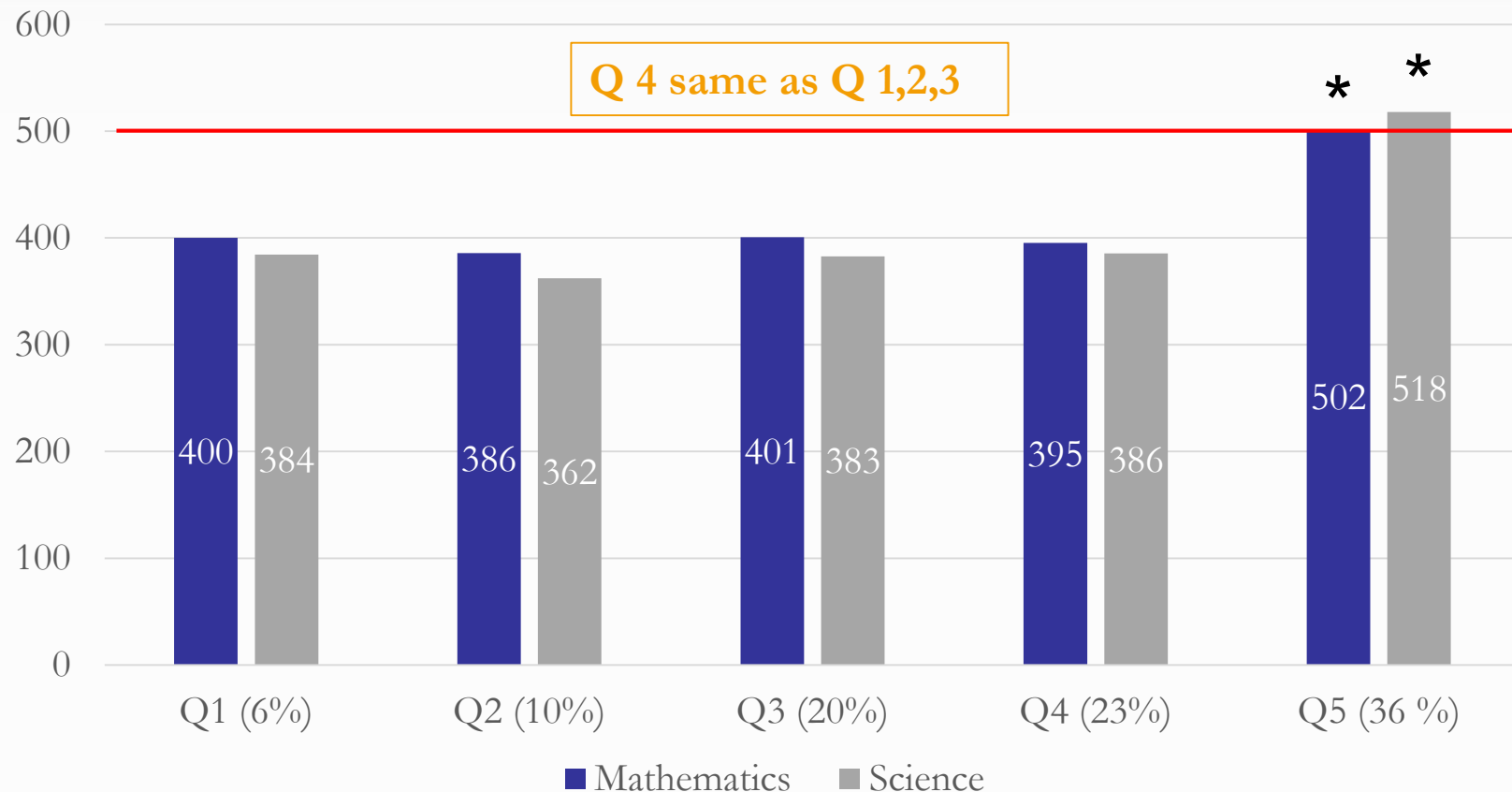
Link between achievement & Provincial macro-economic indicators



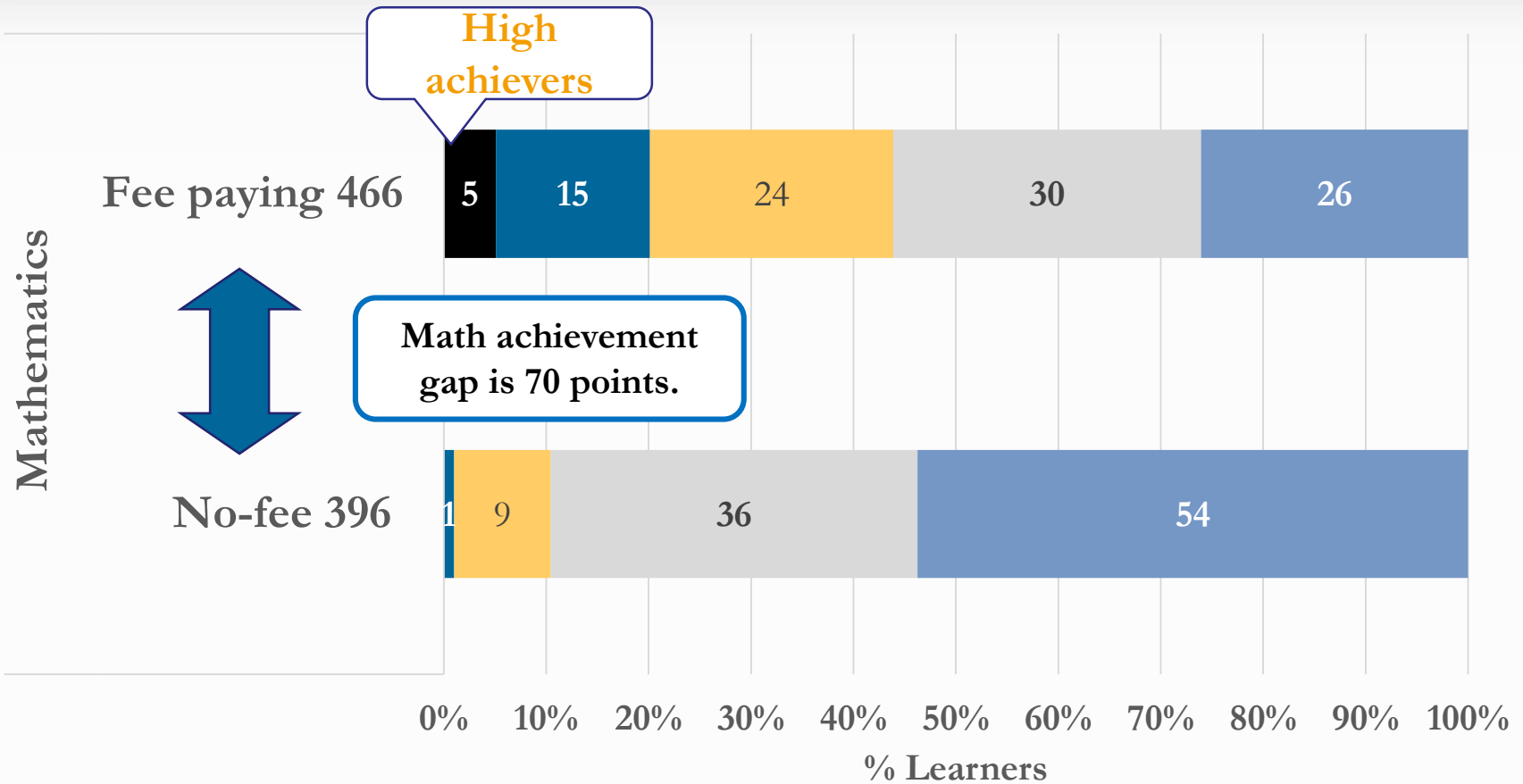
Provincial Achievement, Grade 5, 2019



Grade 9 Achievement, by School Poverty Index

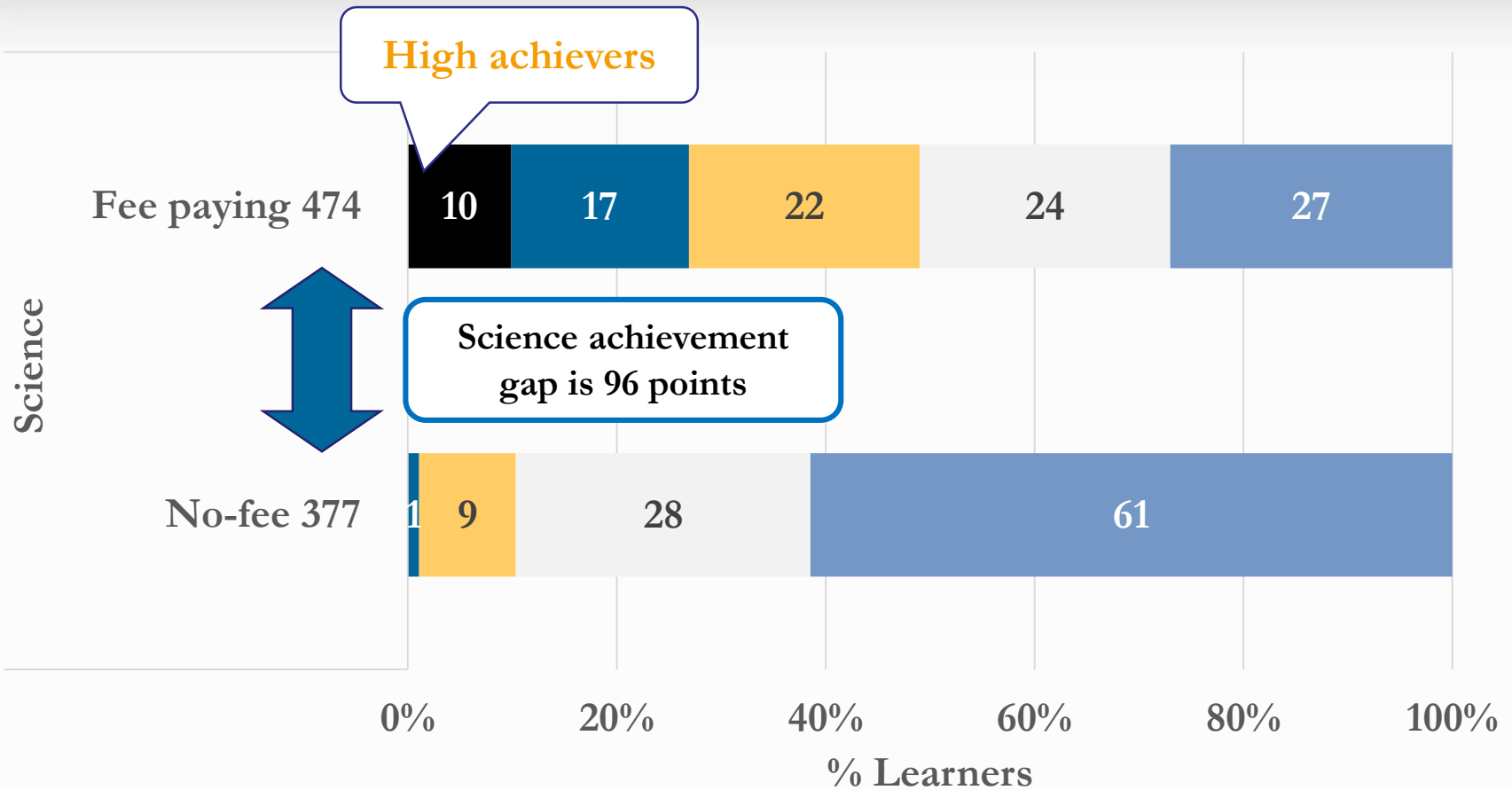


Mathematics Achievement & Ability by Fee-status



Advanced
 High
 Intermediate
 Low
 <400

Science Achievement & Ability by Fee-status



Advanced
 High
 Intermediate
 Low
 <400

Achievement by Gender and Gap

MATHEMATICS

447 (5.4)

SCIENCE

445 (6.2)



MATHEMATICS

436 (5.1)

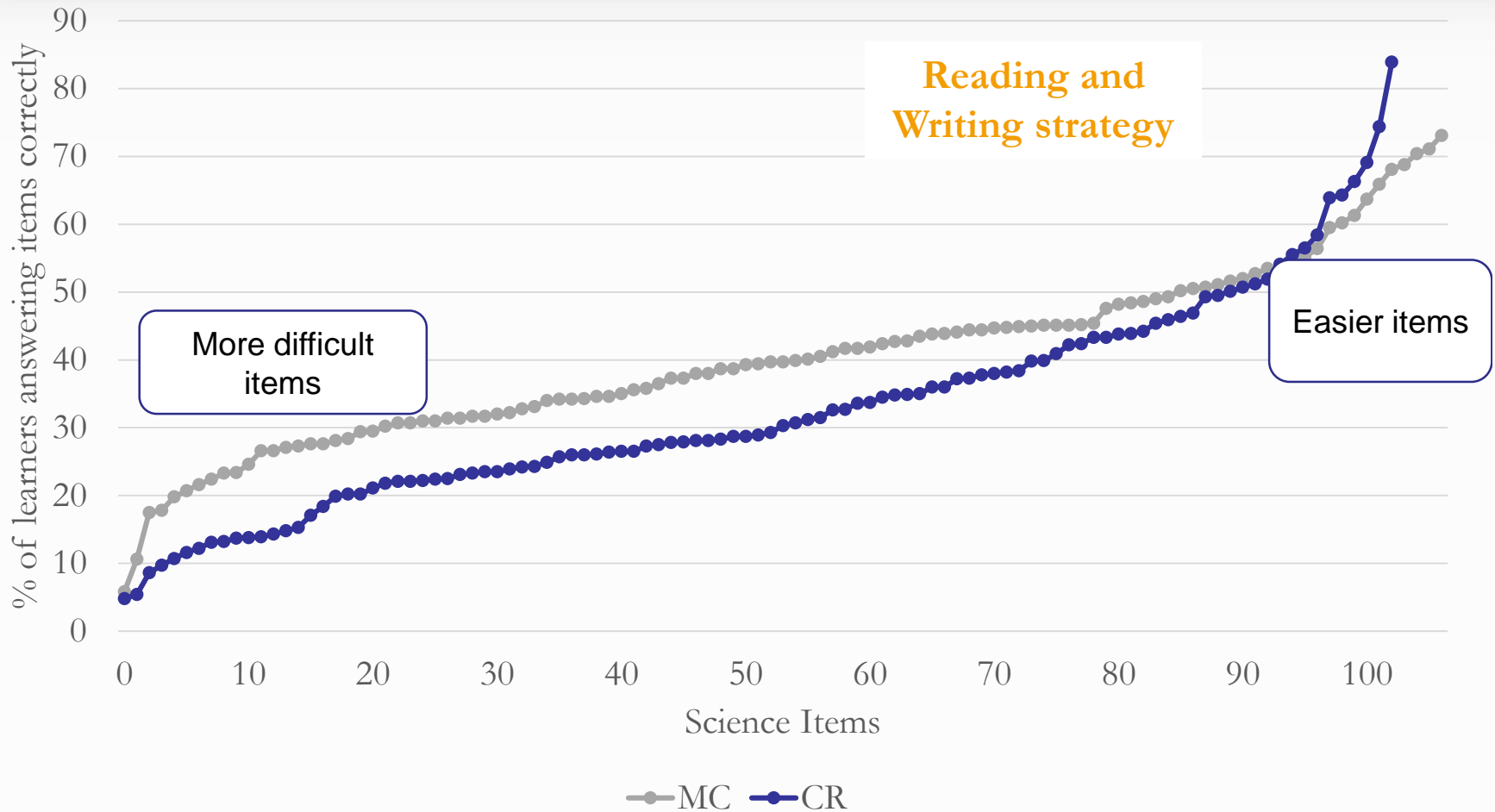
SCIENCE

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 Curriculum	Percentage Match between TIMSS & CAPS
CONTENT DOMAINS		
Number	30	97
Algebra	30	78
Geometry	20	86
Data and Probability	20	54
COGNITIVE DOMAIN		
Knowing	35	70
Applying	40	20
Reasoning	25	10

Western Cape Grade 9 performance internationally

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

GDP per capita:

- W. Cape \$7 340
- Chile \$14 900
- Qatar \$64 800
- Iran \$5 520

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?**

STORY 2: Home, School and Classroom Factors Influencing Achievement

From the bivariate analysis

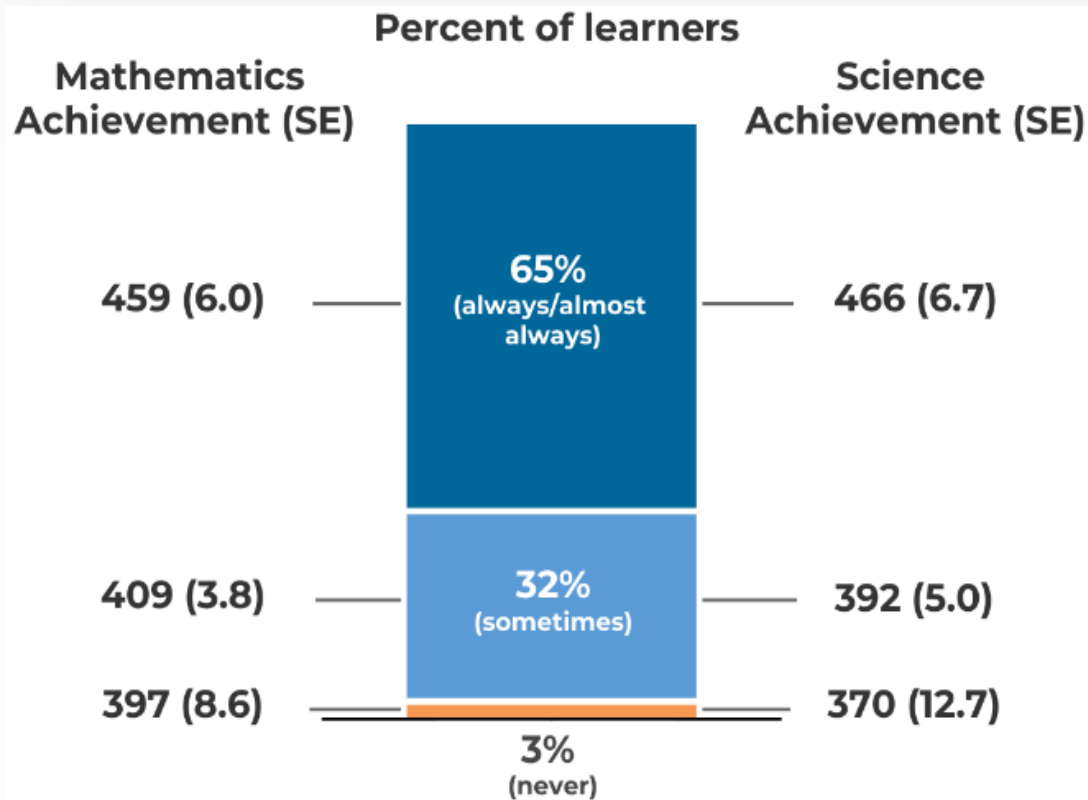
- Unequal Home Conditions
- Educator Preparation and Professional Development
- School Climate and Achievement
- Educational Resources in Schools

Home Assets and Educational Resources

	Basic			Educational			Digital	
	Water flush toilets*	Running water*	Hot running water *	Own room *	Over than 25 books at home*	One parent with a post grade 12 education+ *	Computer or tablet*	Internet Connection*
WC	93	88	56	65	26	35	64	54
No-fee	84	80	27	58	11	25	41	34
Fee paying	97	92	72	69	35	41	77	66

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



Learners who speak the LOLT at home more often score higher than those who speak it less frequently, especially in language-intensive subjects like science.

Only 37% of learners in no-fee schools speak the LOLT at home, in comparison to 80% of those in fee-paying schools.

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

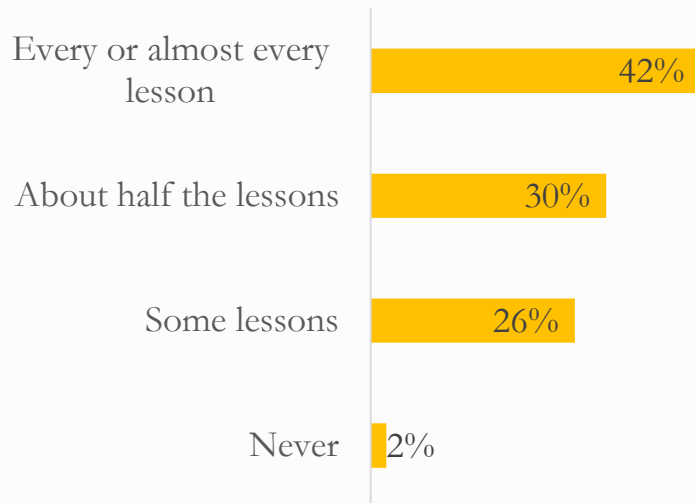
Professional activities	Educators Participation in Professional Development	Educators Indicating a Need in Professional Development
Content	85	53
Curriculum	79	46
Assessment	62	50
Pedagogy/ Instruction	58	62
Integrating Technology into Instruction	58	80
Improving Learners' Critical Thinking or Problem-Solving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

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

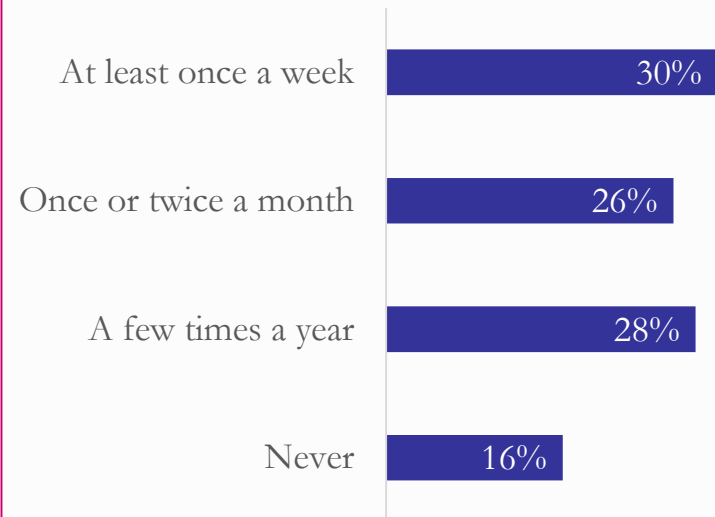
Classroom engagement practices

- 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

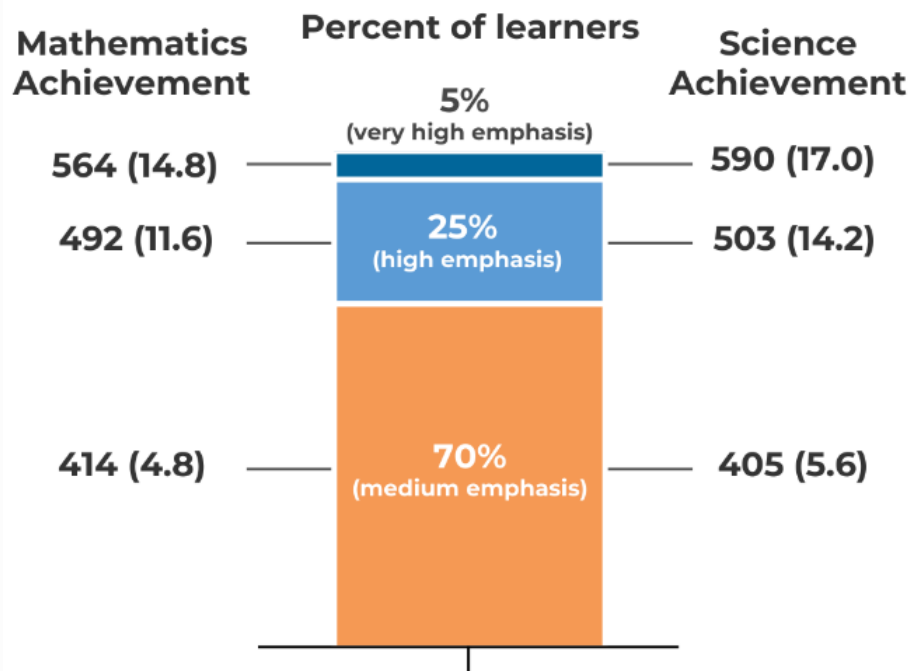


Conducting experiments in science



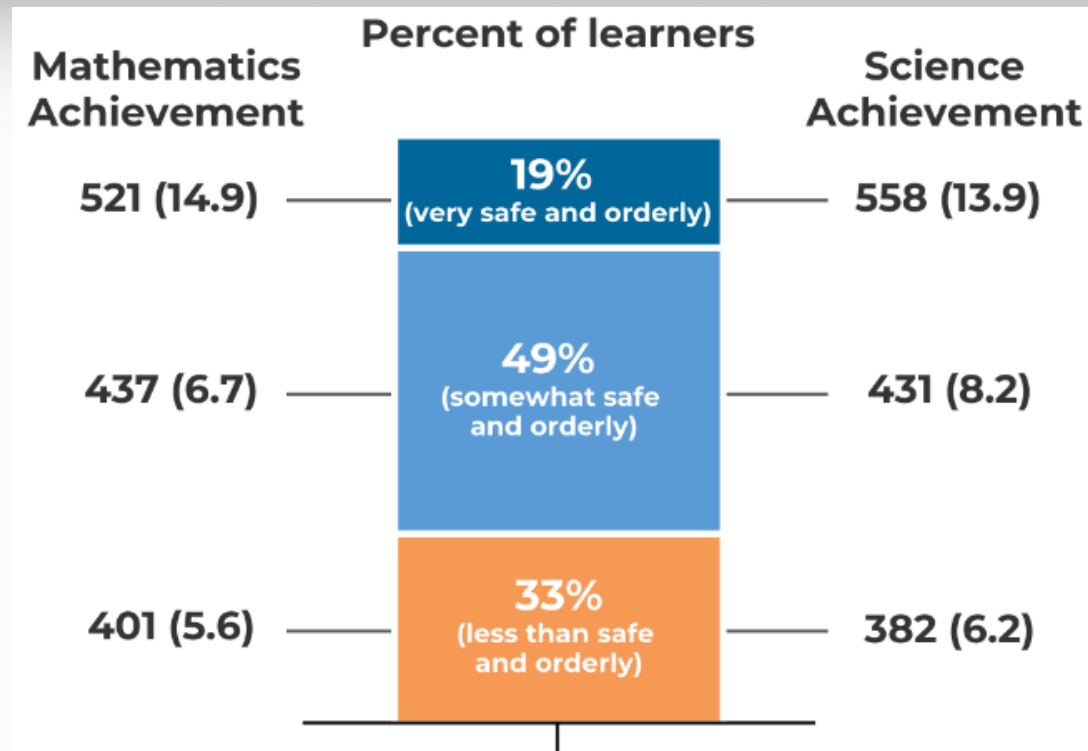
School Climate: Academic emphasis

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



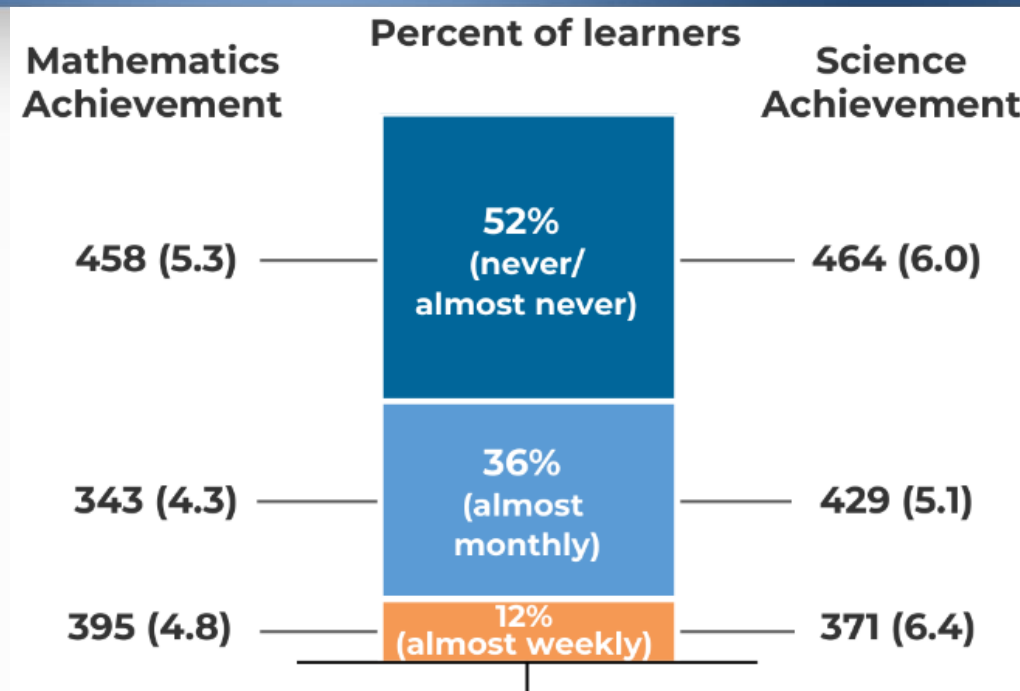
Learners in schools which place a higher **emphasis on academic achievement** performed at a significantly higher level in mathematics and science assessments than medium emphasis.

School Climate: Safe and Orderly Schools



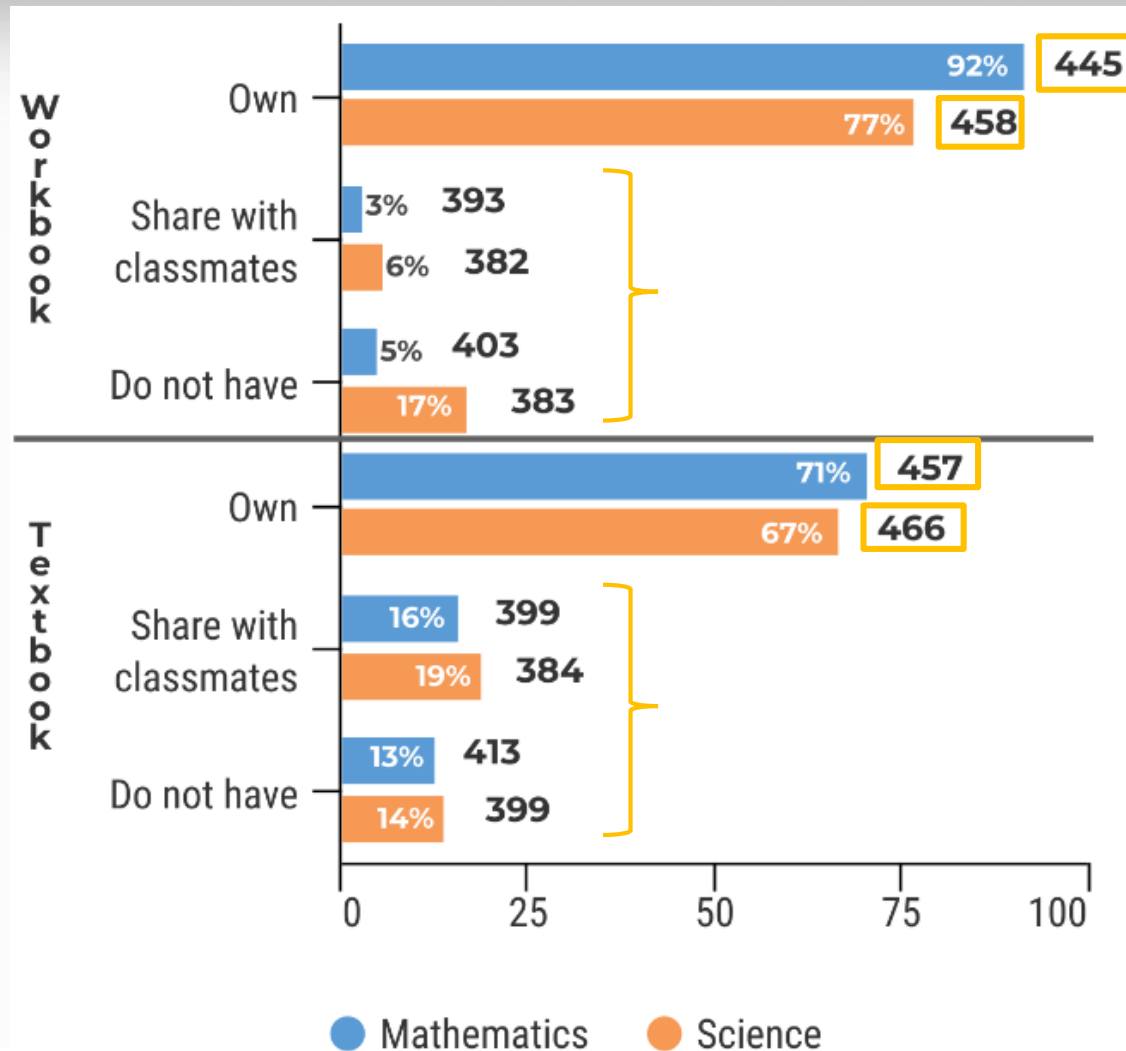
- 25% in fee-paying and 7% in no-fee schools reported 'very safe and orderly' schools
- Internationally 48% of learners attended very safe and orderly schools

Learners Experiencing Bullying Behaviours



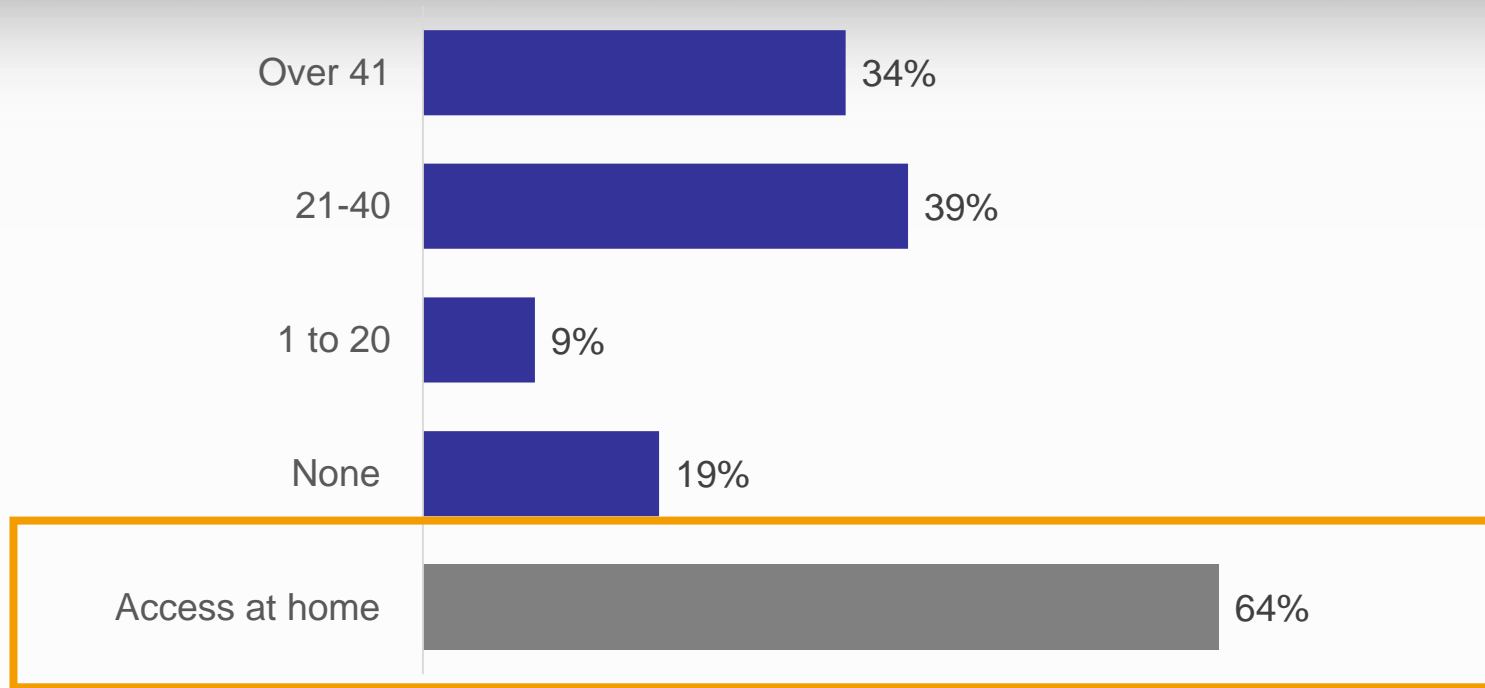
- 45% of learners in no-fee schools and 56% of learners in fee paying schools “never or almost never” experienced bullying at school
- Verbal bullying constituted the highest form of bullying followed by physical and low incidences of cyber bullying
- Internationally 63% of learners reported they were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

Resources: Textbooks and Workbooks



● Mathematics ● Science

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.