Chapter

Mathematics Education System in South Africa

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Abstract

The teaching of mathematics in South African schools has been pronounced to be among the worst in the world. Unacknowledged poor teaching of mathematics in a majority of public schools deprive many learners access to both higher education and modern, knowledge-intensive work skills. The chapter resumes by outlining mathematics curriculum redress and changes in the post-apartheid era, the exploration of mathematics education, democracy and development, together with the introduction of Mathematical Literacy as an alternative compulsory subject to learners incompetent to do mathematics. The chapter further interrogates how mathematics education, in terms of mathematical knowledge, skills, values and attitudes, is distributed in society and thereby shapes educational possibilities together with the research trends and their effect on mathematics education in South Africa. Mathematics teacher training and empowerment are discussed together with shortcomings in the system that leads to learners' poor performance in Mathematics. How South Africa compares in performance with other countries is also examined in this chapter. The closing remarks of the chapter suggest some improvements that the mathematics education system in South Africa can embark on.

Keywords: mathematics education, mathematics curriculum, mathematical literacy, mathematics knowledge, democracy, research, development

1. Introduction

There has been a significant reform in the South African mathematics curriculum such that the mathematics education research community has also grown markedly. The trust and focus of this chapter is to unpack the mathematics education system in South Africa in the post-apartheid era. The author draws and builds envisaged result bearing changes in the system in the country from various scholars. The curriculum reform in South Africa has been generally political driven. Consequently, the country has experienced reduction of education for the past 20 years to, economic ends, coupled with the conflation between mathematical prowess and problem-solving skills for the knowledge economy, which has resulted in mathematics being isolated as essential knowledge in South Africa. Thus in the post-apartheid era in the country, a redress was effected to ensure that all students will have been exposed to some form of mathematics by the time they complete matric.

After the 1994 democratic elections and post elections in South Africa, many changes took place and the biggest change by necessity has been in the area of education. Initially, curriculum 2005 (C2005) which was driven by the Outcomes Based Education (OBE) was unveiled by the department of basic education. It was

mainly characterized by cooperative group instruction which made it difficult for teachers to identify struggling learners in mathematics understanding at all levels. Outcomes-based education was introduced in 1997 to overcome the curricular divisions of the past, and was reviewed in 2000 after the experience of its implementation by stakeholders yielded bad results [4]. The Revised National Curriculum Statement (RCNS) Grades R-9 and the National Curriculum Statement Grades 10–12 was then implemented in 2002. Consequently, according to [2] the RNCS system failed because the educators did not understand it and quite often did not see the difference between C2005 and the RCNS. The result was that the implementation challenges of RCNS were the same as those of C2005 [2]. It also transpired that RCNS was highly loaded and fell short of its expectations, used vague complex terminology and inadequate training of teachers and district officials. In 2012 it was reviewed again and replaced by the Curriculum and Assessment Policy Statement (CAPS) which was rolled out in all phases. According to the authors [3], OBE is still the underlying philosophy which underpins CAPS. Currently, CAPS is the curriculum practiced in the country as a measure that redresses the inequalities and imbalances of the past. With effect from January 2012, a single comprehensive Curriculum and Assessment Policy Statement was developed for each subject to replace Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R-12.

CAPS in general aims to produce learners that are able to:

- use critical and creative thinking in making decisions of identification and solution of problems;
- work effectively as individuals and with others as members of a team;
- manage and organize themselves in handling their activities responsibly and effectively;
- collect, analyze, organize and critically evaluate relevant data;
- use visual, symbolic and/or language skills in various modes to communicate effectively; and
- recognize that problem-solving contexts do not exist in isolation and demonstrate an understanding and interpretation of the world as a set of related systems [4].

Consequently, the learner develops (a) correct use of Mathematics; (b) number vocabulary, number concept, calculations and application skills; (c) learning to listen, communicate, think, reason logically and apply mathematical knowledge gained; learning to investigate, analyze, represent and interpret information, pose and solve problems; and (e) building awareness of the important role that Mathematics plays in real-life situations, including his/her personal development [4]. The intended CAPS prescribed various topics and the content areas to be covered in each grade with time allocated specifics together with the weighting of the content areas in each phase, outcomes and relevant assessment examples. Mathematics is taught at foundation (grades 1–3), intermediate (grade 4–6), senior (grade 7–9) and further education and training (grades 10–12) phases. Ramatlapana and Makonye [14] assert that although the teachers were free to teach the previous curricular as they saw fit, CAPS was prescriptive and demanded uniformity in implementation across the country. This prescription was enforced because the freedom with the implementation of changed curricular were

counter-productive since learners' performance continued to be poor in mathematics. This was evidently reflected from national school assessments and also in the Trends in Mathematics and Science Study (TIMMS) [7] together with Southern and Eastern Africa Consortium for monitoring Educational Quality (SACMEQ) [10], Government officials and mathematics subject advisors are able to monitor the present curriculum. This is because the mathematics content to be taught is explicitly delimited, paced, and sequenced with prescribed mathematics textbooks that point to certain examples. However, Ramatlapana and Makonye [14] argue that the said prescription restricts the mathematics teachers' professional autonomy. This curriculum is favored in the country because it is helpful in the teaching of low achieving learners from disadvantaged socio-economic backgrounds using a more structured teacher directed instruction [5]. In addition, systematic efforts to change the practice, attitudes and beliefs of mathematics teachers in the classroom so as to effect the learning outcomes of students and familiarize teachers with the implementation of the curriculum are effected through Mathematics Continuous Professional Development programs. Those programs were geared to address the quality of mathematics education, improvement of quality of mathematics teachers, numeracy and mathematics teaching in lower grade levels.

Ref. [6] suggests changes to the way mathematics is perceived. Those changes include: (i) In 1994, mathematics was a compulsory school subject until grade 9, and beyond that it was not compulsory. Those who registered for it at matric level did it on either higher or standard grade until 2007. (ii) In 2001 and 2002, the Outcome-Based Education (OBE) and the Common Task for Assessment (CTA) was introduced to high school learners, but was shortly discontinued due to serious challenges in terms of its implementation. (iii) In 2005 another curriculum change in the form of an "outcomes-based" approach was introduced. This change had a major impact in the learning and teaching in the GET (grades 7–9) due to the fact that it was very vague in terms of what had to be taught in different grades [6]. (iv) Curriculum change over the years has also affected the content to be taught in different grades. Changes involved moving content from one grade to another; removing some content and introducing new content. Recently, Technical Mathematics and Technical Science in technical schools in grade 10 from 2016 has been introduced. This clearly indicates that curriculum change in South Africa is a continuing process. Coupled with the change in curriculum was also the introduction of Mathematical Literacy as an alternative to be done by students who were not competent to do mathematics in the FET phase. This was done to cater for those students who could not do pure mathematics and to retain the compulsory status. This then ensures that all learners are exposed to some form of mathematics by the time they finish school.

2. The exploration of mathematics education, democracy and development

The connection in the triad of mathematics education, democracy and development brings critical engagements with the country's developmental features like poverty and inequality. One of the reasons why mathematics was made compulsory was in the fact that in this day and era, it is used by people, institutions and agencies through all types of applications that come to produce and result in a formatting of society. It therefore requires a more sophisticated mathematically literate person to question the applications within a democracy since an increasing amount of some mathematics is found in all areas of life today. The recently introduced new Mathematics and Mathematics Literacy curricula for grades 10–12 in South Africa

could be a redress to ensure that all South Africans are mathematics literate and numerate. Also the evidence in this line of argument is that access to and competence in mathematics serve very different purposes. The implications of both the presence and absence of mathematics education has real consequences since it is used in a multitude of ways in society like predicting, controlling, interpreting, describing and explaining within a particular cultural, economic and socio-political context. Furthermore, mathematics is expected to integrate a critical, democratic and mathematical competence such that citizenry participates meaningfully in the growing economy. Consequently, South African citizens would then be able to grasp the mathematical basis implicit in the decisions taken for or against them [18].

In essence, the developmental challenge for mathematics education is not confined to particular parts of the world, South Africa is included. Venkat et al. [18] proposed a significant new role in contributing to the acceleration of eradicating poverty, promoting gender equality and universal primary education. The author further suggests that mathematicians and mathematics educators need to work together, from different levels of the education system, in different aspects of research and practice, from different perspectives, and from different parts of the world. This according to [18] would address poverty, injustices, inequity, illiteracy and access to education. In addition, Venkat et al. [18] suggest that in order to create employment and to fight poverty, mathematics education can be used to empower people with knowledge and skills that are necessary to reach the targeted economic growth rates. The author further argues mathematics is required to analyze most of the skills areas of the economic sectors that are being targeted to ensure growth is achieved in the country. A shortage of skilled people who can make things with their hands, those skilled in the technique of an art or craft, engineers, architects, doctors, together with many of those who are involved in various kinds of applications of mathematics in South Africa, has been registered in the country. Therefore, for economic growth, the strengthening of mathematics teaching in schools is important in order to reach development goals and the needs of the impoverished and marginalized communities. The improvement of the basic conditions of peoples' lives, including schooling and the quality of all aspects of mathematics education is crucial to sustaining democracy in South Africa.

In addition to the mathematical knowledge and skills needed in the twenty-first century, mathematics education and performance in the subject determines access to jobs and further or higher education studies in a range of areas, from the natural and physical sciences to economics and technology. Thus, mathematics is on the one hand regarded as a gateway subject, a requirement for admission to learning a large number of these high-status, high-paying professions. On the other hand, it also functions as a gatekeeper, a sorting mechanism used to keep some people who fail to learn and perform at the requisite levels or are failed by the education system [18]. In this way, the teaching and learning of mathematics stratify the society. It is in this notion that mathematics education becomes responsible for the country's economic growth.

3. The distribution and educational possibilities of mathematics education

The distribution of mathematics education is made visible and public through international studies of student mathematics performance and national tests and assessments. South Africa's poor performance in Mathematics and Science education quality was highlighted in the first three TIMMS reports—1995, 1999 and 2002. Feza [5] asserts that South Korea and Singapore which are two of the top performing countries in TIMSS had gone through curriculum changes reforms

driven by political influences and have managed to have their students as the lead performers in TIMSS. However, South Africa's repeated ranking at the very bottom of TIMMS and equally poor outcomes in the annual high-stakes national grade 12 matric examination results, follow with endless speculation about the reasons and causes of South Africa's continued poor mathematics performance. Feza [5] further suggests some factors behind the poor mathematics performance in South Africa as those that connect with curriculum implementation and teacher readiness. The mathematics teachers' classroom practices remain unchanged although the current implemented curriculum prescribes precise content that must be taught to learners at various levels. This can be associated with the observations of the Education minister, Motshekga [11], who noted that "South Africa is significantly under performing in education in general, particularly mathematics teaching and learning. Mathematics teaching is often poor quality, with teachers not able to answer questions in the curriculum they are teaching, one indicator of the challenge. Often national testing is misleading as it does not show the major gap at lower grade levels." In an endeavor to address this saga, the government opted to define the set of values for the teaching and learning of Mathematics in the South African context. It was also acknowledged that in education, the country was doing well in terms of the fact that all learners had access to some mathematics studying, equity, but quality was lacking. Mostly, the underperformance was visible in the public sector schools that form about 80% of schooling in the country. OECD [12] associated the South Africa's mathematics educational outcomes with the aggravation of the excess supply of unskilled labor and worsening income inequality in the country. This crisis has recently worsened as the department of education has decided to progress learners who did not meet the minimum mathematics requirements for progression to the next grade in the senior phase, grades 7–9. I argue in this chapter that the progression of learners who fail mathematics compromises the country's future quality of human capital and economic growth. I further suggest that this can be redressed by subjecting underqualified mathematics teachers, those who had done standard grade mathematics to an intense compulsory in-service mathematics teacher training process. In this way mathematics teachers would be equipped with both pedagogical knowledge and mathematics content for teaching the subject.

In the past decade, Venkat et al. [18] asserted that the number of students seeking to become senior secondary teachers of mathematics in schools has not kept pace with demand. Teaching is unable to compete with the status, remuneration and prestige of other expanding career options in science and technology, given the small pool of successful candidates in matric mathematics. This is associated with the fact that in South Africa, through the deliberate underdevelopment of apartheid, the mathematics education system has inherited a nature of teachers with diplomas as opposed to degrees, who were underprepared in handling the content of the changed curriculum. This legacy remains intact and must be addressed for any reversal of the past and for substantial improvements in providing learners with adequate and appropriately qualified mathematics teachers. Those teachers will then acquire the kinds the mathematical knowledge and skills promised in the current CAPS curriculum. Parker [13] notes that approximately 20% of grade 10–12 mathematics teachers are professionally unqualified and of those that are qualified, still only 21% have some university level courses. In addition, there is also evidence to the fact that qualified mathematics teachers in the system are either not teaching mathematics or not teaching it at the level at which they are qualified [13, 15]. Moloi [10], for example, argues that quality mathematics teaching in South Africa will continue to be a phantom unless (i) there is a quality teacher education that refreshes teachers' competencies; (ii) teachers make efforts to understand how their learners think and learn, and recognize the learning experiences of their learners; and (iii) teachers are given the necessary support by the

authorities. Some of the qualified mathematics teachers either serve in management positions in schools rendering therefore a limited human capital that can assist with effective mathematics teaching. This challenge has exacerbated to a level in which the education minister has lowered the pass requirement for mathematics at grade 12 matric level to 20% across the country, a political decision that hits back to the country's economy as affected students cannot enroll for scarce skills at tertiary institutions although they have passed. In the most impoverished parts of the schooling system, better distribution of the educational opportunities for many more marginalized learners to effectively improve in mathematics performance, requires a targeted, systemic and systematic long-term mathematics teacher continuous professional development, a stable curriculum policy environment, and, a critical level of resourcing and schooling infrastructure for the mathematics education system to function.

4. The introduction of mathematical literacy

The subject mathematical literacy (ML) was introduced at in South African schools in 2006 as a compulsory alternative to mathematics. This was done to ensure that every citizen was allowed some form of mathematical skill which they can use in their personal and work-related life (Subject Guidelines NC (V)) [4]. Although this was a good intention, not all the objectives of the subject were accomplished. First at the time of its introduction, there were no trained qualified teachers to handle the subject. Secondly, it was enrolled at grade 10 level by students who did not perform well in pure mathematics and had a weak pass in their grade 9. Such students also struggled to perform well in languages and other subjects. The objective of ML becoming a high-quality subject, which can stand independently with its own set of objectives, and not to be compared with mathematics, is one of those that were not accomplished. Equally shocking was the announcement that ML had since 2014 also not shown any improvement in students' poor performance up to 2016 [17].

Mathematical literacy (ML) is a context driven subject that is taught and learnt from a contextual framework [4]. According to the subject guidelines for ML, Ref. [4] prescribes that it is a subject that is meant to equip the student to deal effectively with everyday problems. According to the Curriculum and Assessment Policy Statement (CAPS) curriculum documents [4]., 'mathematical literacy is defined as follows: The competencies developed through Mathematical Literacy allow individuals to make sense of, participate in and contribute by becoming responsible citizens who base their decisions on sound information to the twenty-first century world- a world characterized by numbers, numerically based arguments and data represented and misrepresented in a number of different ways. Such competencies include the ability to reason, make decisions, solve problems, manage resources, interpret information, schedule events and use and apply technology' [4].

The implications of the above statement is that Mathematical Literacy allows citizens to make informed decisions and choices after carefully considering all information in its contexts by comparing, conjecturing, calculating and problem solving through the use of numbers and by using and applying technology to assist them. It further states that citizens will be allowed to utilize resources, human or otherwise, in a very optimal manner based on their calculations made. Although the above was an expected outcome of the implementation of ML, not much research had been done to verify whether this is what is actually happening in real life for those students who have gone the ML program at schools. But recent studies point to the fact that the percentage failure rate is higher in Mathematical literacy than pure mathematics in grade 12 matric level. In addition, a major concern was when Umalusi (a body that quality assures grade 12 matric results in South Africa)

announced in 2016 that the "needle for mathematics has not moved", which meant that there was no significant improvement and noticeable difference in the marks for mathematics since 2014. Equally shocking was the announcement that ML had since 2014 also not shown any improvement up to 2016 [17].

5. The research trends and their effect on mathematics education in South Africa

In conjunction with the changing landscape of post-apartheid South Africa, research themes explored in mathematics education include assessment; issues of language; aspects of radical pedagogy and progressive classroom practices; ethnomathematics; and teacher education. Nonetheless, it would be of interest to see how all stakeholders understand the connections between curriculum research, reform, policy and practice in mathematics education. Adler et al. [1] report a considerable increase in primary mathematics education over the past decade. This could be a response to South African mathematics education registered challenge wherein learners' performances at all levels, and teachers' specialized mathematical knowledge [2] was significantly low. The Centre for Development and Enterprise (CDE) is one of South Africa's leading development think tanks, focusing on vital national development issues and their relationship to economic growth and democratic consolidation. Spaull [15] who compiled the CDE report assert that that despite some improvement, South Africa is still significantly underperforming in mathematics education. The data they collected points to indicators on school performance and teaching reveal largely unacknowledged poor teaching of mathematics in the great majority of schools. This is despite the fact that mathematics is a key requirement for not only entry into higher education, but also for most modern, knowledge-intensive work. The most recent report from the Head of the Department of Basic Education's National Education Evaluation and Development Unit (NEEDU), argues that poor learner performance in most schools is largely due to the poor subject knowledge of teachers, especially in mathematics. The government official remarks that this is as a result a major problem in with teacher complacency, which is linked to the ways in which many teachers are appointed, often not on merit.

Informed by the research conducted, Spaull [15] developed four points that must be borne in mind in addressing South Africa's numeracy and mathematics schooling challenge, that (i) although the improvement of mathematics teaching and learning in public schools will not happen fast, it must begin urgently; (ii) poor mathematics and numeracy teaching and learning in public schools accelerate private schooling wherein there is enrolment growth in private extra mathematics lessons; (iii) if South Africa is to be realistic about having a knowledge economy and creating more and better jobs, it will require a sustained focus on teacher and teacher-training development, particularly in mathematics teaching, and (iv) in the interim, it is likely that the country will have growing numbers of innumerate young people, and a majority of young South Africans could be unqualified to be hired in many types of high quality work. Spaull's [15] research suggests (i) the address of the inefficiencies in basic education that result in escalating numbers of drop-out students from grade R-12; (ii) the development of early childhood and special needs mathematics education programs; (iii) a systemic account of public further education and training colleges on how they train mathematics teachers, together with (v) low pass rates in higher education institutions which were roughly half the learners at contact education universities who start a bachelor's degree graduating while only 40 per cent of diploma learners graduate. Further research recommended is on whether (i) the selection, appointment and promotion of mathematics teachers is based on their teaching qualities, as opposed say to the teachers' other relationships

or affiliations to unions; (ii) consideration of whether a system of teacher rewards for learner performance in mathematics can replace a formal teaching qualifications (iii) the allocation of more resources to teaching in school grades with the most serious deficiencies can make the most difference to end results at grade 12 matric level; and (iv) how teacher complacency van be addressed in mathematics education.

6. Mathematics teacher training and empowerment

Stinson [16] projects a historical perspective that reveals existence of mathematics as a gatekeeper in the education system structure of the United States. Equally a good performance in mathematics at grade 12 level allows students to enroll and follow careers of high stature in South Africa. Thus it is important that high quality training of mathematics teachers is ensured such that they are able to equip students with high critical thinking and problem-solving skills.

Mathematics teacher training in South Africa was handled by training colleges prior to the re-dressing of the education system under the apartheid era. Those colleges were divided to the various levels in which the teacher was going to teach. For example teachers who did primary teachers' course (PTC) were enrolled to complete their 2-year certificate qualification in primary teachers' colleges. Different colleges enrolled and trained teachers who were prepared to teach in secondary schools and those were awarded a Junior Secondary Teachers' Course (JSTC) certificate after 2 years. In addition there were those few who were trained via a 1 year higher diploma in education (HDE) in universities after the completion of their first degrees. This last group was composed of few students who would join teaching because of other shortcomings or standards that they could not meet in order to advance to higher degrees. This was all because teaching as a profession was and still is an unpopular profession that is not highly recognized in the country.

During the post-apartheid era, many colleges were closed and or changed to be centers for Further Education and Training (FET) colleges or Technical and Vocational Education and Training (TVET) according to Act 98 of 1998. Thus teachers were now trained in universities. The bachelor of education (BEd) course has a duration of 4 years. For a candidate to be able to complete training to be a mathematics teacher, he/she must have done mathematics up to second year level. Others would enroll for a junior Bachelor of Science (BSc) degree after which they enroll for a 1 year post graduate certificate (PGCE) course in mathematics didactics. Due to the high unemployment rate that is dominant in the country, some currently employed mathematics teachers hold an engineering junior degree but opt for teaching to escape the poverty lines. Consequently, Kaino et al. [8] assert that current mathematics teachers in the field today are a combination of a set of teachers with non-matching school subject knowledge and contrasting models of classroom practices together with proactive, reactive and over-reactive teachers [9]. The authors, Kaino et al. [8], further note that teachers with non-matching school subjects require continuous professional development to address and adjust to the consequences of an environment characterized by enormous infrastructural backlogs, resource limitations, an inadequate supply of quality learning support materials, and the absence of common national standards for learning and assessment.

It is for this reason that in each of the provincial departments in South Africa, members of the Sub-Division of the Professional Development and Research Division are responsible for the implementation of the Continuous Professional Teacher Development Management system in all provinces. Such provision is facilitated through the South African Council of Education (SACE) who liaises with other stakeholders like teacher unions, School Governing Body associations and others to approve service providers in different provinces in South Africa. Also mathematics teachers at various

levels work with projects initiated by South African universities to be empowered and improve their mathematics pedagogical skills. It is my contribution and proposal in this chapter that mathematics teachers need to undergo compulsory professional training in-service before they are permanently employed. It is during that training that the mathematics content knowledge gap can be closed and that they would be equipped with the competencies of handling the subject even in under resourced trying conditions. This is practiced in other countries like South Korea and Singapore. The students in those countries are taught well and perform very well in mathematics.

7. Conclusion

Investigations on the South African mathematics education system have consistently revealed how critical the situation is. Irrespective of the highlighted shortcomings and condition surrounding the teaching and learning of mathematics, echoing the irregularities in the system will not help, but the existing challenges must be addressed. Clearly a political solution in which the quality of successful performance standards in mathematics at grade 12 matric level have been lowered to 20% is not a solution. That compromise psychologically disadvantages concerned students who would like to pursue careers in which mathematics is required. In this chapter, I argue that teaching is an art and the teaching of mathematics requires continuous professional development that equips that teachers with mathematics content at various levels and how it can be presented in the classroom. The supervision of mathematics teaching practice must be preceded by demonstrated micro-teaching lessons on various topics. All mathematics teachers should have access to mathematics open education resources that are freely available online.

Also, a shift in the mindset of mathematics teachers must be promoted. The department of education can consider bring back the training colleges such that quality mathematics teachers can be trained. The performance in the subject must be detached from politics and be controlled by conceptual knowledge of the subject. In that way students will not be taught for passing mathematics in different levels, but rather understanding that can assist the student to connect and apply learnt and known mathematics concepts to the improvement of their daily lives. A system that empowers and compels mathematics teachers to serve for 2 years before they are permanent, as practiced in Singapore can turn the tables around for South Africa.

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References

[1] Adler J, Alshwaikh J, Essack R, Gcsamba L. Mathematics education research in South Africa 2007-2015: Review and reflection. African Journal of Research in Mathematics, Science and Technology Education. 2016. DOI: 10.1080/18117295.2016.1265858

[2] Bjorklund AS. Eleven Eastern Cape Teachers' perceptions of the implementation of the curriculum assessment policy statement. Thesis in pedagogy in the field of curriculum reform. Minor Field Study. 2015

[3] Carnoy M, Chisholm L, Chilisa B. The Low Achievement Trap: Comparing Schools in Botswana and South Africa. Pretoria: HSRC Press; 2012

[4] The Departments of Basic Education and Higher Education and Training. Integrated Strategic Planning Framework for Teacher Education and Development in South Africa, 2011-2025. Pretoria; 2011

[5] Feza N. Good intentions are not actions: Mathematics education of South Africa demands action and pride from the citizenry. Mopani–Kruger National Park, South Africa: ISTE; 21-25 October 2014

[6] Govender VG. Factors contributing to the popularity of mathematics olympiads and competitions in some schools: An interrogation of learners' and teachers' views. In: Proceedings of the 24th Annual National Congress of the Association for Mathematics Education of South Africa. 2012

[7] Howie S. Mathematics and Science Performance in Grade 8 in South Africa 1998/99. Pretoria: Human Sciences Research Council; 2001

[8] Kaino M, Dhlamini JJ, Phoshoko MM, Jojo ZMM, Paulsen R, Ngoepe MG. Trends in mathematics professional development programmes in post-apartheid South Africa. International Journal of Educational Sciences. 2015;**8**(1–ii):153-163

[9] Lindeque B, Gawe N, Vandeyer S. Context analysis. In: Teaching-Learning Dynamics. Edinburg Gate, Harlow, England: Pearson Education South Africa (Pty) Ltd.; 2016

[10] Moloi MQ. Mathematics achievement in Southyn Africa: A comparison of the official curriculum with pupil performance in the SACMEQ11 project. In: Paper presented at the International Invitation Education Policy Research Conference. 2012

[11] Motshekga A. Statement on the Release of Annual National Assessments. Results for 2013. Atteridgeville: Mahlahle Primary School; 2013

[12] OECD. Education at a glance. In: Education Indicators. Paris: OECD; 2008

[13] Parker D. Grade 10-12 mathematics curriculum reform in South Africa: A textual analysis of new national curriculum statements. African Journal of Research in SMT Education. 2006;**10**(2):59-73

[14] Ramatlapana K, Makonye JP. From too much freedom to too much restriction: The case of teacher Autonomy from National Curriculum Statement (NCS) to Curriculum and Assessment Statement (CAPS). Africa Education Review. 2012;**9**(suppl 1): S7-S25

[15] Spaull N. South Africa's Education Crisis. Johannesburg: Center for Development and Enterprise (CDE); 2013

[16] Stinson DW. Mathematics as "gate-keeper" (?): Three theoretical

perspectives that aim toward empowering all children with a key to the gate. The Mathematics Educator. 2004;**14**(1):8-18. Available from: http://math.coe.uga.edu/tme/Issues/v14n1/v14n1

[17] Umalusi Report on the Annual National Assessment of 2013: Grade 1 to 6 & 9. Pretoria: Department of Basic Education, Umalusi on their 2013/2014 Annual Reports, with Deputy Minister present, NCOP Education and Recreation; 2014

[18] Venkat H, Adler J, Rollnick M, Setati M, Vhurumuku E. Mathematics and science education research, policy and practice in South Africa: What are the relationships? African Journal of Research in Mathematics Science and Technology Education. 2009;**13**(special issue):5-27