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The Changing Roles of South African Natural Science Teachers in an Era of Introducing a 'Refined and Repackaged' Curriculum

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ABSTRACT The present paper investigates expected changing teacher roles in the implementation of a refined and repackaged Natural Sciences component of the Curriculum and Assessment Policy Statement (CAPS) in South Africa. The problem was based on challenges the Natural Science teachers face in implementing the refined and repackaged curriculum. This empirical study uses a questionnaire with closed and open-ended items, classroom observations and semi-structured interviews. The sample consisted of 40 teachers purposively selected from schools in one of South Africa's 9 educational provinces. Data were analysed using descriptive statistics and analytic induction. The study found that most of the teachers in the schools still teach Natural Science using the traditional method and do not have laboratory equipments and chemicals to conduct practical activities except micro-science kits that they mostly use for demonstration purposes. Recommendations and possible ways that will help teachers to redefine their roles for the refined and repackaged curriculum are suggested.

INTRODUCTION

For a curriculum reform to be a success, it should be done in concert with certain critical considerations such as the redefining of teacher roles (Feeney 2014). South Africa has recently revisited the National Curriculum Statements (NCS), with a view to simplifying the original documents and the subsequent supporting documents (Subject and Learning Area Statements, Learning Programme Guidelines and Subject Assessment Guidelines) for all subjects. The aim was to produce national Curriculum and Assessment Policy Statements (CAPS) as a refined and repackaged version of the original documents, and not create new curricula (Vinjevold 2012; Naidoo and Muthukrishna 2014). The CAPS was introduced because, among other factors, evidence from the Trends in International Mathematics and Science Studies (TIMSS) for 1995, 1999, 2002 and 2011 indicated a poor trend in learner performance in South Africa (Naidoo and Muthukrishna 2014). Furthermore, after years of pitiable performances in education rankings, South Africa is finally ranked last in international rankings of the quality of mathematics and science education (Gernetzky 2012). According to Gernetzky, South Africa was last in the order of merit internationally, and was one of the countries that performed poorly in Grade 8 Science. These are among many of the reasons which led to the refining and repackaging of the previous NCS curriculum.

Changes in classroom practices demanded by reform visions such as the shift from the National Curriculum Statement (NCS) to Curriculum and Assessment Policy Statements (CAPS) ultimately rely on teachers (Spillane 1999; Moodley 2013). For a subject such as Natural Science, the CAPS specify the teaching time, content, skills, Learning and Teaching Support Materials (LTSM) needed and the assessment weightings and prescriptions. However, a great deal of learning on the part of teachers is required if changes of this magnitude are to be a success (Dudu 2014). For example, the shift from the NCS to the CAPS in South Africa meant a change in teacher roles. Naidoo and Muthukrishna (2014) says that when TIMMS results for 2011 were analyzed nationally, it is observed that in Natural Science, the North West Province was beaten by all the provinces except the Eastern Cape and Limpopo hence focus and the context chosen for this study is changing teacher roles in the teaching of Natural Sciences at Senior Phase level in forty schools in and around Mafikeng, North West Province, South Africa.

The term "role", as Dörneyi and Murphey (2003: 109) point out, is a technical term "which originally comes from sociology and refers to the shared expectation of how an individual should behave. In other words, roles describe what people are supposed to do". Several methodologists (Bentley et al. 2000; Fleer and Hardy 2001; Van der Horst and McDonald 2003; Todd and Mason 2005) have suggested many potential roles for a natural science teacher. Bentley et al. (2000: 20) conceptualize the role of the natural science teacher broadly as the "facilitator of learning" in the context of the constructivist approach and classroom practice instead of the rather narrow concept of the "teacher as instructor". Martin et al. (1994: 46) consider the term "facilitator" in a much broader way than Bentley et al. (2000) do, and point out that the teacher following a constructivist approach largely functions as a facilitator of knowledge construction and takes the following alternative roles: presenter, observer, question doer and problem poser, environment organizer, public relations coordinator, documenter of learning and theory builder. This reflects, as Bentley et al. (2000: 20) point out, "a widespread desire in the science teaching community to develop means of allowing learners to play a fuller, more active and participatory role in their science study".

Given that the current curriculum advocates for learning and teaching of science through inquiry (coming to know and understand the world through a dynamic process of being open to wonder and puzzlement), the role of the teacher should be looked at in the context of the notion of the learner-centred classroom, a kind of classroom in which the focus is on the active involvement of the learners in the learning process. Moreover, the role to be adopted by the learner in the classroom also hinges on the role adopted by the teacher (Choudhury 2011). The role of the teacher in the classroom is of paramount significance as it is central to the way in which the classroom environment evolves. Therefore, teachers must be clear about their role in the classroom so that there is no chasm between their perceptions of their role and what they actually practice in the classroom. Of course, when we talk of the classroom role of teachers here, we take a restricted view of the role(s) of a teacher by focusing on what they do or should do inside the classroom only, leaving out of consideration the institutional or societal roles that they have. In this paper, the investigated teacher roles include; instructional specialist-implementing effective teaching strategies (Marzano et al. 2001; Valdés et al. 2014), curriculum specialist-understanding content standards and how various components of the curriculum are linked together, as well as how to use the curriculum in planning instruction and assessment ensuring consistent curriculum implementation throughout a school), classroom supporter- implementing new ideas, often by demonstrating a lesson, co-teaching, or observing and giving feedback (Harrison and Killion 2007; Mukeredzi 2013) and data coaches -using data to drive classroom instruction (Hine and Lavery 2014). These teacher roles will be explicated under the theoretical framework section.

Objectives

The objectives of the paper are to: explore teachers' role expected by the CAPS curriculum; and identify the perceived roles by the teachers in implementing the CAPS curriculum. Thirdly, the paper identifies the actual roles (from the classroom observations and document analysis) played by Senior Phase Science teachers in the implementation of the CAPS in Natural Science teaching. Lastly, challenges encountered by Senior Phase Science teachers in the implementation of the curriculum are identified. The paper is guided by the following research questions:

Research Questions

The study is guided by the following research questions:

i) Which teacher roles are expected by the CAPS curriculum?
ii) What roles do teachers perceive they should play in implementing the CAPS curriculum?
iii) Which role(s) is/are played by Senior Phase Science teachers in the implementation of the CAPS in Natural Science teaching?
iv) What challenges are encountered by Senior Phase Science teachers in the implementation of the curriculum?

Theoretical Framework

This paper is guided by the literature on the constructivist perspective of *guided scientific*

inquiry teaching (Furtak 2006). It may be purposeful to think about scientific inquiry as one side of a continuum of different methods of science teaching. The continuum is bordered on one side by *traditional, direct instruction* in which learners are told the answers they are expected to learn by their teacher. The constructivist perspective can have a profound influence on a teacher's approach to teaching science although teachers may not necessarily follow a deliberate constructivist approach to teaching science in their classrooms. Research in South Africa (Sedibe 1998; Spady 1998; Bosman 2006; Bantwini 2010) conducted and based on the previous curricula (Curriculum 2005 to the NCS) paints a very dull picture of the ways teachers teach Natural science. The role of the science teacher has been found to be that of teaching through the traditional *direct instruction*. Synonyms of the word *traditional* include words like: old, legendary, historical, handed down, customary, conventional, long-standing, established, etc. All these words could be used to describe the ubiquitous traditional *direct instruction* of teaching Natural Science in the previous curricula in South Africa. What, then, are the main features of this traditional *direct instruction* of teaching Natural Science? The traditional method is largely teacher-centred, with the teachers always hogging the limelight (Choudhury 2011). Teachers lecture at length on particular topics and learners listen to them with rapt attention – this has been the methodology for teaching Natural Science for decades now. To Freire (1982), this is called the "banking" system of education in which the learners are considered to be similar to bank accounts into which regular deposits are made to be drawn later for specific purposes like examination. The onus here obviously lies on the individuals making the deposits for it is they who are responsible for earning the money and it is only they who can make the bank accounts swell. Using this analogy for the traditional Natural Science classroom would inevitably mean that the teacher is a "sage-on-the-stage" using Billing's (2001: 2) words, a metaphor for the traditional passive learning environment. The teachers bear the burden of the whole class on their shoulders, and the learner may merely listen to the teacher and sometimes repeat the teacher's directions.

To Choudhury (2011: 36), this "authoritative role (sometimes verging on the "autocratic" or the "authoritarian"!) of the teacher stems from the long-cherished traditional notion that pedagogic success depends on how articulately a teacher teaches". However, it is a fallacy to believe that learning depends on articulate or *eloquent* teaching for, as Kumaravadivelu (2006: 44) points out, "teaching, however purposeful, cannot automatically lead to learning for the simple reason that learning is primarily a personal construct controlled by the individual learner". In fact, the teacher can create and maximize learning opportunities by involving the learners in the learning process because teaching and learning are essentially collaborative in nature. Choudhury (2011: 37) presents a comprehensive picture by saying "this is quite unlike what has always been traditionally considered sacrosanct - that teaching is basically the transmission of items of knowledge, and learning accretion of them".

At the other end of the continuum, students design and conduct their own investigations into phenomena that are not known to the teacher in what can be called *open-ended scientific inquiry*. However, open-ended scientific inquiry is not the only form that instruction called "inquiry" can take in the classroom. While the canonical conception of scientific inquiry usually consists of open-ended, student-directed activities (problems, methods, and answers left open to students)

(Yerrick 2000), realities of the present climate of accountability mean that the answers that students are investigating are usually known, forcing inquiry activities to be more structured (problems, methods, and answers defined for students). Thus, science instruction often takes place somewhere between the extremes, where students are guided, through a process of scientific investigation, to particular answers that are known by the teacher. The particular instructional setting that is guided scientific inquiry teaching combines the scientific and constructivist rationales with the scientifically accepted facts, laws, and principles (that is, the answers) emphasized in current science education reforms (White and Frederisen 1999) - and all of this must be done without telling the answers directly to students (Allchin et al. 2014).

A typical classroom setting consists of learners from various environments and, by implication, different *realities*. Cultural aspects thus become an important factor in constructing scientific knowledge. To be able to teach to bring

out the best in learners, the teachers should have had knowledge of a variety of teaching and assessment strategies in order to provide multiple opportunities for learners to learn and demonstrate achievement. It is therefore important for teachers to consciously make a paradigm shift and introduce learner-centred approaches to teaching. This would include the use of practical work in teaching since the main aim of the curriculum is to produce a competent, independent creative learner who is also a critical thinker. As teachers have acquired the knowledge and understanding of the curriculum and its unfolding nature during pre-service and/or in-service training, they are expected to be in a position to interpret the stipulation of the policy document with insight and develop learning programmes that address the needs of the curriculum. Teachers need to understand the actual classroom dynamics and be adept in adapting their roles to suit changing scenes.

The role of a teacher being an instructional specialist implies that a teacher helps colleagues implement effective teaching strategies. This help might include ideas for differentiating instruction or planning lessons in partnership with fellow teachers. Instructional specialists might study research-based classroom strategies (Marzano et al. 2001; Valdés et al. 2014); explore which instructional methodologies are appropriate for the school; and share findings with colleagues (Harrison and Dillion 2007). Overall, as instructional specialist teachers implement effective teaching strategies (Marzano et al. 2001). As a curriculum specialist, the role entails that teachers understand content standards; also understand how various components of the curriculum link together, and how to use the curriculum in planning instruction and assessment is essential to ensuring consistent curriculum implementation throughout a school. Curriculum specialists lead other teachers to agree on standards, follow the adopted curriculum, use common pacing charts, and develop shared assessments (Harrison and Killion 2007; Mukeredzi 2013).

The role of the teacher as a classroom supporter entails working inside classrooms to help other teachers implement new ideas, often by demonstrating a lesson, co-teaching, or observing and giving feedback. Blase and Blase (2006: 22) found that "consultation with peers enhanced teachers' self-efficacy (teachers' belief in their own abilities and capacity to successfully solve teaching and learning problems) as they reflected on practice and grew together, and it also encouraged a bias for action (improvement through collaboration) on the part of teachers." As data coaches, the role of the teacher is to use that data to drive classroom instruction. Although teachers have access to a great deal of data, they do not often use that data to drive classroom instruction (Harrison and Killion 2007; Hine and Lavery 2014). Teacher leaders can lead conversations that engage their peers in analyzing and using this information to strengthen instruction.

RESEARCH METHODOLOGY

Context and Sample

The study which informs this article focused on teachers from twenty public schools in and around Mafikeng, the capital of North West province. The province has around 300 high schools. Just like other provinces of South Africa, the North West province is characterized by educational challenges that include the low educational standard in most schools, large class sizes, lack of infra-structure to support teaching and learning and teachers who do not have adequate subject knowledge (Mere et al. 2013). The other critical challenge faced by the province is the low pass rate of grade 12 learners in their school-leaving examinations (the Matriculation examination). This limits the number of learners going on to tertiary education. For all of these reasons, educational performance in the province is ranked among the lowest in the country.

The participants in the research were 40 Senior Phase (Grade 8-9) Natural Science teachers, two from each school. The teachers were purposively and conveniently sampled from 10 urban including township schools and 10 peri-urban including rural schools. Purposive in the sense that the researcher selected only those participants who were teaching Natural Science at Grade 8-9 and who were willing to participate in the study and who were accessible. Accessibility in this paper refers to those participants who were willing to forgo their break and lunch time and avail themselves for interview and whose schools were reachable without much difficulty because of the poor condition of roads. Since the schools varied in their socio-economic status, it goes on to say the schools also differ in

the teaching and learning challenges they confront. For example, some urban schools formerly known as Model C used to have the best resources and teachers and up to the present day some of these schools enjoy these priviledges. Township schools are mainly designated for blacks and located in townships. Townships are historic settlements designated for blacks and characterised by poor socio-economic conditions and poor education structure and resources. Most rural and townships schools are still characterized by the lack of adequate teaching and learning resources, aggravated by limited district support for schools and teachers and by other issues mentioned earlier on. These schools typically perform poorly, while learner achievement at urban schools, by contrast, tends to be better.

The study sample was balanced in terms of gender, 20 of the participants were male and 20 were female. The participants were between 25 and 50 years of age ranging between 2 and 25 years of teaching experience. Older teachers received their qualifications at teacher training colleges during the apartheid era. These colleges, especially those that were situated in the homelands, had deficiencies in the teaching of specific content knowledge, leaving their students with knowledge gaps. Some of these teachers went on to upgrade themselves professionally by taking in-service courses at universities after the closure of teachers' colleges, graduating with qualifications like Advanced Certificate in Education (ACE). Despite the upgrading, most teachers still have knowledge gaps since in-service courses at universities such as the ACE focus more on pedagogy rather than the content. Younger teachers who are receiving their qualifications only from universities as of late due to closure of teachers' colleges are not spared either of having knowledge gaps. They go through a curriculum designed in a manner not likely to equip the students with enough content knowledge. In other words, the students are churned out half-baked. Most of the teachers are under- and some even unqualified in the areas of Science and pedagogical content knowledge. Most of the teachers were not specialists in teaching science education (physics, chemistry or earth science) though they were teaching it, mostly due to lack of teachers in mathematics and science subjects. The severity of the challenge has been evident in the learners' achievement outcomes, which are low in a subject such as Physical science as evidenced by its low pass rate.

Research Design and Methods

The study utilized mainly the qualitative method of data collection. A questionnaire which consisted of both closed and open-ended items, structured interviews and semi-structured observations were used. The use of these instruments was to enhance triangulation.

Questionnaire

The questionnaire contained open and closed questions on school demography, teaching and learning support, preparation for teaching, lesson presentation, teaching strategy, assessment practice, teacher support and development, and problems teachers faced and suggestions on how to improve the situation. Closed questions consisted of the "yes" or "no" types followed by explain your choice. An example of one such question is; do you make use of the laboratory? Open-ended questions were adapted from literature (Tudor 1993). The questionnaire had previously been validated by giving it to a different group of teachers from the same province who had been attending a professional development course. Both face and criterion validity were ascertained through this process. For content validity, the questionnaire was given to three professors in science education from a large research university. Corrections were suggested and implemented until all gave it a thumps-up. Schools were visited and permission sought to conduct the research. The respondents were made aware that participation was voluntary. Their anonymity was respected and confidentiality was assured (Resnick 2007). All 40 teachers completed the questionnaire.

Semi-structured Interviews

Six teachers (three males and three females) were sampled based on their responses to open-ended questions in the questionnaire and were interviewed using semi-structured in-depth interviews. The interviews specifically focused on the CAPS Natural Science curriculum and their professional development. Their responses were audio-taped and later transcribed verbatim.

Questions used in the interview were adapted from literature (Tudor 1993). Examples of questions included: which different strategies do you use to teach Natural Science? How equipped are your school laboratories? etc.

Observations

Six teachers were interviewed and were also closely observed during their course of teaching. The observations were non-participatory and semi-structured (Opie 2004). Each teacher was observed twice. Before each lesson, the educator gave the researcher a copy of the lesson plan and supporting material. The observations were based on basic classroom dynamics, teacher and learner activities, and checking whether there were set objectives in the lesson plan, the types of questions used and assessment practices. The researcher set at the back of the classroom recording field notes as observations were being made.

Data Analysis

For qualitative data, ATLAS.ti version 6.2 was used to analyse interview transcripts. The analysis for the questionnaire was done as explicated below.

Questionnaire

Closed items on the questionnaire generated data which was analyzed by means of descriptive statistics. Data from open-ended items was analyzed through analytic induction. This is the same method to which qualitative data from structured interviews and semi-structured observations were subjected.

Interviews and Observations

Analytic induction was used to analyze data from interviews and observations. The researcher read through sets of transcripts making preliminary notes regarding patterns that emerged from individual participants. The transcribed data were read looking for patterns, relationships and other themes within the dimensions as those used to frame questions in the questionnaire. Entries were coded according to patterning identified while keeping a record of what entries went with which element of the patterns. These procedures involved (1) the simultaneous collection and analysis of interview and observation data and (2) comparative methods of analysis whereby participants' responses were compared between and within each participant, and (3) the integration of a theoretical framework that guided the study. Underlying reasoning was then identified for each teacher by writing the category theme for each response and this enabled teacher roles to be determined for each teacher's response. Thus, some aspects of grounded theory analytical procedures (Strauss and Corbin 1998) especially interpretive analysis (see, for example Gall et al. 2003) were used to inductively analyze the participants' open-ended responses.

RESULTS

In this section, the results are presented in the order of research questions. First, the researcher addresses the first research question; which teacher roles are expected by the CAPS curriculum?

An analysis of the curriculum document elicited that Senior Phase Natural Science teachers are expected to perform ten (10) roles by the CAPS curriculum. These are: (1) Resource provider (Teachers help their colleagues by sharing instructional resources. These might include Web sites, instructional materials, readings, or other resources to use with students. They might also share such professional resources as articles, books, lesson or unit plans, and assessment tools); (2) Instructional specialist (An instructional specialist helps colleagues implement effective teaching strategies. This help might include ideas for differentiating instruction or planning lessons in partnership with fellow teachers); (3) Curriculum specialist (Understanding content standards, how various components of the curriculum link together, and how to use the curriculum in planning instruction and assessment is essential to ensuring consistent curriculum implementation throughout a school); (4) Classroom supporter (Classroom supporters work inside classrooms to help teachers implement new ideas, often by demonstrating a lesson, co-teaching, or observing and giving feedback); (5) Learning facilitator (When teachers learn with and from one another, they can focus on what most directly improves student learning); (6) Mentor (Serving as a mentor for novice teachers is a common role for teachers. Mentors serve as role models; accommodate new teach-

ers to a new school; and advise new teachers about instruction, curriculum, procedure, and practices. Being a mentor takes a great deal of time and expertise and makes a significant contribution to the development of a new professional); (7) School leader (Being a school leader means serving on a committee, such as a school improvement team; acting as a grade-level or department chair; supporting school initiatives; or representing the school on community or district task forces or committees); (8) Data coach (Although teachers have access to a great deal of data, they do not often use that data to drive classroom instruction. Teacher leaders can lead conversations that engage their peers in analyzing and using this information to strengthen instruction); (9) Catalyst for change (Teachers who take on the catalyst role feel secure in their own work and have a strong commitment to continual improvement. They pose questions to generate analysis of student learning); and (10) Learner (Among the most important roles teacher assume is that of learner. Learners model continual improvement, demonstrate lifelong learning, and use what they learn to help all students achieve).

The second question is; what roles do teachers perceive that they should play in implementing the CAPS curriculum? From the questionnaire, teachers managed to identify four perceived roles. These are: teacher as an instructional specialist; teacher as a curriculum specialist; teacher as a curriculum supporter; and teachers as data coaches. The exact figures of teachers who practiced which type of role are given in the next section which addresses research question number three.

The third research question is; which role(s) is/are played by Senior Phase Science teachers in the implementation of the CAPS in Natural Science teaching? In an attempt to explicate these teacher roles, the findings are organized around four category themes covering each of the four teacher roles the paper explored. Excerpts from completed questionnaires and interviews are used as evidence in support of the findings. Pseudonyms are used to protect the identity of the teachers and the schools. As this is done, the researcher reflects on some aspects from lesson observations and analysis of curriculum materials.

Teacher as an Instructional Specialist

The questionnaire had nine (9) teaching strategies from which teachers had to choose the ones they use when teaching Natural Science. These are: telling method, group work, whole class discussion, problem solving, co-operative learning, experimentation, worksheets, projects and presentations. Table 1 gives a summary of teachers' responses on closed items on teaching strategies.

Table 1: Use of teaching strategies

Teaching strategy	*Number of teachers who use the strategy (Number as %)*	*Number of teachers who do n ot use the strategy (Number as %)*
Telling method	19 (48)	21 (52)
Group work	36 (90)	4 (10)
Whole class discussion	37 (93)	3 (7)
Problem solving	34 (85)	6 (15)
Co-operative learning	36 (90)	4 (10)
Experimentation	34 (85)	6 (15)
Worksheets	35 (88)	5 (13)
Projects	34 (85)	6 (15)
Presentations	37 (93)	3 (7)

The general perspective attests to fact that the majority of the teachers (85%) in this paper used at least different teaching strategies when teaching Natural Science (see Table 1). This is impressive and gratifying since most of the teaching strategies the teachers indicated they are using are learner-centred and adhere to the results-oriented approach to learning based on beliefs or assumptions that all learners must be granted the opportunity to reach their full potential. However, lesson observation data do not appear to show that the teachers used different teaching strategies for their teaching at all. For all the 12 lessons observed, the telling (traditional) method which is largely teacher-centred, with the teachers always hogging the limelight dominated. The teachers lectured at length on particular topics and learners were listening to them with rapt attention. Here and there, teachers would be seen trying to use group work but groups would have at least 8 learners in each group. This would reduce the group work approach to merely nothing more than child's play. Most of the learners would not be meaningfully involved compromising the quality of learning. During interviewing, when asked to explicate the different teaching strategies they use, two of the teachers said,

…to tell you the truth, I predominantly use the telling method. As much as I would want to vary the different teaching strategies, the class sizes are too big and do not allow for that. I also do not have the apparatus and simple chemicals. All we have at the school are micro-science kits and the best we can do is just teacher-led demonstrations. Most of us teachers need training in this CAPS curriculum […] (Teacher 1, School 17).

…I teach mostly using 3 teaching approaches. These are the telling method, demonstration and the project methods. The main reason for this is because we lack basic chemicals and apparatus at the school. We only have micro-science kits for demonstration purposes. The project method is a "must use" for a certain topic as prescribed by the Department of Education so I just rarely use it (Teacher 2, School 9).

Teacher as a Curriculum Specialist

Closed items on the questionnaire asked questions related to the issues of teacher support and development for effective curriculum implementation. Most of the teachers (85%) agreed that the Department of Education organized workshops for them on the implementation of CAPS. The teachers also said that they use different forms of assessment as follows; homework (98%), assignments (98%), classwork (90%), demonstrations (83%), projects (98%), experiments (80%), investigations (95%), case studies (80%). Having gone through curriculum materials, the researchers confirmed that the teachers used all other forms of assessment except experimentation. Open-ended responses on the questionnaire spelt out clearly that the teachers only get to know how various components of the curriculum link together when they attend workshops arranged by the DoE. Three of the teachers said,

…we are taught how to interpret the CAPS curriculum during workshops by officials from the DoE. They teach us how to plan and assess as well as specify various recommended and prescribed activities (Teacher 7, School13).

…all the training pertaining to curriculum interpretation, implementation and assessment is shared to us by officials from DoE (Teacher 6, School 4).

…when it comes to the understanding content standards and how they link with various components of the curriculum, the DoE officials train us mostly during our school holidays (Teacher 10, School 15).

Interviews also confirmed that workshops organized and run by officials from DoE for now are the only sources that provide the necessary knowledge to the teachers for their role as curriculum specialists. Two of the teachers said,

…in February 2014, we attended workshops in Rustenburg for a week on how to use practical work when teaching Natural Science. The workshops were eye opening and I learned a lot. If we would have more of those workshops I would be a better teacher. We also need constant supply of chemicals and apparatus if we are to perform experiments with learners. We also have had several workshops on content and assessment. The DoE is trying its best […] (Teacher 5, School 4).

…I am a bit frustrated and demotivated with the Department of Basic Education. Just when we thought we had come to terms with the previous curriculum-the NCS, in comes this CAPS curriculum. We are never on top of the situation and we are always found wanting. This is frustrating […]. We are never consulted when they make these curriculum reforms but we are expected to implement the curriculum diligently (Teacher 3, School 17).

Teacher as a Curriculum Supporter

All forty teachers who took part in this study found this as a demanding task to assume. All the participants alleged that the environment in the schools do not allow them to act as curriculum supporters. All participants said they do not participate in co-teaching because teaching in their schools is structured in such a way as not to temper with the status quo. One teacher said,

…it is difficult to try something new given the nature of timetables in our school. Each teacher is pre-occupied with his or her own work. If you go to colleagues and suggest issues of co-teaching, they just look at you and wonder if all is well with you. The best we can do is demonstrating a lesson if we can get the apparatus or chemicals for an experiment, otherwise, you cannot be seen observing or giving feedback to a colleagues' lesson. It will be like poking your nose into someone's business (Teacher 11, School 20).

Teacher as Data Coaches

The teachers indicated great desire in guiding each other to discuss strengths and weaknesses of learners' performance in science as a group, as individuals, by classrooms and in disaggregated clusters by gender and so forth so that they could plan instruction on the basis of this data. However, the teachers expressed grief over a number of challenges including number of too many learners in classes, too much paperwork to deal with and lack of regular workshops from subject advisors. All forty teachers indicated on the questionnaire that they do not engage in this role at all in their school. Perusal of curriculum material like lesson plans given to the researchers also attested to this. Further, classroom observation confirmed this. Two of the teachers said,

…we usually come together as teachers for all subjects offered in the school towards the end of the year when we discuss learners' performances for purposes of promoting the learners to the next grade level. Never have we done this for purposes of informing instruction (Teacher 4, School 9).

…we don't have time for such activities. It will be good and noble, it's ideal but where in the world do we get time to do that? We are overloaded. Time does not allow us to act as data coaches at all […] (Teacher 9, School 15).

DISCUSSION

The CAPS curriculum expects the Senior Phase Natural science teacher to perform all generic roles that build the entire school's capacity to improve (Hine and Lavery 2014). Though the ten roles which have been identified are not exhaustive, in a way they assist in contributing to their school's success. The sampled teachers managed to identify four out of the ten roles that they perceived they should play in the implementation of the curriculum. These are: Teacher as an instructional specialist, Teacher as a curriculum specialist, Teacher as a curriculum supporter, and Teacher as data coaches. In a way, the questionnaire instrument limited the participants because it had no section which asked them to elaborate on the other roles. However, the interviewed teachers could not identify any other teacher roles they are expected to play. This finding supports that of Mukeredzi (2013) who found that 12 professionally unqualified practicing teachers did not know of their expected teacher roles in rural Zimbabwe and South Africa.

One of the roles of a teacher is to see that effective teaching strategies are implemented (Valdés et al. 2014). Though the participants attested to the fact that they use a variety of teaching strategies while completing the questionnaire, these data must be interpreted with utmost care because there was a mismatch of what teachers said and what they were observed doing during lesson observation period. These findings are rather disappointing as lesson observation pointed to the teachers using the traditional method and lack of guided scientific inquiry teaching. Similar findings were found in a study by Choudhury (2011). The learners were reduced to play a passive, reactive role with no control over content or methods (Choudhury 2011). For interest's sake even topics such as chemical reactions, oxides and reactions of metals with oxygen, electrostatics, electrical systems including series and parallel connections were taught mostly using the traditional method. The participants attested to the fact that when it came to role of teacher as curriculum specialist, the DoE was running workshops to ensure teachers understand content standards and how various components of the curriculum link together, as well as how to use the curriculum in planning instruction and assessment ensuring consistent curriculum implementation throughout a school. As much as this is a noble idea, Feeney (2014) suggests teachers must be part of the consultative process and should be involved from the early stages of curriculum reforms.

The teachers lamented that it was difficult for them to assume the role of curriculum supporter; as they could not implement new ideas, often by demonstrating a lesson, co-teaching, or observing and giving feedback due to the rigidity of the curriculum. These results corroborate the findings of a great deal of the previous work in this field by Mukeredzi (2013). Despite benefits of co-teaching such as more detailed observation of learners engaged in the learning process occurring regardless of models of co-teaching individuals use (Cook and Friend 2004), the teachers are not practicing it. As data coaches, teachers lamented on lack of engagement

with their peers in analysing and using a great deal of data at their disposal to strengthen instruction. This was despite of the fact that teachers having access to a great deal of data which they can use to drive classroom instruction (Hine and Lavery 2014).

It is not to be disputed that reforms are indispensable and inevitable, as they bring hope for the desired educational changes. This study endorses the notion that curriculum reform is a very complex exercise (Naidoo and Muthukrishna 2014), and requires to be connected to all aspects of teaching and learning. Curriculum reforms have important benefits, but they must occur in concert with other social changes in order for them to have a significant and long-lasting effect (Gamoran 1997; Mooney and Mausbach 2014). From the study, it is evident that certain critical considerations were neglected and these required attention in concert with the launch of the refined and repackaged CAPS curriculum. These included contextual factors such as teachers' workload, a lot of paper work for teachers and classroom conditions such as teacher to learner ratio. The advocated teacher to learner ratio is one teacher is to 30 learners at secondary school. This ratio is still unattainable at Senior Phase, the level at which learners require more attention and where strong educational foundations can be laid especially when it comes to science concepts. The high teacher to learner ratio makes it difficult for teachers to implement different strategies when teaching Natural Science. Teachers also find it difficult to offer guidance to individual learners to fulfil principles advocated by the CAPS curriculum. The lack of appropriate teacher orientation to the reforms was found discouraging and teachers lose motivation (Feeney 2014).

Evident from the findings is that the quality of the refined and repackaged curriculum on its own does not guarantee a successful reception by teachers, and neither the redefining of teacher roles for its successful implementation in the various classrooms. Neglect of these issues creates frustration and sends out a message that the DoE lacks concern about its teachers and can aggravate the gap between conception and reality, between political symbolism and implementation as noted by Lemon (2004). These problems, Lemon believes, derive from the frustration of pursuing idealistic aims that are often based on what is regarded as good practice in most developed countries without the human or financial capacity to achieve them. Thus, we need to guard against viewing curriculum reforms as a 'quick fix' solution to existing challenges, but rather as a long-term solution (Feeney 2014). The DoE needs to maintain a close working relationship with the teachers so that they can identify and learn about teachers' difficulties relating to the reforms hence, it is important to learn about and understand teacher roles in implementing the CAPS curriculum. It is also imperative to check continuously where teachers stand in their understanding of the reforms. In this way, teachers are kept accountable and given a chance to re-think the reforms and redefine their roles. Teachers sometimes miss capturing the goals and visions of refining and repackaging curricular because of the way in which the new messages are introduced to them. Also, when teacher roles in advancing education are recognized through involvement in the processes that discusses new reforms, they are likely to take ownership of the reform process (King and Newmann 2000; Feeney 2014) and that will ensure their success.

CONCLUSION

All reforms in education face challenges, whether contextual, cognitive or otherwise. The launch of reforms such as the introduction of the CAPS must take these challenges into consideration and they should be treated positively. Teachers must be part of these reforms by introducing them to policy and consultative forums so that there is a match of their perceived roles with the expected roles of the curriculum before they are expected to implement the reforms. The CAPS curriculum is clear on roles teachers should assume when teaching Natural Science. It gives ten teacher roles. Participating teachers managed to identify only four out of the ten roles. Teacher roles had to change from the traditional, direct method to guided scientific inquiry teaching method, for example when looking at a teacher as an instructional specialist. However, classroom observation did not attest to this change regardless of teachers' responses to questionnaire items pointing to the fact that they use a variety of teaching strategies. Teachers mostly teach using the traditional direct method. They lamented lack of equipment and chemicals. Plans should also be made to resolve the challenges teachers face when executing their roles concurrently with the implementation of the reforms. Teachers are also hungry for more workshops as it appears DoE

officials harbour the knowledge of the refined and repackaged curriculum. Hence, DoE should invest significantly in continuous professional development, provide support structures, monitoring and evaluation, and promote teacher collaboration within the schools. This should ensure that teachers develop the appropriate understandings of the refining and repackaging so as to immediately redefine their roles, as well as quickly receive necessary help whenever challenges arise.

RECOMMENDATIONS

The refining and repackaging was carried out over a short period, depriving teachers of sufficient time to discuss and consider implementation of the curriculum in their classes. It is recommended that in future more time should be given for teachers to discuss incoming curriculum so as to encourage and motivate them. In so doing teachers will be made aware of their roles in advance. In future, teachers can be asked to appoint a group of teachers who will liaise between them and the policy makers when considering refining and repackaging of existing curriculum. This will keep teachers informed of the processes being followed and might allow them to take ownership of the adopted curriculum. Teachers should be given adequate apparatus and chemicals to use in the schools so that they can implement all teaching approaches advocated by the CAPS curriculum and forgo or use the traditional method at a minimum which they have been using for decades.

LIMITATIONS

The questionnaire focused on four teacher roles as these were the ones the paper was investigating. However, besides questions posed during semi-structured interviews, an open-ended question should have been included where all the teachers who took part in the study should have given other perceived teacher roles they believe were under their jurisdiction as teachers.

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