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DOI: http://dx.doi.org/10.18820/2519593X/pie.v35i2.1
ISSN 0258-2236
e-ISSN 2519-593X
Perspectives in Education
2016 34(4): 1-15

Quality education for sustainable development: Are we on the right track? Evidence from the TIMSS 2015 study in South Africa

Abstract

Obtaining quality education provides the foundation for improving people's lives and contributes to sustainable development. The world has come a long way in achieving the goal of equality in primary education for girls and boys, but few countries have achieved that target at all levels of education, as reported by UNICEF (2016). The Human Sciences Research Council of South Africa, in 2016, warned that social ills such as South Africa's high levels of poverty, inequality and unemployment have an effect on the quality of education offered, taking into account different levels of education at various schools. South Africa now participates in many national and international benchmarking studies to assess its progress in the quality of schooling and in specific areas of the curriculum against international standards. The Trends in International Mathematics and Science Study (TIMSS) is one of the studies in which South Africa has participated since 1995. Subsequent to 1995, the country has made considerable progress in mathematics and science achievement – key subjects for much-needed national development. Approximately 12 500 grade 9 learners participated in the 2015 TIMSS from South Africa. The purpose of this paper is therefore to investigate the contextual factors that exist and to critically assess the progress made by senior phase mathematics learners in TIMSS 2015. This is to make recommendations in order to accelerate this progress thereby positively contributing to learners' performance in the Eastern Cape and, in the long term, to the achievement of Sustainable Development Goals (SDGs) as laid out in the National Development Plan of 2030 for South Africa.

Keywords: Quality education; sustainable development; TIMSS 2015; mathematics achievement

1. Introduction

As proposed in the 4th goal, which is about transforming our world (UNICEF, 2016), obtaining quality education is the foundation for improving people's lives and for sustainable development. The report also says that although education at all levels is available, enrolment rates in schools, particularly for women and girls and for basic literacy has improved. However, audacious efforts are needed to make even greater strides towards achieving universal education goals. For example, the world has achieved equality in

access to primary education for girls and boys, but few countries have achieved that target at all levels of education (UNICEF, 2016). The UNICEF (2016) report also notes that although education plays a unique role in levelling the playing field for children, the number of children who do not attend school has increased since 2011 and a significant proportion of those who do go to school are not learning.

The report, *Quality Education: Why it Matters*, on sustainable development goals by UNICEF (2016) points out that education is the key that allows many other Sustainable Development Goals (SDGs) to be achieved as the cycle of poverty can be broken through quality education. This helps to reduce inequalities and to reach gender equality. Education also empowers people everywhere to live healthy and sustainable lives. Education is also crucial in fostering tolerance between people and contributes to societies that are more peaceful. According to the UNESCO Institute for Statistics (UIS Data Centre), between 2000 and 2012, the percentage of out-of-school children among primary-school-age children has declined from 40% to 22% in sub-Saharan Africa and from 20% to 6% in South Asia (UNICEF, 2016).

The National Development Plan 2030, published by the South African Government, aims to eliminate poverty and reduce inequality by 2030. It concedes that South Africa has made remarkable progress in the transition from apartheid to democracy and that South Africa has been able to build the institutions necessary for a democratic and transformative state. However, it also reports that even after 23 years into democracy, South Africa still remains a highly unequal society where too many people live in poverty, too few work and the quality of school education for most black learners is poor (National Planning Commission, 2012). It is also pointed out that while the achievement of the objectives of the National Development Plan 2030 requires progress on a broad front, three priorities stand out: raising employment through faster economic growth; improving the quality of education together with skills development and innovation (National Planning Commission, 2012:17). A sustainable increase in employment is only achievable through high quality education. To accelerate development and to reduce the acute effects of poverty on millions of South Africans over the short term, the plan proposes to improve the quality of education in underperforming schools and Further Education and Training (FET) colleges (National Planning Commission, 2012:18).

The Planning Commission of South Africa reports that South Africa has an urbanised youthful population that presents an opportunity to boost economic growth, increase employment and reduce poverty. In recognising that young people bear the brunt of unemployment, the Commission in its proposals included universal access to two years of early childhood development; improving the school system (including increasing the number of students achieving above 50 per cent in literacy and mathematics); increasing learner retention rates to 90 per cent; bolstering teacher training and providing full funding assistance. This funding assistance includes covering tuition, books, accommodation and living allowance for students from poor families (National Planning Commission, 2012:20). The planning commission also proposes that by 2030, South Africa needs an education system reflecting the attributes of high quality; universal early childhood education; quality school education with globally competitive literacy and numeracy standards and further and higher education and training that enables people to fulfil their potential. It also needs an expanding higher-education sector that can contribute to rising incomes; higher productivity and a shift to a more knowledge-intensive economy as well as a wider system of innovation that links universities, science councils and other research and development role players with priority areas of the economy (National Planning Commission, 2012:38)

The planning commission calls for urgent action on the management of the education system. It is believed that more resources should be available to support schools and teachers as well as interventions to be put in place that are supportive and corrective and that need to be inversely proportional to school performance. Better-performing schools can be given the freedom to get on with the job, as long as there is measurable improvement. The commission proposes a campaign to improve infrastructure in poor schools, especially in rural areas and calls for professional development of teachers, peer review, school infrastructure, the provision of learner support materials and support systems to strengthen teachers. It states that teachers, both individually and at school level, should be held accountable for learner performance, with due recognition of the learning environment (National Planning Commission, 2012:40). It was also noted by the Human Sciences Research Council (HSRC) in 2016 that South Africa has high levels of poverty, inequality and unemployment and these social characteristics have an effect on education quality taking into account high levels of variation between schools (Reddy *et al*., 2016b). They also argue that as a low-income country we need to respond to what happens inside classrooms and schools to improve teachers and learners' mathematical knowledge and the need to identify the effects of the learning and teaching contexts on learner educational achievement. The severe inequalities in educational outcomes in South Africa can be seen alongside a number of correlated dimensions, most notably: wealth; school location; language and province and in each case, the huge differential between the top and bottom performance categories within and across grades. Sometimes this differential is as large as four grades (Spaull, 2013). McCarthy and Oliphant (2013) argue that fundamental reforms are needed in the public sector in that business leaders need to have an understanding of private education and other market experiments and schooling innovations in their overall perspective and priorities for intervention and reform in South African schools.

2. Mathematics learning and teaching in the South African context

Mathematics is considered a key requirement for not only entry into higher education, but also for most modern, knowledge-intensive jobs. Research on school performance and teaching reveal largely unacknowledged poor teaching of mathematics in the majority of schools. Feza and Webb (2005) point out that the Bantustan system was introduced in South Africa in 1948 in which blacks were offered a different and inferior curriculum, usually with no maths or science. However, the adoption of the Constitution of the Republic of South Africa (Act 108 of 1996) and the amendments that followed provided a basis for curriculum transformation and development in South Africa (DoE, 2003). "In the post-apartheid society, social transformation in education is aimed at ensuring that the educational imbalances of the past are redressed and that equal educational opportunities are provided for all sections of our population" (DoE, 2003:2). The Department of Basic Education introduced the present curriculum, known as the National Curriculum Statement into Grade 10 in 2006, which is modern and internationally benchmarked. It requires learners to do seven subjects from Grades 10 to 12 of which either mathematics or mathematical literacy is a compulsory subject. This is to ensure that all learners are prepared for life and for the real world in an increasingly technological, numerical and data-driven world (Pandor, 2006). Since, either mathematics or mathematical literacy was not a compulsory subject in the previously-disadvantaged (formerly black and coloured) South African schools during the apartheid era, and considering that many of its mathematics or mathematical literacy teachers are the products of Bantu Education, the impact of the Bantu education system can be seen even today (Feza & Webb, 2005). Mji and

Makgato (2006), however state that even the schools that offer mathematics and science do not all have facilities and equipment to promote effective teaching and learning. South Africa therefore faces the challenge of providing quality mathematics education for its multi-cultural society of 43 million people (Howie, 2003). Lack of appropriate learner support materials and the general poor quality of teachers and teaching are some of the factors that have contributed the lack of formal mathematical knowledge among disadvantaged learners from impoverished learning environments (Maree *et al.,* 2006). This has resulted in the apparent lack of exposure to mathematics in these under-resourced schools.

South Africa's development as a knowledge economy depends partly on improving the teaching of mathematics and numeracy. Furthermore, South Africa's extremely high youth unemployment, which is currently at 50 per cent, is closely linked to the quality of schooling – the quality of numeracy and mathematics competency in particular (McCarthy & Oliphant, 2013). It is anticipated that better educational outcomes will lead to higher employment and incomes, whereas more rapid economic growth will broaden opportunities for all and generate the resources required to improve education (Visser, Juan & Feza, 2015). Given the persistent pattern of low achievement scores at schools for learners from low-income households, the research and policy challenge is how to improve the schooling system to break the cycle of poor achievement in mathematics (Reddy *et al.,* 2012).

3. South African mathematics performance ranking in an international context: TIMSS

It is noted that South Africa's development is affected by what happens in the region and in the world. Success will depend on the country's understanding and response to such developments (National Development Plan 2030:18). The Trends in International Mathematics and Science Study (TIMSS) is one of the international benchmarking studies in which South Africa has been participating to check its progress in the quality of schooling and in specific areas of the curriculum against international standards.

The South African component of TIMSS has been assessing mathematics and science achievement among Grade 8 and 9 learners since 1995 (Reddy *et al.,* 2016a). In South Africa, TIMSS was conducted in 1995, 1999, 2003, 2011 and 2015. The TIMSS 2015 South African sample consisted of 292 schools. Twelve thousand five hundred learners and 330 mathematics and science teachers participated from three different categories of schools, namely, no-fee paying and fee-paying public and independent schools (Reddy *et al.,* 2016a). At the Grade 9 level, the TIMSS 2015 results showed that there were noteworthy improvements at the lower and top end of achievement scores (Reddy *et al.,* 2016a). However, even though South Africa continues to improve its performance in mathematics scores since 2003, it is still a concern to see that it is at the lower end of the rank order of the countries that participated, and that the Eastern Cape is at the lower end of the rank order of South Africa's nine provinces. The purpose of this paper is therefore to investigate further the underlying problems and to critically assess the progress made in 2015 to accelerate progress and to implement positive steps to improve performance in underperforming provinces such as the Eastern Cape. This is in line with the National Development Plan 2030 and the recommendations by Reddy *et al.* (2016b) in that the provinces should identify the different problem areas and devise strategies to support both the low- and high-performing schools. Clearly, "good" conditions in the home and school result in the higher achievement scores.

South Africa was a performing African participant among 59 countries in TIMSS 2015 (Reddy *et al.,* 2016a). Yet the national score for mathematics remained the same for TIMSS 1995, 1999 and 2003 (Reddy *et al.,* 2016a). On the contrary, the 2003 mathematics score of 285 improved by 67 points to 352 in 2011. This trend continued into 2015 with the mathematics score increasing by a further 20 points to 372. At the Grade 9 level, the TIMSS 2015 results showed that there were noteworthy improvements at the lower and top end of the achievement scores (Reddy *et al.,* 2016a). TIMSS and other benchmarking studies such as the Programme for International Student Assessment (PISA), Southern Africa Consortium for Monitoring Education Quality (SACMEQ), the Annual National Assessments (ANA) and the National Senior Certificate (NSC) exams, however, show that despite many years of mathematics development programmes aimed at redressing the devastating effects of the past, there is little evidence to prove we have made enough progress at the level of the learner (Pournara *et al.,* 2015). These studies should prompt us to look at the direction in which our education system is heading (Reddy *et al.,* 2016b). The report by Reddy *et al.* (2016c), based on TIMSS (2011), also points out that vast differences have been noted in the type of schools the learners attend as learners with access to private educational resources have been found to be achieving better results.

It was also noted in the review done by the Human Sciences Research Council (HSRC Review, 2013) that the greatest improvement was among learners who can be described as “the most disadvantaged”, coinciding with learners and schools that received the highest number of interventions, which aimed at improving the quality of education, from the public and private sector providers. These results reflect the value of continued investment in low-income households and in less-resourced schools. It also gives hope that the greatest improvements in scores is observed at the lowest end, from the lowest performing schools and provinces, and in schools formerly designated for Africans (Prinsloo, 2013). It was also noted that the publication of the 1999 TIMSS results in South Africa sparked a great deal of debate in different circles and was one of the events that catalysed an increased allocation of resources to science and mathematics at school level, thus acting as a lever of change for these two subjects (Reddy, 2013). In this context, it is proper to investigate these factors further and critically assess the progress made in 2015. Measures are to be put in place to accelerate the positive change that we have seen and promote the achievements in previously disadvantaged provinces and schools to attain the Sustainable Development Goals (SDGs) as laid out in the National Development Plan of 2030.

4. Research questions

Using the data from TIMSS 2015 and previous TIMSS 2011 studies, this paper investigates the following research questions in terms of the provinces, types of schools and resources:

1. What differences were noted in Grade 9 learners’ mathematics performance in South Africa in TIMSS 2015 provincially?
2. What factors are associated with Grade 9 learners’ mathematics performance in terms of the provinces in South Africa and what contextual factors are linked to performance in the Eastern Cape?

It is hoped that the answers to the above questions will lead to recommendations that can be made to under-performing provinces so that they can make a significant progress in the future to ensure sustainable development.

5. Methodology

The data for this paper were sourced from the TIMSS 2015 conducted by the International Association for the Evaluation of Educational Achievement (IEA). TIMSS was first conducted in 1995 and the study has been repeated every fourth year since then. South Africa took part in the 1995, 1999, 2003, 2011 and 2015 cycles.

From the population of South African schools, which offered Grade 9 classes in 2015, the IEA Data Processing and Research Centre selected a stratified random sample of 292 schools. The authors conducted the meta-analysis under the guidance of a senior research analysist from the IEA Data Processing and Research Centre on the sample that was stratified by province, language of instruction and type of school (independent and public). A further random selection process of classes was applied for each sampled school after which intact classes participated in the study. Approximately 12 500 Grade 9 learners participated in the 2015 TIMSS for South Africa.

6. Measurement of mathematics and science achievement

One of the consequences of ambitious reporting goals regarding TIMSS is that more questions are set for the assessment than can be answered by any individual learner. To summarise the achievement results on a common scale with a mean of 500 and a standard deviation of 100, TIMSS 2011 used item response theory (IRT) methods. The TIMSS IRT scaling approach used "plausible values" methodology to obtain achievement scores in mathematics and science for all learners. Achievement scores were reported on a scale that ranged between 0 and 1000.

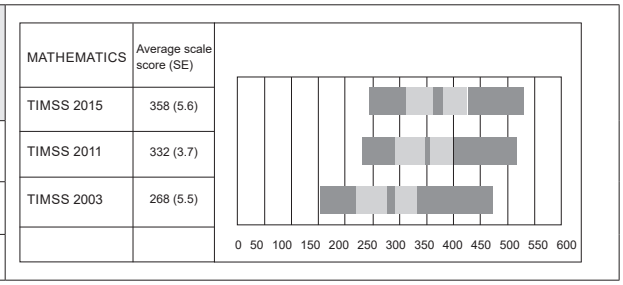
The data analysis for this paper was carried out using IBM SPSS Version 24 and the IEA International Database (IDB) Analyser, which is a plug-in for SPSS developed by the IEA to analyse data from IEA surveys that use a complex sample design and make use of plausible values. The data were subjected to exploratory data analysis as a basis for this descriptive analytic paper.

7. South Africa's achievement in mathematics in TIMSS from 2003-2015

The following table, which was taken from the meta-analysis of Reddy *et al.* (2016b), shows South Africa's achievement in mathematics in TIMSS from 2003 to 2015.

Table 1: South African Achievement in mathematics from 2003-2015 (Grade 9)

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



(Source: Reddy et al, 2016b)

Table 1 shows that South African learners have achieved positive score increases ranging from a score of 285 to 372 in their performance in mathematics. This shows that South Africa's performance is steadily improving even though it is at a slow pace.

8. Performance by province in mathematics: TIMSS 2015

Although the government is working to rectify the imbalances in education, the greatest challenges lie in the poorer, rural provinces such as the Eastern Cape. Schools are generally better resourced in the more affluent provinces such as Gauteng and the Western Cape. The achievement in mathematics performance was analysed per province and Figure 1 shows the achievements in mathematics as taken from Reddy *et al. (*2016b).

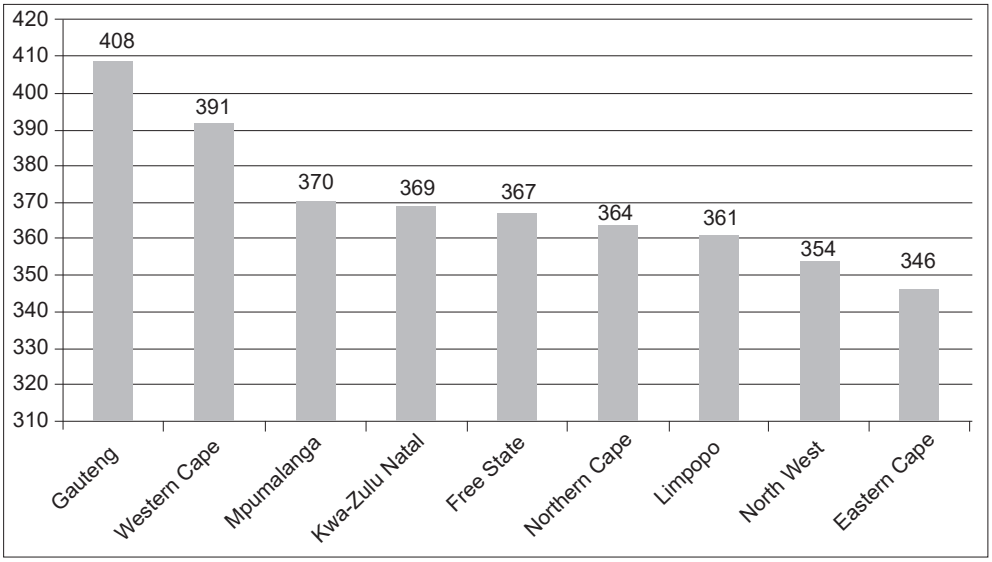


Figure 1: Performance in mathematics by province: TIMSS 2015

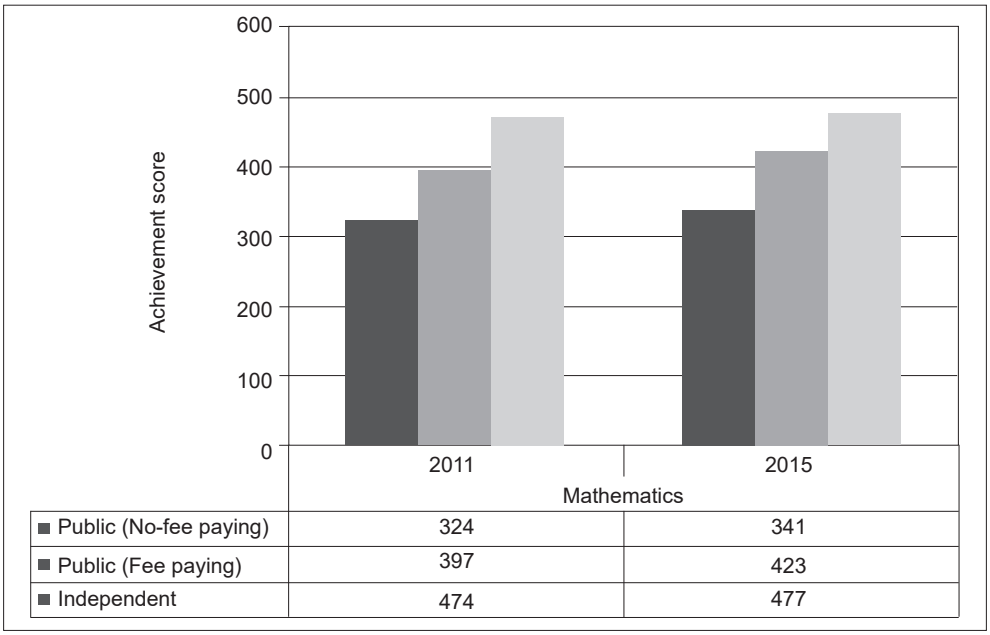
(Source Reddy et al, 2016b)

Figure 1 shows that the Eastern Cape was the lowest performing province in South Africa with an achievement score of 346, which was far below Gauteng, the highest performing province with a score of 408. The Western Cape was the second best province in mathematics with a score of 391. These two provinces scored higher than the national South African average score of 372. Reddy's team (2016b) also noted that South Africa had a wide score distribution, reflecting high educational inequalities, which echo societal inequalities. This highlights the fact that less affluent provinces have many less-resourced schools and consequently their performance is poorer.

9. Performance by school type in mathematics: TIMSS 2011 & 2015

The South African schooling system consists of 7% independent schools and 93% public schools. A wide variation in the physical conditions of schools and the contexts in which schools are located are noticed in the highly unequal South African society. Public schools are

discerned into fee-paying schools and no-fee schools. In TIMSS 2015, 65% of the participated learners attended public no-fee schools, 31% attended public fee-paying schools and 4% independent schools. (Reddy *et al.,* 2016b:6).



	2011	2015
Public (No-fee paying)	324	341
Public (Fee paying)	397	423
Independent	474	477

Figure 2: Performance by school type in mathematics: TIMSS 2011 & 2015

(Source Reddy et al, 2016b)

It is noted in Figure 2 that no-fee schools were the worst performing schools in 2011 and 2015 TIMSS with scores of 324 and 341, respectively. The independent schools performed the best in both years with scores of 474 and 477 respectively. It is noteworthy to see that the achievement score difference was highest in the no-fee schools in 2011 and 2015. This gives hope that the achievement can be attained if contextual factors are addressed and nurtured.

10. Contextual factors that were assessed against the performance in mathematics in TIMSS 2015

Home, school and community environments and the interactions within (Reddy et al., 2016b) mould education and learning. In addition to achievement data, TIMSS collects contextual information about the participating learners, teachers and schools. This helps researchers understand what factors predict learners' academic success (Topçu, 2016).

In the sub-sample of South Africa in the TIMSS 2015, the schools were analysed according to the three categories as no-fee paying, fee-paying and independent schools with regard to schools and home contexts. The analysis was conducted on the variables that could possibly be attributed to sustainable development such as parents with tertiary education, access to running tap water, access to flush toilets, high emphasis on academic success, almost always speaks the test language and bullied on a weekly basis. These aspects are in this paper and Figure 3 was sourced from Reddy *et al.* (2016b).

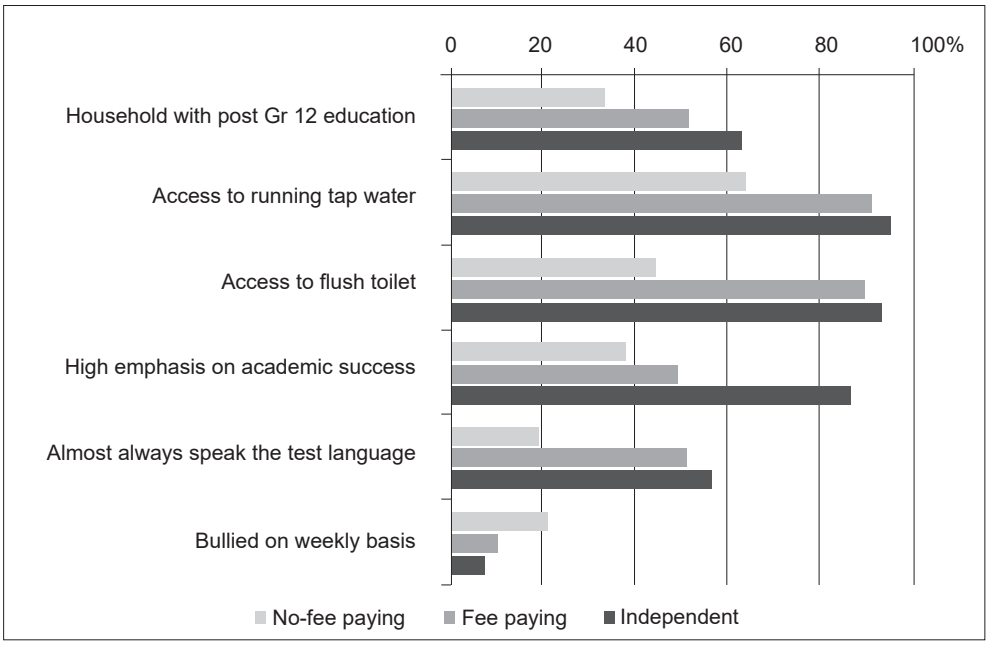


Figure 3: School and home contexts by school type in South Africa: 2015

(Source: Reddy et al, 2016b)

It can be noted from Figure 3 that households with post matric education, access to running tap water, access to a flush toilet, high emphasis on academic success and almost always speaks the test language are the highest for independent schools. Bullying on a weekly basis is happening in most of the no-fee paying schools. The conclusion is that Eastern Cape's very low performance can be attributed to its contextual factors.

The above situation in the Eastern Cape is further analysed by the authors in terms of percentages of the contextual factors against the South African averages. Tables 2-6 show the analysed data of these contextual factors.

11. Household with post-matric education

Higher average mathematics achievement is associated with higher parental education across almost all of the participating countries in TIMSS as noted by Thomson, Hillman and Wernert (2012). The following table analyses the Eastern Cape's percentages against Gauteng, the best performing province and the South African averages.

Table 2: House hold with post-matric education and mathematics achievement

	Eastern Cape		Gauteng		South Africa	
	%	Average Maths score	%	Average Maths score	%	Average Maths score
University or Higher	19.0	388.04	28.86	452.63	22.00	412.51

	Eastern Cape		Gauteng		South Africa	
	%	Average Maths score	%	Average Maths score	%	Average Maths score
Post-secondary but not University	16.0	357.45	21.78	396.90	18.63	375.40
Upper Secondary	24.7	336.79	20.54	378.62	25.44	358.68
Lower Secondary	12.4	323.04	5.34	362.00	8.36	348.48
Some Primary, Lower Secondary or No School	11.2	311.93	3.75	356.30	8.76	338.27
Don't Know	16.7	361.92	19.73	423.35	16.81	383.37

It is noted from Table 2 that the households with family members with university or higher qualifications (19% for the Eastern Cape) performed better with a score of 388.04, which is a better score than 311.93 where the household education indicates household members had some primary, lower secondary or no schooling. Gauteng also reflects the same pattern but with a much higher score.

It is noted from the table that the higher the percentage on higher household education, the higher the mathematics achievement score.

12. Almost always speaks the test language and mathematics achievement

How often English is spoken at home is a factor that is associated with achievement, both in past cycles of TIMSS and in other similar studies (Thomson *et al.,* 2012).

Table 3: Almost always speak the test language and mathematics achievement

	Eastern Cape		Gauteng		South Africa	
	%	Average Score	%	Average Score	%	Average Score
Always	16.11	368.24	17.36	478.08	16.44	408.62
Almost always	13.31	398.48	21.25	445.10	14.42	424.30
Sometimes	65.64	333.79	56.65	377.38	63.42	356.16
Never	4.94	312.28	4.74	362.97	5.72	325.10

It is noted from Table 3 that the students who never speak the test language (English, which is not the home language) scored the lowest average score of 312.28, far below the national score of 325.10. The 13.31% of learners in the Eastern Cape who almost always speak the test language performed the best with the score of 398.48 against the national score of 424.30 where 14.42% of learners almost always speak English. This proves that if the learners are exposed to more of the test language both at home and at school, they can achieve better. Surprisingly, the scores were better than for the learners who always speak the test language. Gauteng also shows the same pattern with a much higher score.

13. Quality of schooling and school discipline

Quality of schooling is measured in terms of the facilities provided in the school and in terms of the discipline observed by the school learners. The two variables that were considered for this paper were access to flush toilets as a measure of facilities provided and the bullying in schools as a measure of school discipline to check against mathematics achievement.

14. Access to flush toilets and running tap water and mathematics achievement

Access to a flush toilet and running tap water can be taken as better school conditions that enhance student learning and achievement. The following table shows the average scores in the Eastern Cape in relation to access to flush toilets.

Table 4: Access to flush toilet and Mathematics achievement

	Eastern Cape		Gauteng		South Africa	
	%	Average Score	%	Average Score	%	Average Score
Yes	46.8	385.18	89.4	416.51	61.20	397.90
No	53.2	327.04	10.6	355.89	38.80	341.83

It is evident from Table 4 that the majority of the learners (53.2%) in the study have no access to flush toilets and their performance is lower with 327.04 against that of 385.18 who said they have flush toilets. In both cases, the condition and scores are below the national percentages and scores reflect the vast differences in the best performing province. In Gauteng, the majority of the schools (89.4%) have access to flush toilets and their performance is much better than that of the Eastern Cape and the national averages.

15. Access to running tap water and mathematics achievement

Table 5: Access to running water and mathematics achievement

	Eastern Cape		Gauteng		South Africa	
	%	Average Score	%	Average Score	%	Average Score
Yes	59.03	368.61	91.02	415.42	73.9	388.2
No	40.97	320.07	8.98	345.17	26.1	333.7

It is evident from Table 5 that the majority of the learners (91.02%) in Gauteng have access to running water and their performance is higher with 415.42 against that of 368.1 who said they have running water in the Eastern Cape.

In both cases, the condition and scores are below the national percentages and scores reflect the vast differences in the best performing province. In Gauteng, the majority of the schools have access to flush toilets and running tap water and their performance is much better than that of the Eastern Cape learners and the national averages.

16.Bullied on a weekly basis and mathematics achievement

TIMSS students and their teachers were asked about their perceptions of safety in their schools since a supportive school environment for learning is one in which teachers and students feel safe and secure, which is an important aspect of school life. It was measured by asking the students about being bullied at schools (Thomson *et al.,* 2012:114).

Table 6: Bullied on weekly basis and mathematics achievement

	Eastern Cape		Gauteng		South Africa	
	%	Ave Score	%	Average Score	%	Ave Score
Almost Never	38.1	374.70	44.2	431.80	36.39	396.50
About Monthly	44.7	350.82	43.0	399.84	46.52	373.67
About Weekly	17.2	304.08	12.8	360.76	17.09	328.35

It can be noted from Table 6 that the learners who are almost never bullied (38.82%) in the Eastern Cape performed much better with a score of 374.70 than those who were bullied on a weekly basis (17.2%) with a score of 304.08. It can also be noted that in Gauteng, the percentages show a similar pattern reflecting a high score of 431.80 where the students who were never bullied totalled 44.2%.

The safety in a school can be taken as a measure for achievement as learners in safer schools achieve better.

17.Discussion

South Africa's future socio-economic prospects for learners and the development of the country as a whole need enormous improvements in the teaching of mathematics in the public schooling system (McCarthy & Oliphant, 2013:3). This analysis is consistent with the report by Spaull (2013), which was commissioned by the Centre for Development and Enterprise (CDE). This report points out that every South African educational achievement dataset analysis shows that two different public school systems are in effect in South Africa in which the smaller, better performing system accommodates the wealthiest 20-25 per cent of learners who achieve much higher scores than the larger system which caters for the poorest 75-80 per cent of learners. These two education systems can be seen when splitting pupils by wealth, socio-economic status, geographic location and language (Spaull, 2013). This is consistent with the analysis of TIMSS 2011 on Australian students by Thomson *et al.* (2012). They observed a decline in the performance of students from metropolitan schools to provincial schools and students from remote schools perform worse compared to the students in provincial schools. The drift of families into provincial and metropolitan areas contribute to the decline in the quality of schools in remote areas which further worsens the problems of remote schools (Thomson *et al.,* 2012:31).

In the analysis of TIMSS 2011, Thomson *et al.* (2012:28) noticed that in Australia, parental education was found to be strongly related to student achievement. The mean score increases as the level of parental education increases indicating a high correlation between parental education and student achievement. A similar situation has also been observed in studies on South African learners.

Thomson *et al.* (2012:30) also noticed that less exposure to the language of instruction and the test disadvantaging the Australian learners coming from homes where English is not frequently spoken. The language of teaching and learning, when it is different from the home language, is a factor that has a significant role in mathematics performance among South African learners (Howie, 2003). It is noted from the study that the students who never speak the test language (English, which is not the home language) scored the lowest average score. Surprisingly the scores were better than the learners who always speak the test language.

Access to flush toilets and other basic facilities can be taken as a better school condition that enhances student learning and achievement. It is sad to see that nearly 20 years after the end of apartheid, many schools remain without basic facilities (Simkins, 2013).

School discipline and a conducive atmosphere for teaching and learning are considered as contributing factors in learner achievement. This is consistent with the Australian learners as reported by Thomson *et al.* (2012:115) that feeling secure at school showed a positive relationship with learners' TIMSS mathematics achievement scores.

18.Conclusion

South Africa emphasises the significance of mathematics and science as part of the human development strategy for South Africa. The improvement is visible in the international benchmarking as the scores in mathematics performance have steadily improved and the achievement score difference is highest in the no-fee schools over the years of TIMSS 2011-2015. The change in achievement scores can be attributed to the change in the conditions.

Investigating the factors associated with learner achievement may help stakeholders to understand the reasons for low achievement and effective measures can therefore be put in place to bring about higher achievements. It is noted from the analysis that the contexts and conditions in the home and in the school that a learner experiences affects learner achievement. Schools are generally better resourced in the more affluent provinces and their achievements are better, compared to those in poorer areas. The higher the parental education and the more often the test language is used, the better the achievement of the learners. The safer the school atmosphere and better facilities at school also support high academic achievement.

The analysis of TIMSS 2015 highlights the view that quality education for sustainable development can be achievable through an increase in parental education, infrastructure development at public schools, learners' exposure to the language of teaching and learning and improvement in school safety measures in poorer provinces such as the Eastern Cape.

19.Recommendations

To attain the Sustainable Development Goals (SDGs) as laid out in the National Development Plan of 2030, the contexts and conditions in the home and in the school that a learner experiences, and which support academic achievement, should be improved. This can be achieved through differentiated interventions that suit each school type and conditions at home.

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