Some trends in mathematics professional development in selected developing and developed countries: an insight into post-apartheid South Africa

Prof Luckson M. Kaino, Dr Mapula G Ngoepe, Dr Moshe M Phoshoko, Dr Zingi MM Jojo, Dr Joseph Dhlamini, Ms Ronél Paulsen

Department of Mathematics Education
College of Education
University of South Africa (UNISA)
SOUTH AFRICA
Email: kainolm@unisa.ac.za; muganyizikaino_prof@yahoo.com

Abstract
This paper reports on a pilot study on professional development in mathematics in the post-apartheid era in South Africa. The study endeavoured to examine the status of existing professional development practice and the challenges practitioners experience in the implementation of such programmes. The study involved five of the nine provinces in South Africa. The population of the study was 55 and consisted of teachers, principals, subject advisors, district officials, ministry of education and service providers. Data were collected by means of a teacher questionnaire and interviews which were analysed using qualitative methods. The study found that the status of the implementation of the Mathematics Continuous Professional Development (MCPD) programmes is determined by a variety of factors such as relations between labour unions and the employer, the political legacy of the country and others. The study also established that different participating groups experienced different challenges regarding the implementation of MCPD programmes. This data was also useful in the modification of some of the research instruments.

Key words: Mathematics Continuous Professional Development (MCPD), teacher training, teacher knowledge

Background
The background endeavours to provide the reader with the reality of mathematics education in South Africa and to sketch the curriculum developments that have impacted on the teaching methods and contents of mathematics teaching and learning in schools. It also provides an overview of the professional development of mathematics teachers – their pre-service as well as the in-service training which is inextricable from how the teaching and learning of mathematics takes place in the classroom. To do this, it is necessary to reflect on the past and present situation of mathematics education in the country.

Historical perspective
Teacher education in South Africa has been characterised by segregation of teacher education programs that generated a set of teachers with non-matching school subject knowledge and contrasting models of classroom practices. According to the report by the Department of Basic Education and Higher Education and Training [DBEHET] (2011), controversies in the South African education system are mainly due to the previous political incorporation of language and race issues in education. The apartheid-conscious architectural model in figure 1 clearly necessitated different training programs for teachers, with consequences of different teaching qualifications and uneven quality of inputs for teachers of different races. According to (DBEHET, 2011), many colleges for training black teachers were built with little national planning, quality assurance or accountability. These colleges focussed mainly on primary school teachers despite a huge demand for secondary teachers such as those of mathematics and science (Parker, 2003). Towards the 1990s, the training of white teachers in the
colleges was being phased out in favour of a more structured and progressive university teaching qualification, while colleges for black teacher education continued to mushroom all over South Africa (Parker, 2003). For instance, in 1981 there were 37 training colleges for black teachers in South Africa and they reached a peak of 120 with about 80000 student teachers by 1994 (Parker, 2002). Despite many colleges that existed to train black teachers and a relatively high volume of teachers that emerged from these establishments, the schools under the Department of Education and Training (DET) persistently performed poorly when compared to schools served by the Department of Education and Culture (DEC).

![Diagram](image)

**Figure 1: The education structure of South Africa during the apartheid era**
*Source: Macrae (1994, p. 272)*

The democratic government of national unity in 1994 undertook to resolve persisting problems in the teacher training system addressing undesirable societal inequalities. In particular, the culture of poor performance in black township schools mirrored the inferior quality standards of teacher training programs associated with 120 colleges that existed at that time. After the democratic elections in South Africa in 1994, there was a radical change to the way education was perceived and approached. Further changes to the education system that took place since have contributed to setting up a framework and philosophy for the current education system. Underpinning any educational reform that is introduced are the concomitant changes regarding what is viewed as being important to teach, how it should be taught and consequently the way the pre-service training and professional development of serving teachers is approached.

Curriculum 2005, dubbed C2005, was introduced in 1998 and provided the shift from a content-based to an outcomes-based curriculum (Mda & Mothata 2000) as was alluded to in the 1994 statements. This system was the first, and probably one of the most significant, changes to take place in the new democracy's education system. The implementation of Curriculum 2005 took place in an environment characterised 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. One of the basic principles of Outcomes Based Education (OBE) is that learners should become active participants in the classroom. The learners should take ownership of their learning. The shift in methodology from a teacher-centred to a learner-centred approach was one of the main propositions. In an OBE classroom the learners had to be allowed to apply their knowledge in real-life situations (Van der Horst & McDonald 2008).

Assessment strategies also changed drastically from mainly summative assessment to formative assessment. The teacher was to take on the role of facilitator, while the learners emerged as the creators of learning. Learning was to replace teaching, and the construction of meaning took priority.
over classroom instruction. Jansen & Christie (1999: 213) indicated that this “disappearing” of teachers under C2005 was “completely naïve about the working conditions and proficiency profiles of most South African teachers”.

The implementation of C2005 was not without its problems and OBE came under heavy criticism from teachers, parents, the media and academics (Spady, 2008; Jansen, 1998). Jansen (1998) provided reasons why he thought OBE would not work in South Africa. He made recommendations regarding what he perceived should be done to overcome the challenges posed by C2005 if it were to be implemented. One issue that stands out from what Jansen’s concerns were, was about the quality of in-service teacher development that he considered would be (and was) superficial.

Despite the critique, the consequence was that C2005 was then modified into the National Curriculum Statement (NCS) in 2002. Kadar Asmal (Minister of Education) was adamant that “OBE is here to stay” (Asmal 2000). Thus, the NCS was still underpinned by the philosophy of OBE. Despite the introduction of the NCS in 2002, the education dilemma continued and mathematics teaching and learning continued to be fraught with problems. On the 5th November 2009, Minister Angie Motshekga declared the “death” of Outcomes Based Education in Parliament.

The deliberations in the previous paragraph gave rise to yet another change in South Africa’s Educational System. In 2012, the Curriculum and Assessment Policy Statement (CAPS) became part of the National Curriculum Statement (Department of Basic Education, 2011). The Department of Basic Education gave the reasons to the changes made to the NSC as:

- Complaints about the implementation of the NCS
- Teachers who were overburdened with administration
- Different interpretations of the curriculum requirements
- Underperformance of learners (Pinnock, 2011)

In the CAPS document, the National Curriculum Statement was repackaged so that it could be more accessible to teachers. Every subject in each grade now had a single, comprehensive and concise Curriculum and Assessment Policy Statement (CAPS) to provide details on what content teachers ought to teach and assess on a grade-by-grade and subject-by-subject basis. There were clearly delineated topics for each subject and a recommended number and type of assessments per term. The terms Learning Outcomes and Assessment Standards were no longer used, and Learning Areas became known as subjects, as before.

In reference to the South African education system, Section B of DoE (2005) begins with the statement that “the education system requires a steady flow of newly qualified teachers” (p. 10). This statement clearly conjured the new government’s intentions of finding new possible ways to produce a competent generation of teachers for the 21st century. As a departing point the government embarked on a merging project that saw different ministries of education becoming one National Department of Education. The resulting merging of the Departments of Education also meant that the issue of teacher training and education needed serious and immediate intervention.

Because colleges offered a teaching diploma for training teachers, it was soon proposed that teaching must be a graduate profession. With this proposal came an idea that initial teacher education programs be moved from Colleges of Education to Higher Education Institutions. Between 1994 and 2000, many Colleges of Education ceased to exist, making universities to become major providers of teacher training. As a consequence, most of the colleges were either merged or incorporated into larger entities as part of provincial rationalization processes aimed at overcoming the educational inequalities of apartheid and reducing an identified oversupply of primary school teachers (DBEHET, 2011).

While the current government is making efforts to produce highly qualified mathematics teachers, the challenge is that there still exists a knowledge gap in terms of professional development of teachers. Teacher education is a form of professional education that has a purpose to improve the professional classroom practice of teachers (DOE, 2005). Mathematics education in particular in South Africa has suffered a multitude of well-publicised problems namely:

- Shortage of mathematics teachers
- Under qualified teachers
• Teachers struggling with subject content
• Little or absence of pedagogical content knowledge and
• Poor teacher performance in mathematics in general
• Mathematics taught in English, a second language for the majority of both teachers and
learners. There are 11 official languages used to teach all subjects from grade R to grade 3
From grade 4 up, instruction is given in English, a language that is used in school classrooms
only, and they switch back to their home language outside the class
In addition the frequent changes in both mathematics curricula and syllabi (OBE, curriculum 2005,
NCS, and CAPS) have resulted in challenges at classroom and governmental level.
In the classroom:
• Poor learner performance standards and results
• A lack of classroom discipline
• Insufficient resources (modern technology not an option in most rural situated schools)
• Inadequate infrastructure
On a governmental level:
• Failure of appropriate teachers' work support, inspection, and monitoring,
• Lack of continuous training of teachers in service
• Changing curricula without proper training and communication
• No continuity for teachers as well as learners
• Demoralisation and disillusionment among teachers and
• Negative and worsening perception of the teaching profession as a whole.

The importance of a senior school certificate with mathematics
Mathematics as a subject in the Further Education and Training Phase (grades 10–12) in South Africa
is considered to be a passport to higher education. The success of a learner in gaining access to higher
education depends on his or her choice of subjects in the FET phase. For learners who wish to enrol at
a higher education institution, their mathematics score plays an important role in their choice of studies.
Before 2008, students could choose between higher and standard grade mathematics, or could opt not
to take mathematics at all. The matriculants of 2008 were the first cohort of students who were able to
choose between mathematics and mathematical literacy in grades 10–12. As Schollar (2008:4) puts it:
“Until recently, the only national measure of the outcomes of the school system has been matriculation
examinations.” The class of 2006 provided particularly interesting data worth reflecting on, for it was the
first post-apartheid cohort of learners to pass through the system.
Schollar (2008:4) quotes the following figures:
• A total of 1 676 273 learners enrolled in Grade 1 in 1995
• These learners were in Grade 4 in 1998, the year that OBE was introduced in the
form of C2005.
• 528 525 learners (31,5%) survived to write the matric exams in 2006.
• 330 513 learners (19,7%) wrote the mathematics exam.
• 25 217 learners (1,5%) achieved a pass in mathematics at the higher grade.
International comparisons
The most recent report on Mathematics outcomes in South African schools was published by the Centre for Development and Enterprise in October 2013. This report summarises two specially commissioned research papers by Professor Charles Simkins and Dr Nic Spaull. The 2011 TIMSS showed that South Africa performed worse than any other middle-income country. The average South African Grade 9 learner is 2 years’ learning behind the average Grade 8 learner from 21 other middle income countries in mathematics. (CDE Report, 2013)

![Average Grade 8 (South African Grade 9) Mathematics Achievement in 2011 in Comparison to Other Middle-Income Countries](image)

Source: Spaull 2013, report for CDE, South Africa’s Education Crisis

The quality of education in South Africa 1994-2011

Dr Nick Taylor, in his most recent report as 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. He also emphasised the role of patronage in teacher appointments in his input paper for the National Development Plan.

More broadly there is a major problem with teacher complacency, and this is linked to the ways in which many teachers are appointed – often not on merit. One aspect of this lack of attention to merit is how teachers evaluate themselves.

Spaull (2013) reports that:

“In the recent TIMSS 2011, 89 per cent of South African Grade 9 teachers felt ‘very confident’ in teaching mathematics, in stark contrast to teachers in Finland (69 per cent very confident), Singapore (59 per cent very confident) and Japan (36 per cent very confident), the best performing countries. This is particularly at odds with Grade 9 student performance, where 32 per cent of South African students perform worse than random guessing on the multiple choice questions.”

The report further indicates that in reforming mathematics teaching, it is likely that resistance from teachers will be encountered. Why should they want to improve and undertake retraining, for example,
if they believe they are already doing a good job? Interventions will thus have to bear in mind that teachers will be faced with a change in attitude.

Based on this evidence, CDE has developed four points that must be borne in mind in addressing South Africa’s numeracy and mathematics schooling challenge.

1. Improving mathematics teaching and learning in public schools will not happen fast, but must begin in earnest as a matter of urgency;
2. Poor mathematics and numeracy in public schools is likely to accelerate private schooling growth and enrolment in private extra mathematics lessons;
3. 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 enhancement, particularly in mathematics teaching, which – given its scale and current attitudes – will likely take a decade or more to achieve significant results;
4. In the interim, it is likely that we will have growing numbers of innumerate young people, and a majority of young South Africans could be unqualified for many types of white collar work (assuming less than 30 per cent in mathematics in Grade 9 roughly translates into such a status).

(CDE Report, 2013)

Teacher training in South Africa

Most teachers in South Africa at present were trained under the apartheid government (Van der Berg & Burger 2010:13). The teacher is likely to have completed secondary schooling in 1998 and entered the first grade in 1986 at the earliest. Between 1976 and 1996, South African schooling, particularly for black South Africans, became part and parcel of the political struggle against apartheid. Consequently in many black townships school where there was considerable political turbulence, a breakdown of the culture of teaching and learning was inevitable. Many schools became dysfunctional and their primary education practices were thrown into disarray (Adler & Davis, 2006).

In the Government Gazette vol 41, No 19421 of 1998, the amendment of the Further Education Act was announced. The purpose of this Act was “…to establish a national co-ordinated further education and training system which promotes co-operative governance and provides for programme-based further education and training” (Government Gazette 98 of 1998: A-859). Subsequently, all the teacher training colleges in South Africa were either closed or incorporated into Higher Education institutions. The incorporation of teacher education into Higher Education institutions was, in the words of Welch (in Adler 2003: 25) “…the most profound change in teacher education”. Welch further states that the rationalisation of teacher education was necessary, because of the expensive fragmented teacher education created by apartheid. The decision to incorporate these colleges was taken in order “…to raise the professional status of the teaching profession” (Pandor in McGregor 2008). Hence, programmes such as the National Professional Diploma in Education (NPDE) and the Advanced Certificate in Education (ACE) were introduced for practicing teachers to upgrade their qualifications. The NPDE was intended to bring teachers with the old-two year pre-service qualification to an M+3 level and ACE was to further upgrade these teachers to an M+4 level.

Nevertheless, currently South Africa continues to face a serious shortage of teachers in the “scarce” subjects such as mathematics and science as Moloi & Strauss (2005) point out. Clearly there is a need for better and improved pre-service training, and relevant and effective in-service training for mathematics teachers. The new curriculum requires teachers to change their existing beliefs, knowledge and practices that are typical of a traditional classroom (Graven 2004) and it seems that most teachers still function within a traditional performance-based model of education, which is not congruent with the curriculum reforms in South Africa (Taylor & Vinjevold 1999).

It is important to recognise that in-service development entails more than the improvement of the content knowledge of teachers – not that it has necessarily been successful in this regard. However, professional development through in-service training should include guidance on the improvement of teachers’ classroom practices which means that successful professional development should involve

---

1 A three year qualification after matriculation
2 A four year qualification after matriculation
teachers in content knowledge as well as knowledge of teaching (Borasi & Fonzi 2002). The mathematical knowledge that teachers bring to teaching will have a positive influence on their learners’ learning (Hill, Rowan & Ball 2005). Nevertheless, although professional development may equip teachers with knowledge and skills, it is still up to them to make their own connections with their daily practice in the classroom (Bass, Usiskin & Burril 2002:1).

In order to succeed in achieving the aspirations of the Department of Education, teachers need better and more sustainable training in mathematics content knowledge and mathematical knowledge for teaching. Teachers need more direct training, and not more paperwork, as expected by the Department of Education.

New directions in teacher training in South Africa

In 2011, the Department of Higher Education and Training published a new policy on the minimum requirements for teacher education qualifications. (MRTEQ). This policy aligns qualifications for teacher education with the Higher Education Qualifications Framework (HEQF) of 2007, and it replaced the Norms and Standards for Educators in Schooling, 2000, in its entirety.

The policy also describes articulation routes for teachers holding historic qualifications into the new set of HEQF-aligned teacher education qualifications. The specification of a set of minimum requirements for teacher education qualifications is aimed at ensuring that the higher education system produces the kinds of teachers that the country needs. All new teacher education qualification programmes, offered by public universities, must comply with this policy to be approved by the DHET for inclusion in a particular institution’s PQM, as well as for recommendation for submission to the CHE/HEQC for accreditation. Unisa compiled a Programme Qualification Mix (PQM) according to the framework of the new policy.

The diagram below illustrates the articulation of previous qualifications into the new PQM framework.

Articulation of previous qualifications into the new framework [p.44] (DHET 2012)

---

3 DHET: Department of Higher Education and Training
4 CHE: Council of Higher Education
5 HEQC: Higher Education Quality Committee
In this respect, the Department of Mathematics Education proposed three new programmes for in-service training of mathematics teachers. These will be offered on-line, opening the door for already qualified teachers to improve their qualification.

**Objectives of the study**

The general objectives of the pilot study were to:

1. examine existing Mathematics Continuous Professional Development (MCPD) practices in South Africa
2. to test the instruments designed for examining the current status of professional development of mathematics teachers in South Africa

The specific objectives of this study were to:

1. determine the nature of the MCPD activities conducted by practitioners.
2. explore the practitioners' views on MCPD
3. investigate the roles and contribution of the stakeholders in MCPD
4. explore the challenges the practitioners experience in the implementation of continuous mathematics professional development programmes.

**Research questions**

The two research questions for this study were:

- What is the nature of mathematics teacher professional development programmes that exist in South Africa?
- What are the challenges experienced in implementing current initiatives in mathematics teacher professional development programmes?

**Methodology**

**Research design**

This pilot study was exploratory in design in which data were obtained by means of a teacher questionnaire and interviews for the other participants. The exploratory design was used to determine the nature of mathematics teacher professional development programmes that exist in South Africa. The study also explored the views and roles of the practitioners, contribution of stakeholders and the challenges experienced by the practitioners in the implementation of the mathematics professional development programmes.

**Population and sample**

The population of the pilot study consisted of a convenience sample (N = 55). In a convenience sampling process the researcher works with “whoever happens to be available at the time” (Gay, Mills & Airasian, 2011, p. 140). It was felt that this non-random sampling technique would be appropriate at the pilot stage in order to optimize the elicitation of data collection for analysis and to enhance the instrument refinement process. This population consisted of mathematics teachers (n = 17), school principals (n = 11), subject advisors for secondary schools (n = 14), district officials (n = 9), provincial officials (n = 3) and service providers (n = 1). The rationale for including all these participating groups was to explore the nature of Mathematics Continuous Professional Development Programmes (MCPD) at various levels of implementation, and to triangulate data from these sources. Triangulation essentially involves cross-checking for internal consistency and reliability (Gall, Gall & Borg, 2006).

The study was piloted in five of the nine provinces of South Africa. The five provinces were Gauteng, Limpopo, Mpumalanga, Eastern Cape and North West. The distribution of participants in terms of the provinces is provided in Table 1.

---

6 Practitioners in this study refers to teachers, principals, subject advisors, district officials, provincial officials and service providers

7 Stake holders in this in this study refers to principals, subject advisors, district officials, provincial officials and service providers
Table 1: Distribution of study participants (N = 55) in terms of provinces

<table>
<thead>
<tr>
<th>Province</th>
<th>Eastern Cape</th>
<th>North West</th>
<th>Gauteng</th>
<th>Mpumalanga</th>
<th>Limpopo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>8</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Principals</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Subject advisors</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>District officials</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Service providers</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Instruments
The instruments used in the pilot study consisted of a teacher questionnaire and interview guides for teachers, principals, subject advisors, district officials, provincial officials and service providers. Different instruments were used to elicit and acquire comparable views of participants on MCPD. The items in each of the instruments were mainly constructed and modified by the researchers to collect cross-sectional data on participants' experiences, views, needs, and expectations regarding MCPD's.

Teacher questionnaire
The questionnaire probed teachers and motivated them to think more critically on the influence of MCPD on their abilities to perform effectively at classroom level. In this section participants were not given responses to choose from, they provided individualized responses that were largely influenced by their practice. Essentially, items sought teachers' views on the MCPD they had experienced. This included specifically the MCPD workshops and meetings they had undertaken in the past three years that preceded the study. Some of the items in this section were: What are the benefits of MCPD in your practice as a teacher?; What challenges do you face in implementing MCPD initiatives after attending?; etc. A sample of teachers' responses to these items is documented in the analysis section of this paper.

The interview guides for other participants
Except for teachers, all other participants were interviewed. All items in the interview guides were developed by researchers mainly to address the research questions of the study. Different items were constructed for each group of respondents, and were posed to address issues pertained to each category of participation. For example:

- **Principals**
  - What kind of support do you have for the facilitation of the MCPD programme in the school?
  - What kind of professional assistance do your mathematics teachers need?

- **Providers**
  - How do you develop the MCPD programmes? Please explain.
  - How are the programmes conducted? (e.g. face to face; online, etc)

- **Subject Advisors/ District officials**
  - What kind of professional development support do you as a subject advisor provide to the mathematics teachers in your district?
  - What suggestions do you have on the improvement of the MCPD programmes?

- **Ministry**
  - What type of professional development programmes exist in the country? (short courses, lesson study, progression related type, continuous development, once off intervention type, etc)
  - What kind of professional development programmes do you provide for mathematics teachers in your province?

Reliability and validity of the instruments
Reliability
The results of the pilot study were used to refine the instruments. Some of the items were redesigned and other discarded during the discussion of the original instrument. This paper deals with the responses of the pilot study.
Validity
The validity of a qualitative design is the degree to which the interpretations and concepts have meaning for both the participants and the researcher (Creswell, 2002). In this study, multiple instruments, multiple informants and more than one data-gathering method were used, which greatly strengthened the study’s usefulness in other settings.

Data collection
The team of researchers from the Department of Mathematics Education (DME), at the University of South Africa, participated in all data collection activities. The actual field work of the pilot study lasted for approximately three months. In each case two researchers were assigned to visit provinces and districts to administer the questionnaires and conduct interviews. The administrative staff from the DME assisted in securing appointments with district managers to access schools. In addition, district managers were requested to assemble school principals to the district offices to facilitate the interviewing process. School principals, subject advisers and district officials were interviewed separately. Researchers divided themselves in terms of different participating groups in each district. All interviews lasted for almost 30min and were audio recorded.

The next session entailed the administration of a questionnaire to mathematics teachers. Arrangements were made with school to access schools to interact with teachers. Given that the data collection process took place during the normal school day, all teachers were visited during this time. It would not have been possible to assemble teachers at the district since this would disturb the normal running of the school. Upon arrival in each school mathematics teachers were requested to complete both sections of the questionnaire. In each case arrangements were made that teachers complete the questionnaire at a time when they were not engaged in teaching activities. Teachers asked questions in items which seemed not to be clear to them. Averagely, the data collection process for the questionnaire lasted for almost 30min. Given that all questionnaires were completed in the presence of researchers the return rate was 100%.

Data analysis and discussion
A thematic analysis of the interview and questionnaire data revealed categories of existing MCDP’s. After the data collection phase all researchers convened to do the analysis. The interview questions for subject advisors and ministry were adopted because they were valid and reliable. The rest of the instruments were modified as follows:

District Officials- Item 2-which read, ‘What kind of professional development programmes do you provide for mathematics teachers in the district’ to ‘What kind of mathematics professional development programmes do you provide for mathematics teachers in the district? (e.g. content knowledge, instructional skill and strategy, methods, etc.)

Teachers- initially the categories that represented teachers’ years of teaching were given as <3; 4-5; 6-10; 11-15; 16-20 and >20. They were then modified to 0-3; 4-6; 7-12, then more than 12 years and leave out the other options. The modification was to align the instrument with the purpose of the study which contextualized the study within the post-apartheid era. Some of the responses necessitated the addition of new items to the instrument to capture the relevance of the effect of MCPD’s to their practice. For example, one of the items added was, ‘What are the benefits of CPD in your practice as a teacher? The process of reviewing the instruments also entailed the rephrasing, and removal. In addition, there was also an agreement to pose certain items in an open-ended format in order to give ground for teachers to talk.

Challenges in the pilot study
The following were challenges encountered during the pilot study:

- Timing for data collection

Some of the teachers were visited while their lessons were in sessions and this hindered the data collection process. In some instances some of the district officials were unavailable even though
appointments had been arranged. Initially the researchers had planned to include observation schedules for data collection with the providers which did not materialise. This is because there was no MCPD activity that was being implemented at the time of field work.

- Distance from one district to the other
- Some of the participants used the researchers’ visits as opportunities to voice complaints with expectations from DBE, which researchers could not give solutions to.

**MCPD Teachers’ responses**

Although the term Continuous Professional Development (CPD) was unknown to some of the respondents in the pilot phase of the study, the majority of the teachers described it in terms of a definition or what it does or will do to/for them on a personal basis. In terms of a definition, it was described as a guiding, empowerment, enrichment, enhancement and development tool of content knowledge and teaching. It was also described as tool to close any existing gap in the content knowledge and teaching practices. As a description in terms of what CPD would do to/for them, teachers identified collaboration with other professionals as reflective of CPD. CPD was also described by teachers as the means by which they acquire resources, teaching skill and content knowledge for their own development or use.

Responding to the question of whether they had ever participated in any kind of Mathematics Continuous Professional Development (MCPD), some teachers indicated that they had not while others responded in the positive, listing Dinaledi, NCS and CAPS training, district, sub-district or school-based workshops and in-service or ETDP seta (skills development) training as some of the programmes they had been involved in.

Teachers mentioned the provision of learning support materials and the unpacking of challenging topics as some of the benefits of having been involved in the MCPD programmes. They also indicated the acquisition of content knowledge, pedagogical content knowledge and skills to present (interpret and/or implement) the curriculum as beneficial to them. According to these teachers, their participation in MCPD programmes influenced their practice in terms of motivation as well as the quality of skills and knowledge in the teaching and learning of mathematics. They indicated that they were encouraged “to go back to the learners to help them”, had gained the confidence to present some mathematics topics and also felt free and positive about their work. They described their teaching and learning of mathematics after participation in the MCPD programmes in terms of “easy”, “understandable” and “effective”.

The majority of the teachers identified the Department of Education as the source of financial support for their MCP development while others mentioned the school, non-governmental organisations and individuals. Apart from financial support to participate in MCPD programmes, teachers identified other kinds of support such as professional, motivational and the provision of transport, facilities and/or resources. The adequacy of the support provided for the teachers to participate in MCPD programmes was seen as positive by the majority of the teachers in the pilot study albeit others felt it was not enough. Those who viewed the support in the negative cited distance, lack of transport and food and awkward times as the reasons for their negative perception of the support they received.

The strengths of MCPD programmes were identified as their ability to empower teachers with new approaches in teaching and learning and provide them with the confidence to teach the content. The shortage or lack of resources was cited as the weakness of the implementation of MCPD programmes. Improvement of teaching skills and learners’ performance were highlighted by teachers as successes in their classroom practice after attendance of or involvement in MCPD programmes. Overcrowding and shortage or lack of resources was identified by teachers as impediments for the successful implementation of MCPD initiatives.
Subject Advisors
When interacting with subject advisors they indicated that a variety of MCPD’s exist in the country, and these are done based on teachers’ needs. These needs would be identified through cluster meetings between subject advisors & teachers to address gaps in terms of content and methods in mathematics teaching. If it was noted that teachers continue to manifest weaknesses in the areas of content and pedagogical knowledge workshop, then a follow up workshop would be arranged. Although some of the workshops were conducted by higher institution of learning they also reported challenges with regard to the shortage of facilitators, hence they often opted for the services of expert teachers. Basically these MCPD’S are targeted at capacitating novice teachers and under-qualified teachers to proficiency. They also registered concern around the availability of time to train teachers and absence of the evaluative mechanisms to measure the effectiveness of the MCPD offered.

Principals
The principals gave the impression that most of the MCPD initiatives were coming from the DoE. This was observed as most of their responses revolved around the government initiated evaluative system called Integrated Quality Management System (IQMS). Some principals use the IQMS as a tool to assess professional development of their teachers, but they have doubts about the effectiveness of the instrument, as they argued that it is used as a monetary incentive. They also mentioned that there was no follow up on issues such as attending workshops to determine the impact the training had on the classroom performance.

Ministry
Of the five provinces that participated in the study, the ministries from two provinces expressed similar challenges with regard to teachers’ attendance of MCPD workshops. In this regard the role of the unions in deciding whether or not teachers should attend a workshop was mentioned. For examples unions discouraged teachers from attending workshops conducted during school holidays. The researchers observed that the criteria used by the ministries to select MCPD service providers was almost similar in the two provinces since they looked at the experience of experts who would be conducting the workshops.

Summary
South Africa faces a dilemma with regards to mathematics education. Unless improvements are made, millions of South African learners will not have the skills needed to hold down decent jobs or run a profitable micro-enterprise. The recent ANA results suggest that more than 90 per cent of South African youth could fall into this category. The study endeavours to make recommendations for the implementation of professional development programmes that will inform stakeholders for improved deliverance.

Conclusion
Mainly, the pilot study aimed to collect MCPD-related data with the view to ascertain the reliability of the teacher questionnaire and the interviews schedules which were administered on the other section of the participants. Apart from presenting data collected through these instruments this paper has also demonstrated how these data components were subsequently used to address issues of reliability and validity. For instance, in the preceding sections of this paper the authors mentioned that the items in the subject advisors and ministry instruments were adopted because they were perceived to have generated a valid and reliable data. Other instruments were modified and we suggest that all the instruments that discussed in this paper should be recommended for data collection in the main study. In addition, the authors recommend that the administration of the observation schedule for the facilitation of the MCPD workshops should be timed accordingly, that is, should be administered when these workshops are being conducted. This will help to capture data to verify and triangulate data from other data collection sources.
Recommendations
The following recommendations are suggested:

- MCPD programmes should be monitored properly
- MCPD programmes should be designed to accommodate the distance learning mode of presentation,
- MCPD programmes should specifically be designed to address the needs of the teachers, especially those that affect the teachers' classroom practice and learners' performance
- Period of CPD training/workshop should be long enough to benefit teachers qualitatively.

REFERENCES


Pinnock, A.J.E., 2011. *A practical guide to implementing CAPS: A toolkit for teachers, schools managers and education officials to use to assist in managing the implementation of a new curriculum.* NAPTOSA.


