Understanding mathematics achievement amongst learners in South Africa

TIMSS 2015 Grades 5 and 9 National Reports

Vijay Reddy and the TIMSS team

27 March 2018

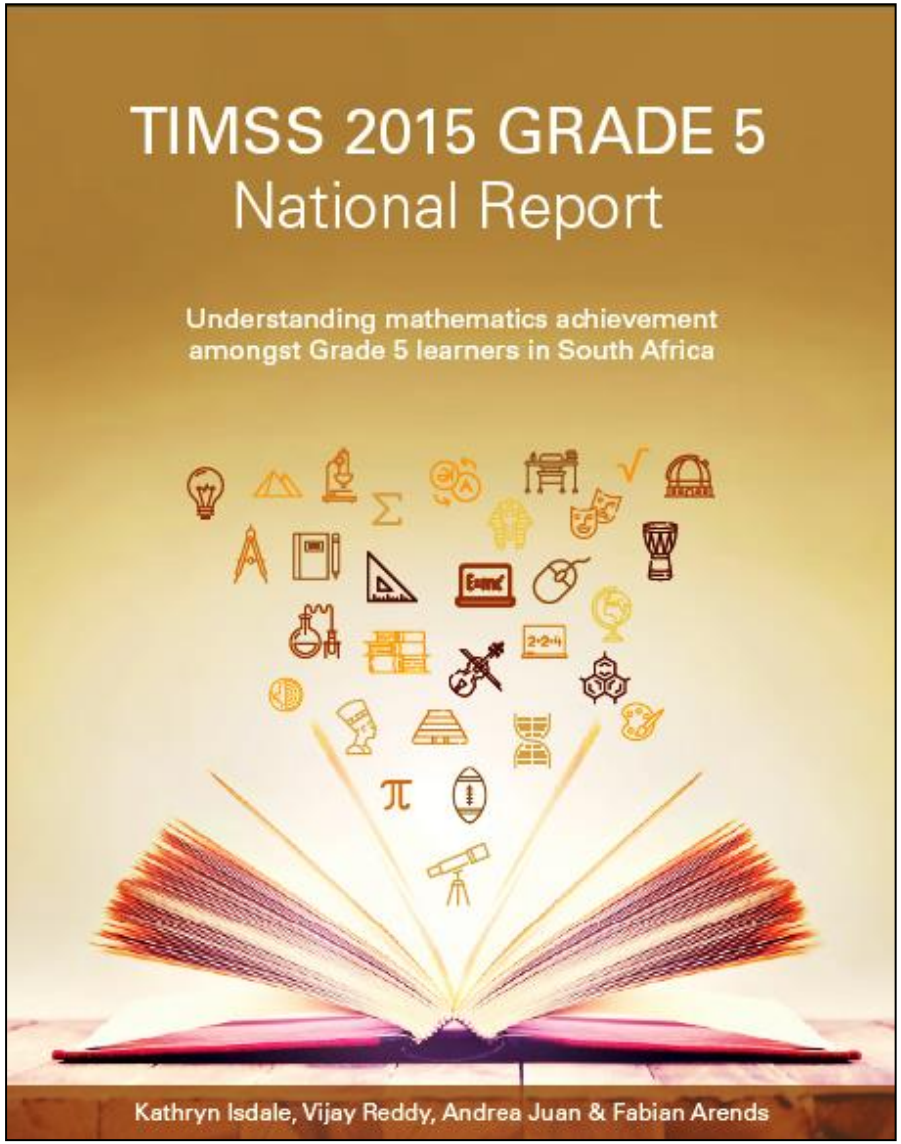
basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

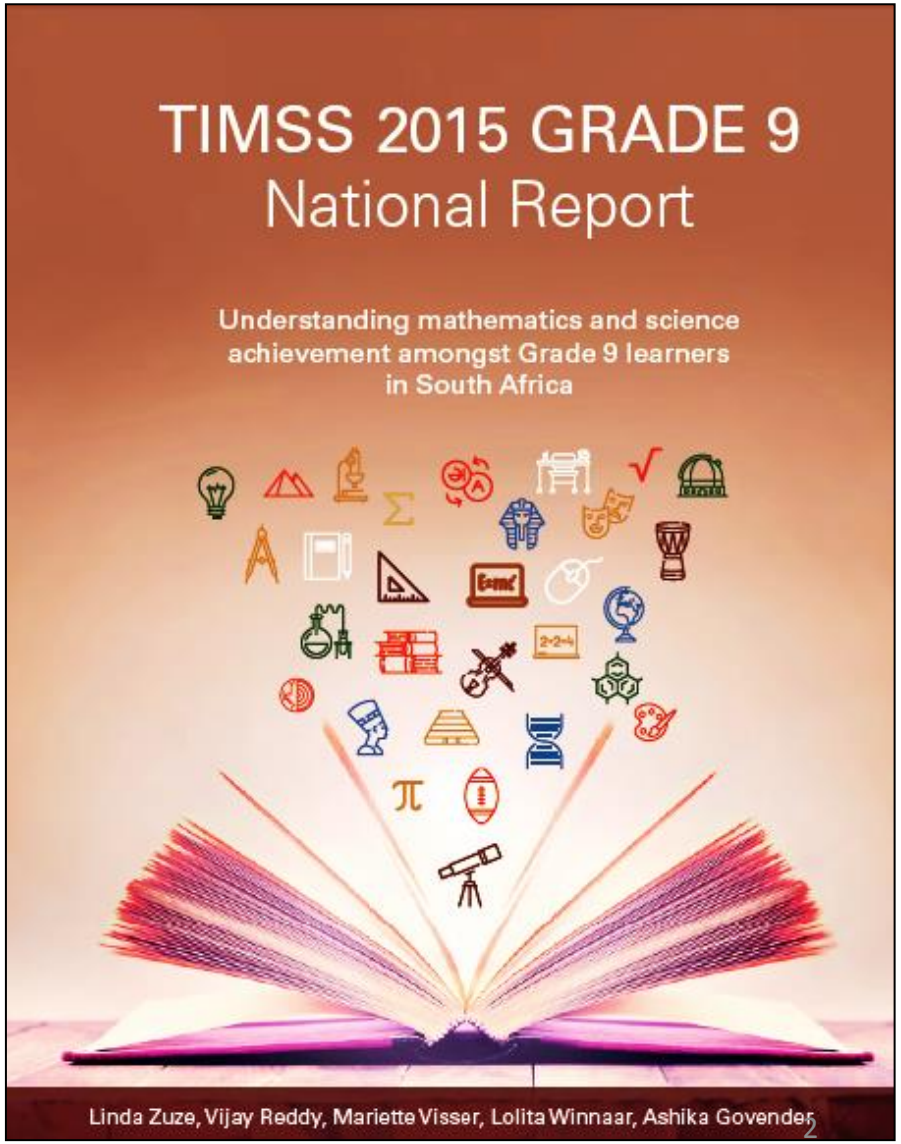
HSRC
Human Sciences
Research Council

IEA

timsssa
education | equity | excellence | evidence

www.timss-sa.org.za





Why participation in TIMSS is important

TIMSS achievement data in combination with the contextual questionnaire data

- Monitor system-level achievement trends in a global context
- Inform educational policy
- Pinpoint any underperforming areas, and stimulate curriculum reform
- Obtain important information about the home and school contexts for teaching and learning in relation to learners' achievement in maths and science

Trends in International Mathematics and Science Study

Grade 4/5

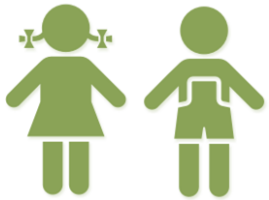
- 48 countries
- Science and mathematics
- First time South Africa participated in TIMSS Grade 5 mathematics. Assessment is a baseline against which to track future performance.
- TIMSS 2015 SA sample
  - 297 schools
  - 11 000 learners
  - 297 mathematics educators
  - 10 500 parents/care givers

Grade 8/9

- 39 countries
- Science and mathematics
- Tested at Grade 8 level in 1995, 1999, 2003 and the Grade 9 level in 2003, 2011 and 2015.
- TIMSS 2015 SA sample
  - 292 schools
  - 12 000 learners
  - 330 mathematics and science educators

Outline of the presentation

Achievement and achievement trends in South Africa



Individual factors and achievement

The home environment

The school environment

Mathematics and Science achievement in South Africa

TIMSS 2015 performance internationally

Grade 9 Math

Country	Score
Singapore	621
Korea, Rep. of	606
Chinese Taipei	599
Hong Kong SAR	594
Japan	586
Australia	505
Sweden	501
TIMSS Centerpoint	500
Italy	494
Malta	494
New Zealand	493
Botswana (9)	391
Jordan	386
Morocco	384
South Africa (9)	372
Saudi Arabia	368

Grade 9 Science

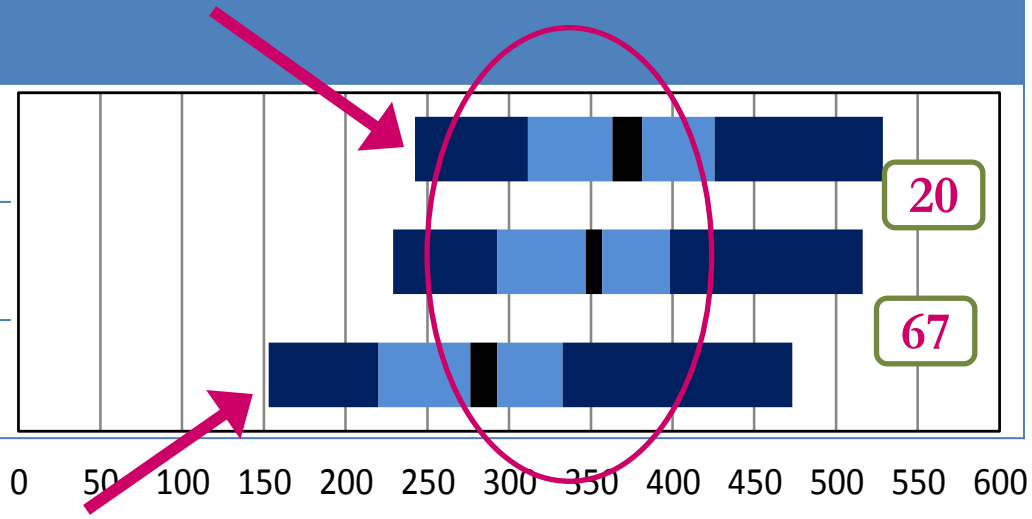
Country	Score
Singapore	597
Japan	571
Chinese Taipei	569
Korea, Rep. of	556
Slovenia	551
Australia	512
Israel	507
TIMSS Centerpoint	500
Italy	499
Turkey	493
Malta	481
Saudi Arabia	396
Morocco	393
Botswana (9)	392
Egypt	371
South Africa (9)	358

Grade 5 Math

Country	Score
Singapore	618
Hong Kong SAR	614
Korea	608
Chinese Taipei	596
Japan	593
Spain	505
Croatia	502
TIMSS Centrepoint	500
Slovak Republic	498
New Zealand	491
France	488
Jordan	389
Saudi Arabia	384
Morocco	378
South Africa (5)	376
Kuwait	354

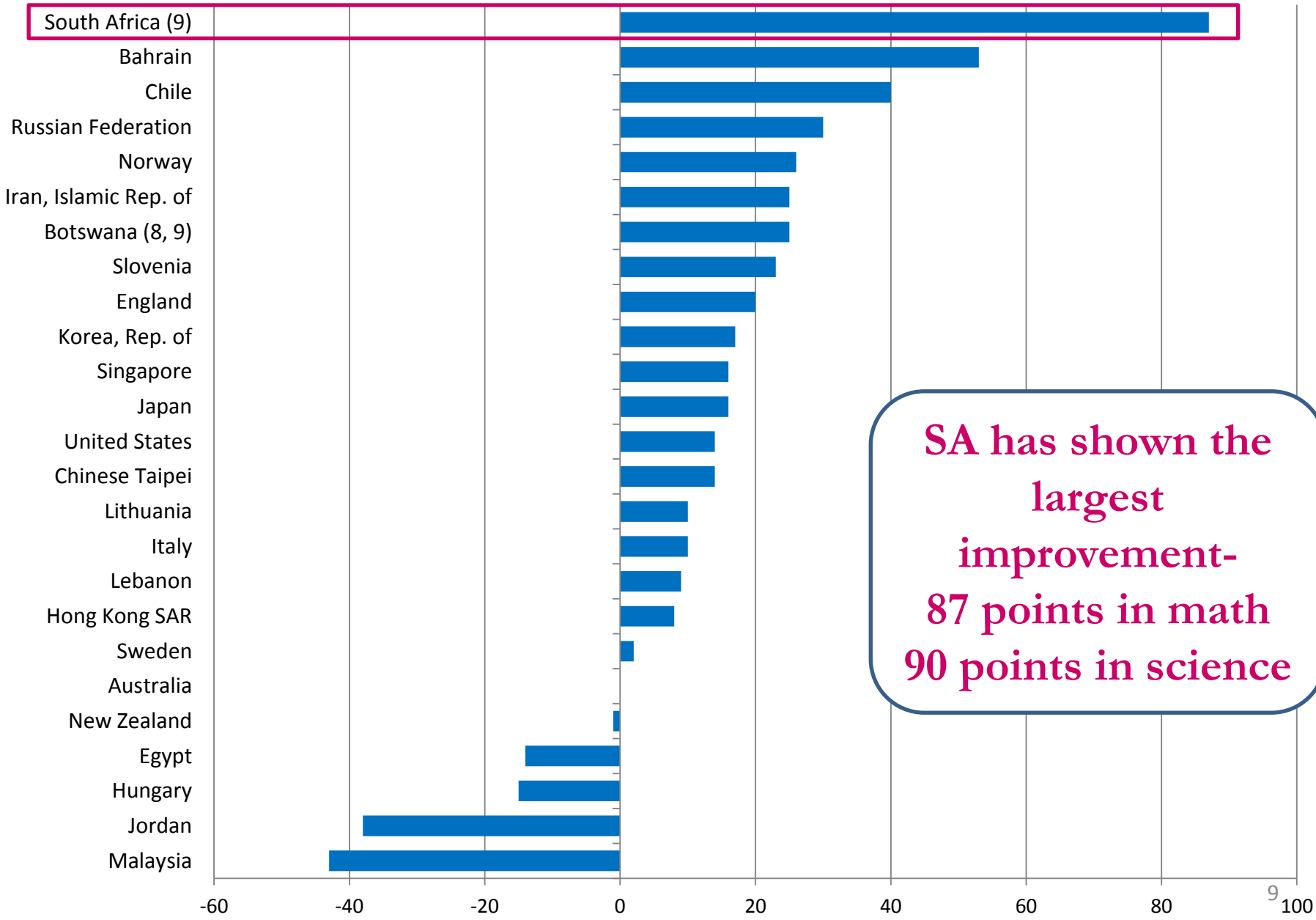
South African mathematics achievement from 2003 to 2015

Mathematics	Ave scale score (SE)
TIMSS 2015	372 (4.5)
TIMSS 2011	352 (2.5)
TIMSS 2003	285 (4.2)



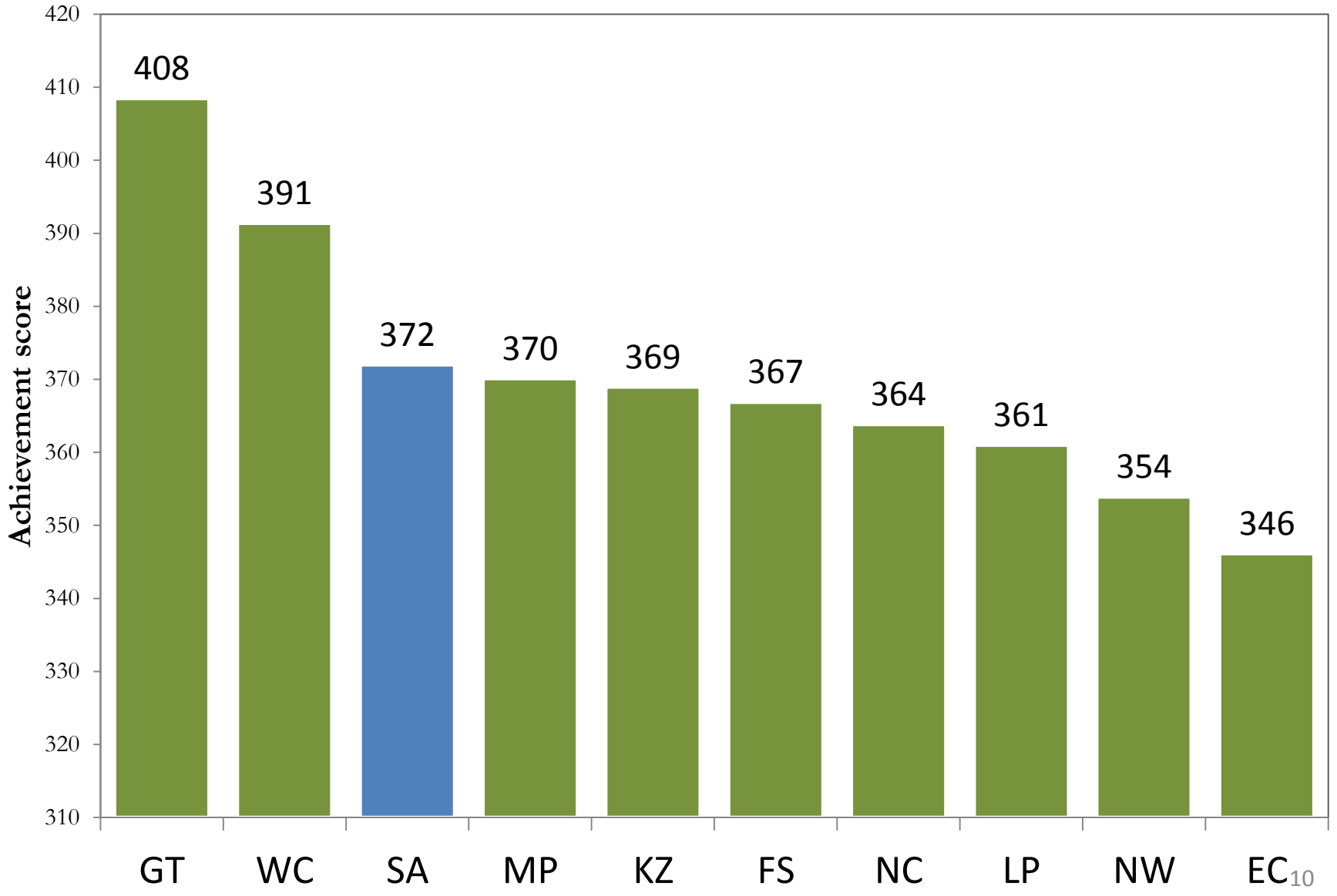
- Distribution has shifted to the right
- Largest improvement at the bottom end

Mathematics performance change (2003 to 2015)

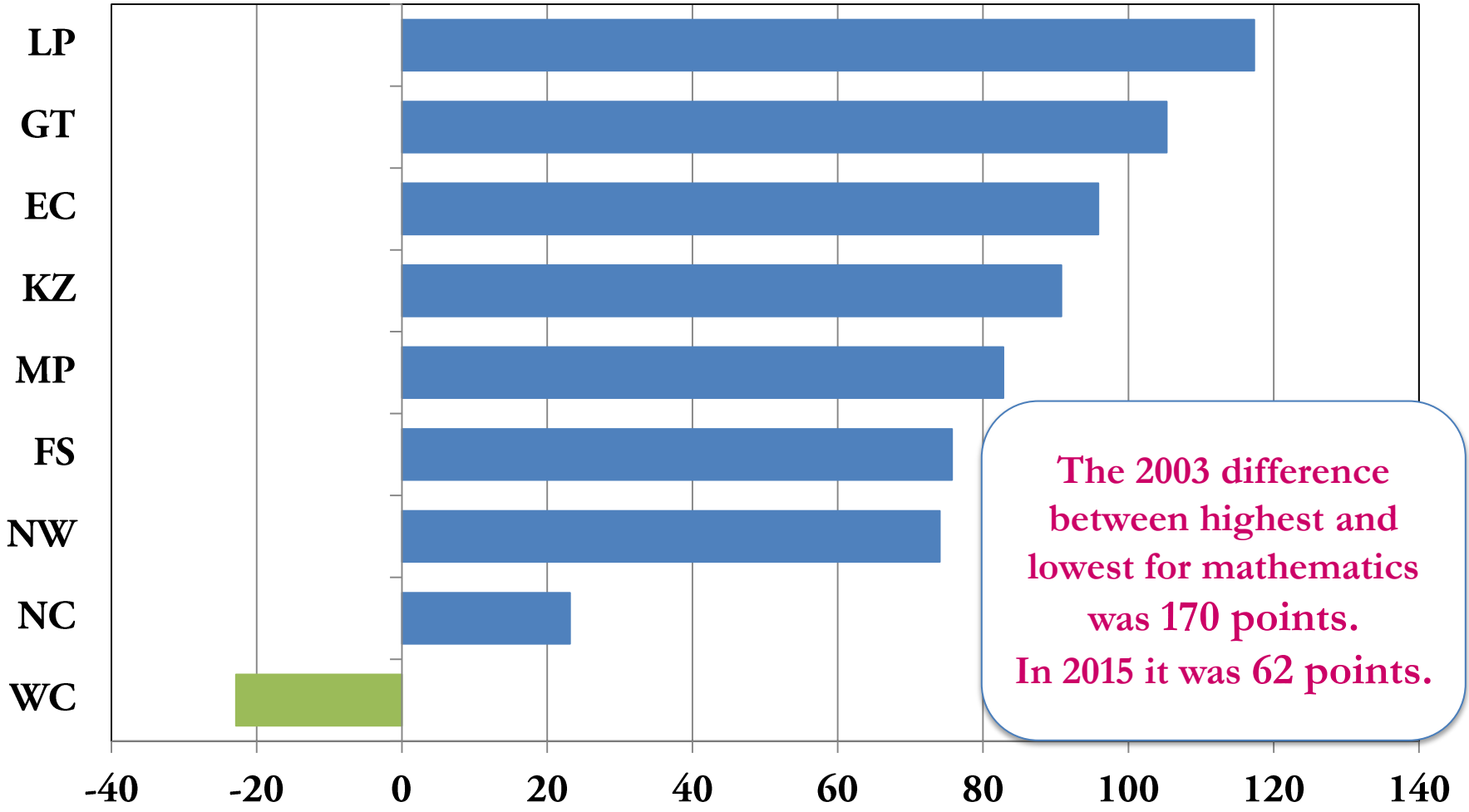


SA has shown the largest improvement-
87 points in math
90 points in science

Mathematics performance by province, 2015

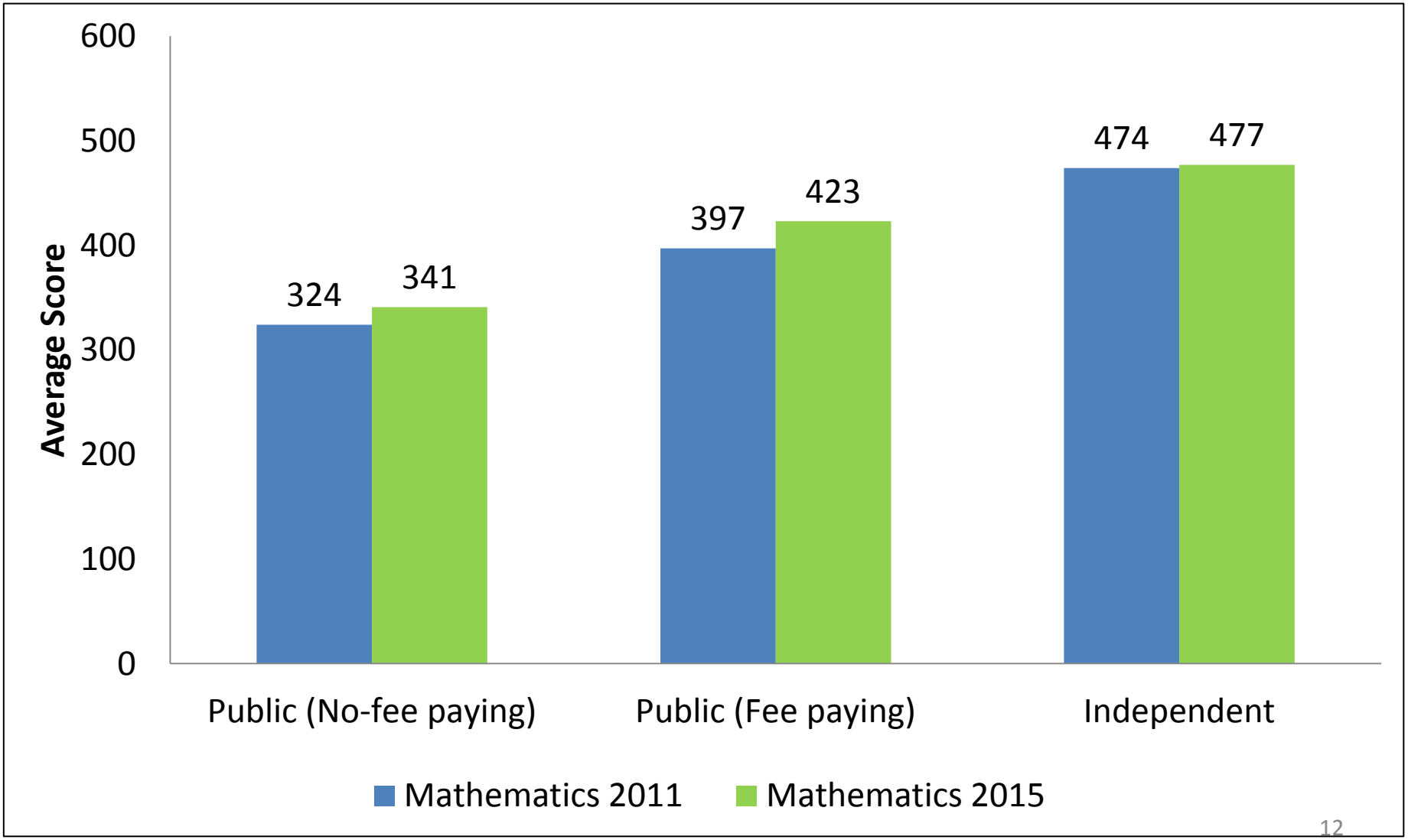


Change in provincial math achievement 2003 to 2015



The 2003 difference between highest and lowest for mathematics was 170 points.
In 2015 it was 62 points.

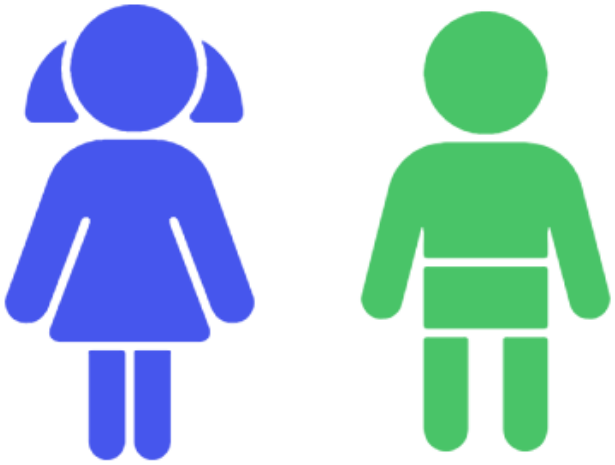
Mathematics performance by school type (2011 and 2015)



Individual factors associated with achievement

- **Gender**
- **Age**

Performance by gender



Maths score

Girls outperformed boys by an average of 16 points

This perceived advantage is lost over time

Grade 5	384	368
Grade 9	376	369

Girls outperformed boys but this difference is not statistically significant.

Age and performance

Average age of learners

	No-fee	Fee-paying	Independent
Grade 9 Expected range 14.5-15.5	15.9	15.4	15.2
Grade 5 Expected range 10.5-11.5	11.5	11.4	11.3

Learners who are the CORRECT AGE for their grade PERFORM BETTER than over-age learners

The majority of over-aged learners were in the public school system

For grade repetition to lead to improved learning outcomes, repeat learners must receive extra learning support.

Understanding the home environment

- **Socio-economic status**
- **Early learning**

Socio-economic conditions

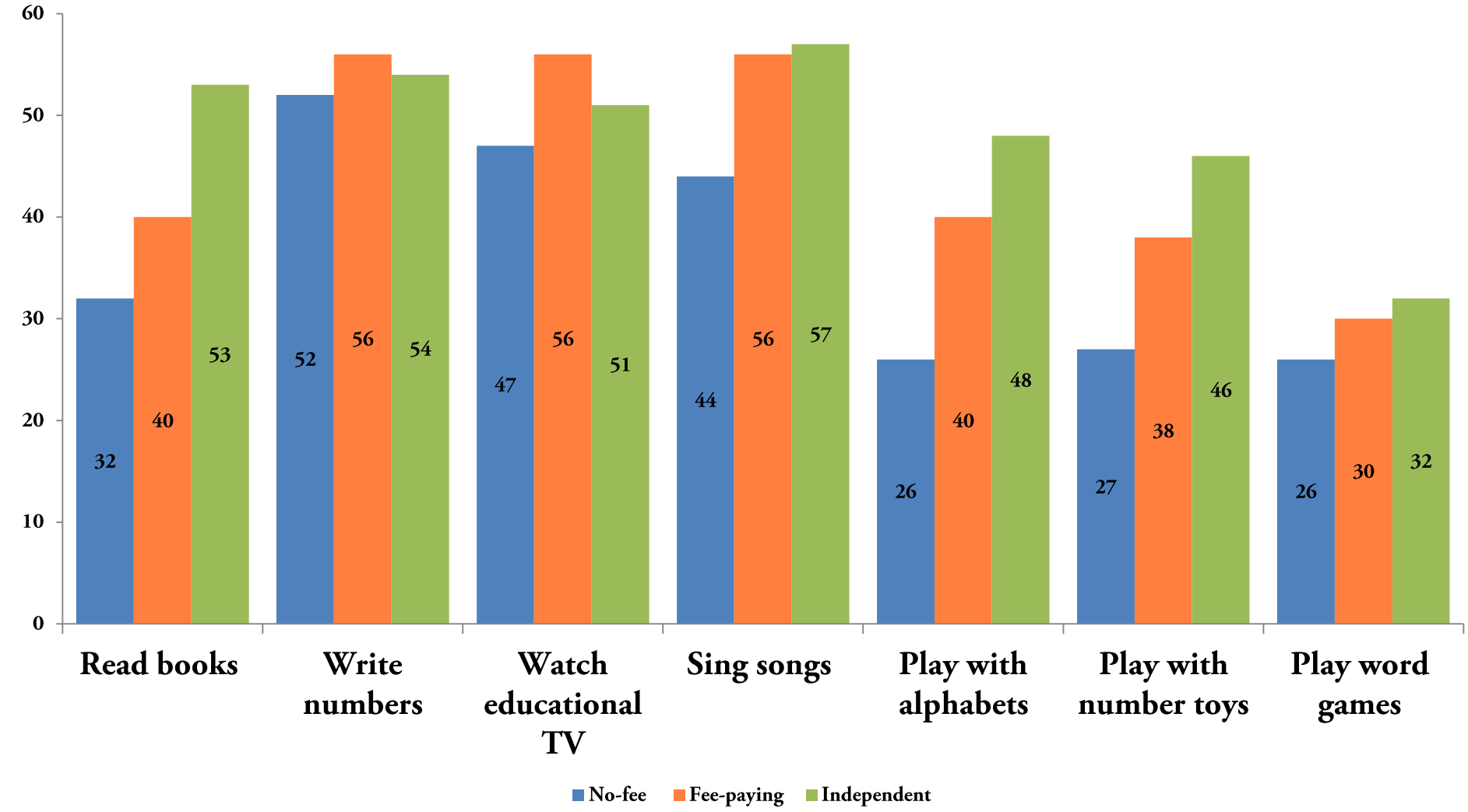
- **Household resources are vastly unequal**
- **Low in comparison to other countries**
- **"Advantage begetting advantage"**

Resource at home	SA Average	School type		
		No-fee	Fee-paying	Independent
Computer (own)	31%	27%	39%	56%
Internet connection	36%	28%	51%	67%
Flush Toilets	56%	41%	87%	89%
Electricity	83%	78%	93%	94%
Running tap water	64%	59%	76%	83%
Government grant	74%	86%	50%	28%
Maternal education above gr 12	46%	37%	62%	84%
More than 25 books at home	20%	16%	26%	50%
Parent whose occupation in professional	18%	11%	31%	55%
% Who always speak LOLT at home	31%	20%	54%	55%

Association between SES and achievement

	Conditional	
RESOURCES IN THE HOME:		
Assets:		
Learner has own computer	-10.7	***
Internet connection	5.6	***
Flush toilets	0.6	
Electricity	19.7	***
Social grants	-2.4	***
Indicators of socioeconomic status		
Household education (low to high)	5.7	***
Total number of books in the home	3.4	***
Highest household occupation	3.5	***

Activities in the home



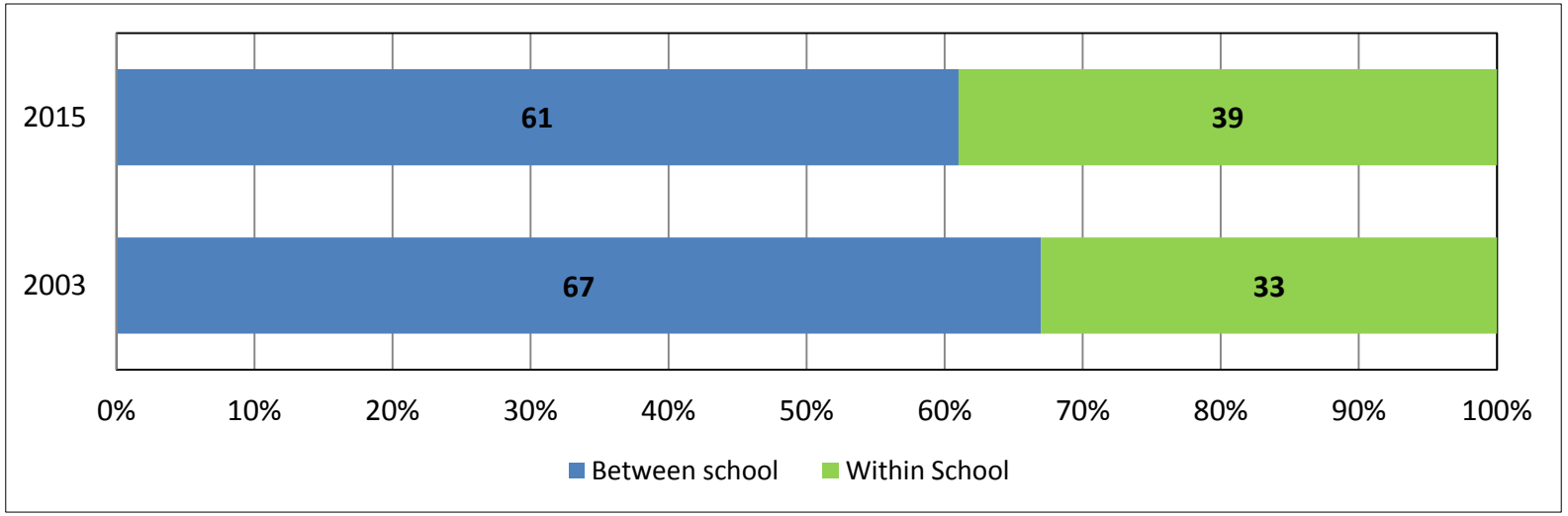
% Learners whose parents reported often engaging in activities

A comparison of the Grade 9 schooling environment

- School type
- School resources
- School climate

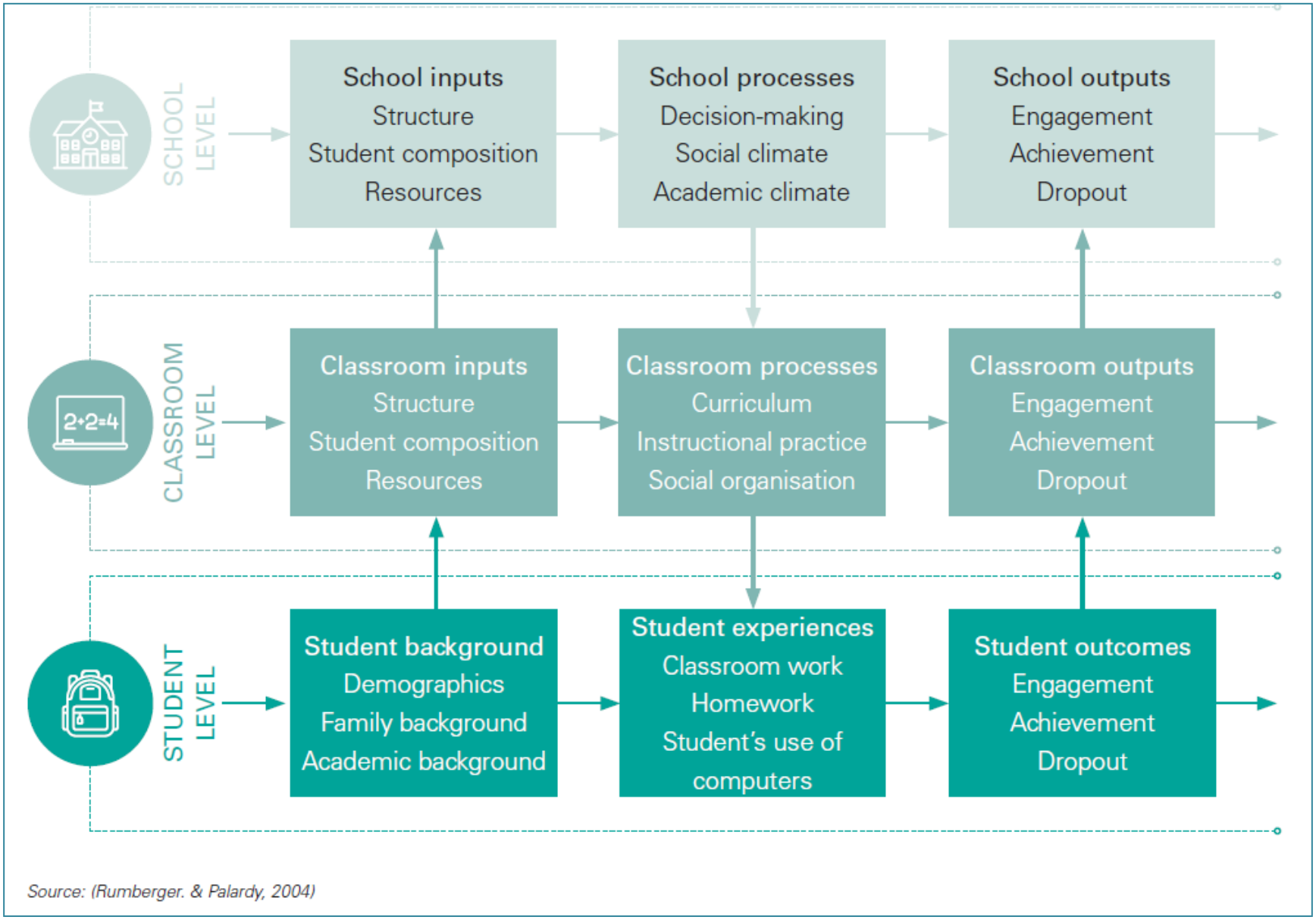
Inequality between schools

Variation in mathematics performance: within and between schools



- 61% of variance in Gr 9 Math Achievement was between schools
  - Indicative of large inequalities within the SA education system.
- A slight reduction in variance between 2003 and 2015
  - Inequality gap has narrowed slightly
- Strive for effective schools

Effective Schooling



Source: (Rumberger. & Palardy, 2004)

Multilevel - Hierarchical Linear Model

- **Purpose of Multilevel Models**
  - ✓ Takes into account the nested structure of the data;
  - ✓ Learners within a school are not the same
  - ✓ Schools within a country are not the same

  } HLM model able to indicate what these differences are

- **Aim:**
  - Identifying school level factors that would reduce the achievement gap between low and well performing learners
    - After controlling for learner level factors
- **Controls at the Learner level**
  - SES, Age, Girl, LoLT, bullying

Narrowing the achievement gap!

School Type (No-fee ref. group)
- Fee-paying - **73** score difference
- Independent - **119** score difference

School Resources

School Type (No-fee ref. group)
- Fee-paying - **67** score difference
- Independent - **93** score difference

School Climate

School Type (No-fee ref. group)
- Fee-paying - **49** score difference
- Independent - **45** score difference

Key Findings : HLM analysis

- Compared to no-fee schools, school average achievement was significantly higher in fee-paying schools and higher still in independent schools;
- Resources explained part of the achievement gap but educational success goes beyond improving access to resources;
- A far greater part of the achievement gap was explained by the school climate;
- Creating a healthy school climate clearly requires far more than just improving the quantity and quality of resources available at a school.

POLICY RECOMMENDATIONS

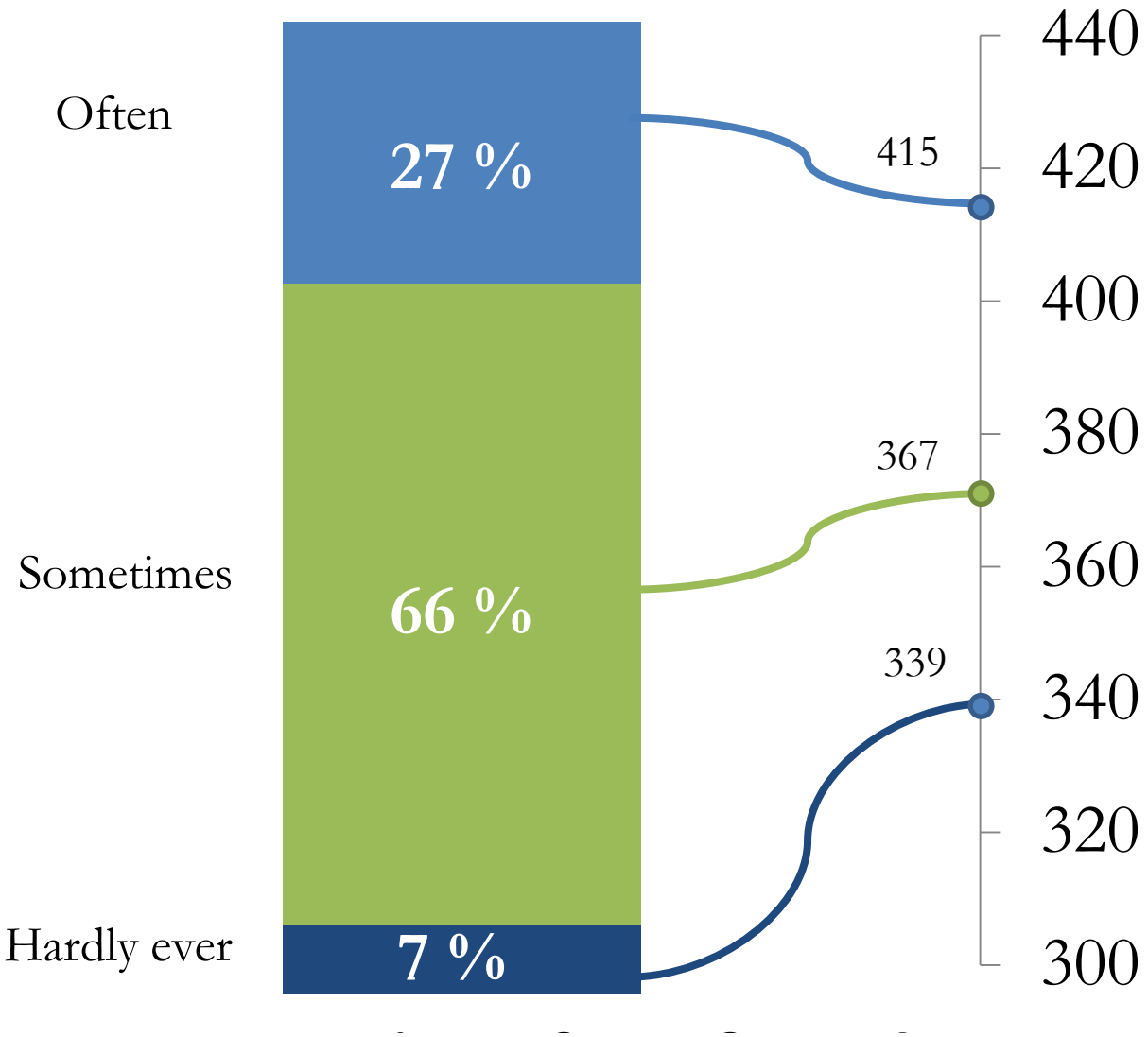
National	• Continue to use international assessments to track progress towards education targets.
	• Strengthen meaningful language development in Home Language and Language of Learning and Teaching
	• Develop accountability systems to ensure the competence of newly appointed school principals.
Provincial	• Ensure that pedagogical infrastructure and resources (especially textbooks) are in schools and used effectively.
	• Promote awareness about the importance of a healthy school climate
District	• Design appropriate interventions for improving the use of language in teaching mathematics and science.
	• Monitor teacher and learner attendance and punctuality
	• Monitor the availability of learning and teaching support materials (especially textbooks) and evaluate how effectively these materials are used.

POLICY RECOMMENDATIONS

School	• Ensure safety, discipline and order.
	• Promote an academic culture in schools
	• Develop additional programmes for learners who are repeating a grade
Teachers & classrooms	• Evaluate and improve on teacher subject matter knowledge and pedagogy
	• Provide learners with practice examples and regular feedback
Learners	• Increase reading and writing activities
	• Regular practice of mathematics and science examples with written homework
Households	• Engage with teachers and school officials about education delivery, school climate, learner support programmes and performance.

THANK YOU

Home literacy and numeracy activities and achievement



Learners whose parents reported spending time with them on early literacy and numeracy activities had higher achievement.

What can the learners do?

- **Percentage of learners showing a minimum competency → a score of 400 and above**

39%	34%	32%
Grade 5 Math	Grade 9 Math	Grade 9 Science

- **Major improvement from 11% for Math and 13% for science in 2003**
- **The majority of learners could not apply basic math and science knowledge**
- **In both grades, 1% of learners could apply understanding and knowledge to complex situations and explain reasoning**