THE DYNAMICS OF COPING WITH POLICY AND PRACTICE: MATHEMATICS EDUCATORS' EXPERIENCES

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Abstract

This article reports on the experiences of Mathematics educators during the implementation of the National Curriculum Statement (NCS) in Grades 10 – 12. The study is contained in five different, but educationally related constructs addressing training, problem areas which challenge or appeal to Mathematics educators, lesson planning, assessment strategies and the effective integration of OBE in the teaching of Mathematics. A mixed methods design was used, with data being collected and collated using questionnaires and semi-structured interviews. The quantitative data employed descriptive data analysis, while the qualitative data was analysed by identifying differences and similarities. The study revealed that educators differed in terms of the problems they encountered with implementing the NCS in Mathematics. They agreed, however, that the implementation was successful and that it contributed to better teaching.

Keywords: National Curriculum Statement (NCS); Implementation; Mathematics education; Further Education and Training (FET) band; Assessment strategies; Lesson planning.

1. INTRODUCTION

Globally, education systems are dynamic, fluid and ever changing. According to Rambuda and Fraser (2004: 10), one such change is a shift from a philosophy that focuses mainly on the transmission of information to one based on a constructivist approach to teaching and learning. In South Africa this shift change was evident in outcomes-based education (OBE) introduced two years after the country's first democratic elections in 1994. The introduction of a new curriculum addressed the traditional pedagogical style of rote learning and suggested more learner-centred pedagogical approaches and engendered critical thought. Mason (1999: 137) argues that OBE in South Africa aims at addressing the legacy of apartheid by promoting the development of skills to prepare all learners for participation in an increasingly competitive global economy. The transformation that took place in Mathematics education in South Africa over the past 15 years, and the eventual launch of the NCS for use in South African schools, served as motivation for the study about which this article reports.

The process of curriculum change in South Africa gained momentum with the phasing in of the NCS for the Further Education and Training (FET) band, in 2006.

The NCS attempted to provide more structure and support to educators than its forerunner, Curriculum 2005 (C2005). With the implementation of C2005 it was critical that the three pillars addressing curriculum transformation were aligned and in place. These pillars were curriculum development, teacher development, and the development, selection and supply of learning materials.

As the implementation of C2005 began, there were apparently no clear strategies put in place by the Department of Education in any of the nine provinces (Jansen & Christie, 1999: 231). The implementation of C2005 was not successful, and in 2006 it was replaced by the Revised National Curriculum Statement (RNCS) for Grades R – 9. One of the central aims of the RNCS was to clearly define the assessment standards per grade against which learners were to be assessed. The RNCS streamlined and strengthened C2005. It was part of the process of transforming education and training to realize the aims of the South African democratic society and of the constitution. The RNCS had three curriculum design features, namely critical and developmental outcomes, learning outcomes and assessment standards.

The NCS for Grades 10 – 12 operated with the same design features, namely critical and developmental outcomes, learning outcomes and assessment standards. Educators were furthermore provided with guidelines on the context and content, as described in the Assessment Standards (ASs), through which the learning outcomes could be achieved. According to the NCS Grades 10 – 12 (DoE, 2003A: 7) assessment standards were “criteria that collectively provide evidence of what a learner should know and demonstrate at a specific grade. They embodied the knowledge, skills and values per grade required to achieve the learning outcomes.” However, for the learning outcomes to be achieved, educators had to know how to interpret and teach in line with the assessment standards.

Mathematics education in South Africa arguably has a tradition of narrowly defined teaching strategies, derived from the content that Mathematics educators are expected to teach. If policy intends a “transformational” perspective and approach in a new curriculum, that moves away from a “traditional” perspective and approach in a previous curriculum, how then will the new approach counter the teaching of mathematical techniques and procedures in ways that educators have been doing all along? Educators would determine whether the newly implemented curriculum succeeded or not, simply by the way they executed their teaching duties. The implementation of the new curriculum therefore necessitated educator involvement and development as an integral part thereof.

The fundamental objective of the study on which we are reporting was the need to determine and highlight the teaching experiences encountered by Mathematics educators regarding the implementation of the NCS in Grades 10 – 12. There was also a need to determine how educators understood the position of OBE and its contributing role, or lack thereof, with respect to the problems encountered by FET educators teaching Mathematics according to the new curriculum. Our argument is that direct, clear and appropriate guidance from the Department of Education on the implementation of the NCS in Mathematics in Grades 10 – 12, can contribute to educators coping with implementation difficulties in an effective manner.

In an attempt to realize the objective of the study, five constructs were addressed. Firstly, solutions to problems regarding the training of FET Mathematics educators were investigated. Secondly, problem areas in the NCS that challenge Mathematics educators teaching in the FET band and areas which appealed to these educators were identified. Thirdly, we asked the question: which guidelines exist to assist educators with lesson planning in Mathematics? Fourthly, the question of guidelines that exist to assist educators with appropriate assessment strategies in Mathematics, were answered. Fifthly, guidelines for the effective integration of OBE in the teaching of Mathematics were determined.

In the following sections, the situational context of the study is described and underpinned by applicable literature. An explanation of the mixed research methods used in the study and a discussion of the results, follow. The article concludes with recommendations for curriculum implementation and suggestions for further research.

2. SITUATIONAL CONTEXT

It is indisputable that educators are key to the success of curriculum reform (Smith & Desimone, 2003; Spillane & Callahan, 2000). Their knowledge, beliefs and perceptions play a fundamental role in understanding the reforms (Blignaut, 2007; Haney et al., 2002). It would therefore be irrational to expect educators to accept educational reform without questioning it. In general, school curriculum reform can be initiated as a result of poor student performance, although the evaluation of results obtained from the Trends in International Mathematics and Science Study (TIMSS) has also lead to curriculum reform.

Curriculum reform may be initiated with the goal of producing scientifically literate citizens capable of competing nationally and internationally. However, developing and launching a new curriculum does not guarantee that educational challenges and problems will be overcome (Gitlin & Margonis, 1995). A range of factors, including educators' understanding and acceptance of the new curriculum, are likely to impact on implementation.

In South Africa, for example, Jansen (1998) and Chisholm (2005) noted that since democracy in 1994, there has been a series of educational changes, all intended to redress past educational injustices. Contrary to expectations, these have not been unconditionally welcomed (Lessing & De Witt, 2007).

In South Africa one often hears the words transformation, change, reform, development and growth. Because curriculum reform confronts in-service teachers, in-service training is essential. In-service training (INSET) programmes are professional development programmes that focus on transformation, change and reform in the education system. INSET programmes are organized in the form of workshops. These workshops are meant to develop educators and improve their classroom practice. Changes in classroom practices may be attributed to many factors, namely, the introduction of technology in education, changes in curriculum, reform in instructional methods and new assessment practices and techniques (Adler, 2002: 160). Along with learning and teaching materials (LTMs) and especially textbooks, effective educator training is crucial to the successful implementation of a curriculum.

Submissions from the review team of the panel appointed by the then Minister of Basic Education, reported that many newly qualified educators have deficiencies in respect of their subject knowledge and methodologies (DoE, 2000). It would appear that newly qualified educators are not adequately prepared in respect of a range of educational aspects. A more general observation is that especially new educators are not confident with assessment strategies. This is a troublesome observation. If new entrants to the profession are equipped with the necessary knowledge and skills with regard to the curriculum, the need for on-going training could be reduced over time.

Jansen (1998) and Chisholm (2005) noted that curriculum revision in South Africa proceeded in three main waves. The first involved cleansing syllabi from racist language and controversial and out-dated content. This process also aimed at laying a foundation for a single national core syllabus with curriculum decisions made in a participatory and representative manner. The second wave included the launch of C2005 in March 1997. C2005 was driven by the principles of OBE used in countries such as Australia, Canada and parts of the United States of America. C2005 also mirrored the South African constitutional emphasis on equity and human rights. It was seen as important for its content to be non-authoritarian and to be shaped in a participatory manner (Fiske & Ladd, 2004). OBE thus formed the foundation of the revised South African school curriculum.

The origins and nature of OBE have been traced by various authors. Fiske and Ladd (2004) simply describe it as an instructional method in which curriculum planners define the general knowledge, skills, and values that learners should acquire.

It thus differs from traditional instruction in which curriculum planners define specific kinds of knowledge and skills that are to be transferred from educator to learner, leaving educators to enjoy less freedom of operation.

Due to challenges experienced in the implementation of C2005 in classrooms, the Ministry of Education appointed a task team led by Professor L. Chisholm to review C2005 in 2000. The Review Committee recommended that the curriculum be strengthened by streamlining its design features, simplifying its language, aligning curriculum and assessment, and improving educator orientation and training, learner support materials and provincial support (DoE, 2000). This process marked the start of the third wave of curriculum reform.

The NCS (Grades 10 – 12) was introduced in 2002. The curriculum laid the foundation for the achievement of the goals of the South African constitution, stipulating that everyone has the right to education which the state, through reasonable measures, must make progressively available and accessible. The NCS furthermore stipulated Learning Outcomes and Assessment Standards and spelt out the key principles and values that underpin the curriculum.

Recommendations by the task team for the review of the implementation of the NCS included the following. In the first place, a coherent, clear, simple five-year plan to improve teaching and learning across the schooling system needed to be developed and adhered to. The offering of support to educators and the improvement of learner performance had to be its central themes. Mechanisms to monitor the implementation of the plan, through regular external monitoring in order to assess whether it had the desired effect on learner and educator performance, needed to be built into the plan. There was a plethora of policies and guidelines at all levels of the education system. Complicating the implementation stage, however, was the reality that educators, as well as some DoE staff, had not made the shift from C2005 to implementing the revised NCS. This had resulted in widespread confusion about the status of the new curriculum and assessment policies.

Contemporary curriculum changes posed a number of problems to educators. Central to the problem was the implementation of the NCS in the FET curriculum band in South Africa. An observable problem for educators included understanding the critical outcomes and teaching Mathematics in the FET band in such a way that the critical outcomes were reached by the end of a learner's Grade 12-year. Successful and accurate assessment strategies were implicit in determining whether or not critical outcomes had been reached. Assessment in Mathematics had to focus on collecting reliable information regarding learners' mathematical growth and competence. Assessment formats included informal assessments, formal internal assessments and external assessments.

The purpose of the informal or daily assessments was to inform the educator about how learners were progressing towards achieving assessment standards with the purpose of enhancing teaching and learning. Formal internal assessment tools provided the educator with the means to differentiate between learners on a given scale. External assessments occurred in the form of the Grade 12 National Senior Certificate examinations.

A new approach to Mathematics assessment on the NCS content in the FET band was the introduction and use of rubrics. "These rubrics can be self-assessment rubrics, peer-assessment rubrics, group assessment rubrics or rubrics designed to help the educator assess whatever is being looked for. A rubric is a set of criteria that will be applied in the learning process." (Govender et al, 2006: viii).

Mathematics educators specifically were previously not exposed to the use of rubrics for assessment purposes, as tests and examinations were always accepted as the norm. It was therefore a foreign concept and its unfamiliarity hindered use and implementation.

Implementing the NCS in the FET band clearly challenged educators in general and Mathematics educators in particular. The following section describes the methodology followed in an attempt to determine how Mathematics educators coped with and experienced the implementation of the NCS.

3. RESEARCH DESIGN AND METHODOLOGY

The study employed a mixed method design in which qualitative and quantitative research methods were used to collect and collate the data. The rationale for using a qualitative methodology on the one hand was the multi-layered nature of the issues under study. Qualitative inquiry would portray the issues in their multifaceted form (Leedy & Ormrod, 2001: 147). The researchers remained neutral and objective about the multiplicity of the realities under investigation, however.

"Researchers try to create a research environment devoid of extraneous influences and attempts to have them operate equally among participants and empower capability of the phenomena that is being studied" (Marshall, 1997: 51). Semi-structured interviews were conducted, with a blend of flexible and open-ended questions. One educator from each of the 15 randomly selected schools in the Motheo district was anticipated to participate in this interview process. However, only 10 educators eventually participated in the process, due to personal and work-related responsibilities.

To collect quantitative data a questionnaire was employed. There was a clear structure, sequence and focus to the questionnaire, but the format remained open-ended, enabling the respondents to respond freely.

The five constructs that were addressed included aspects regarding training, problem areas which challenged or appealed to Mathematics educators, lesson planning, assessment strategies and the effective integration of OBE in the teaching of Mathematics. The questionnaire was distributed to 52 Mathematics educators in the Motheo district. The sample consisted of three to four Grades 10 – 12 Mathematics educators per school who participated on a basis of availability. In accordance with research ethics, participation had to be voluntary and the participants were free to withdraw at any stage if they chose to.

An analysis of the qualitative data was made by identifying and documenting similarities and differences in the respondents' answers from the interview discourses. Two sections (A and B) of quantitative responses from the questionnaire were obtained and analysed. The first section (A) contained each respondent's personal and educational particulars. A descriptive analysis of the sample data for the second section (B) of the questionnaire, containing responses to the questions, was then done. Respondent counting was used, while percentages and the average (mean) of the responses to each statement in the questionnaire were determined. Respondent counting involved counting the number of respondents who marked SA (strongly agree), A (agree), D (disagree) or SD (strongly disagree) in response to the statements in Section B of the questionnaire. Points were allocated on a scale of 1 – 4 with 1 allocated to SD and 4 to SA. A summary of the frequency of responses for each question per category was determined. The frequency data was converted to percentages, indicating the percentage of respondents who marked a particular category in relation to the total number of respondents.

Although the main study included both quantitative and qualitative methods, the bulk of data on which the researchers are reporting in this article was obtained by employing quantitative methods. Some qualitative findings which directly support the quantitative findings are mentioned, however.

4. RESULTS AND DISCUSSION

The findings revealed that educators differ in terms of the problems that they encountered in implementing the NCS in the teaching of Mathematics in the FET band. However, average responses from the interviews and questionnaire corresponded and leaned over to the positive side, averaging at around 60% in favour of the NCS implementation. Qualitative data indicated that six out of the 10 educators who were interviewed, reported a positive overall attitude with regard to the problems encountered with the implementation of the NCS in the teaching of Mathematics at secondary schools. The implication of these findings is that although there were problems, the majority of participants were comfortable with the implementation of the NCS in Mathematics at FET level.

A possible reason for the positive attitude of the majority of educators may have been the streamlining and strengthening of C2005 in the form of the RNCS in Grades 8 and 9 and the NCS in Grades 10 – 12.

A summary of the information pertaining to the problems encountered by Mathematics FET educators in the Motheo district regarding the implementation of the NCS in Mathematics, indicated that 9,6% of the participants strongly agreed and 42,3% agreed that the timeframes for implementing the NCS in Mathematics were realistic. Only 34,6% disagreed and 13,5% strongly disagreed. The mean score is 2,48 out of a possible four. When converted back to the nominal categories of the scale it falls within the A (Agree) category. Therefore, on average, the participants agreed that the timeframe for implementing the NCS in Mathematics was realistic. The participants furthermore agreed, on average, that they received adequate training in implementing the NCS in Mathematics teaching. Specifically, 7,7% of the participants strongly agreed and 46,2% agreed.

In general, educators agreed: that the timeframe for implementing the NCS in Mathematics was, on average, realistic (2,48 out of 4); that educators received support from the departmental officials through attending workshops in order to assist them with the implementation of the NCS in Mathematics (2,83 out of 4); that the materials received from the DoE was useful for implementing the NCS in the teaching of Mathematics (2,42 out of 4); and that educators found the simplified terminology of the NCS in Mathematics easily understandable (2,56 out of 4). These observations answered the research questions on training and the problematic aspects in the NCS that either frustrated or appealed to Mathematics educators teaching in the FET band. In both cases the average of responses fell within the A (Agree) category.

Regarding the guidelines for appropriate assessment and the level on which educators received assistance with record keeping in Mathematics, the results revealed that 50% of the educators disagreed that the NCS had a negative impact on their record keeping of learners' performance. A total of 70% of the educators disagreed that the NCS had a negative impact on their assessment of learners' performance in Mathematics. They furthermore agreed that the NCS had a positive impact on their lesson planning in Mathematics (56%). Disagreement on the first two negatively worded statements and agreement on the third positively worded statement resulted in overall agreement about the existence of guidelines for lesson planning and appropriate assessment strategies in Mathematics in the FET band. These responses therefore once again delivered means which fell within the A (Agree) category.

On average, educators agreed: that they found the simplified terminology of the NCS in Mathematics more easily understandable compared to that in the preceding curriculum documents (a mean of 2,56 out of a possible 4); that the educators used the NCS in Mathematics in their day-to-day planning and teaching (a mean of 2,94 out of 4); and that 41% of the participants either disagreed or strongly disagreed about taking long to feel confident with implementing the NCS in Mathematics. Seventy-five percent of the participants either disagreed or strongly disagreed that the NCS had a negative impact on their teaching methodology in Mathematics. It was furthermore found that 69% of the participants either disagreed or strongly disagreed that they had difficulty in using the learning outcomes in implementing the NCS in Mathematics; that 50% of the participants disagreed to having difficulty in integrating knowledge and skills from different learning areas when they implemented the NCS in Mathematics and that 65% of the participants either disagreed or strongly disagreed on having difficulty differentiating between learning outcomes and assessment standards in the NCS for Mathematics. These results answered the research question on the existence of guidelines for the effective implementation of Mathematics didactics and OBE principles in the FET band. According to the participants, they agreed that these aspects were in place.

5. APPLICATIONS AND RECOMMENDATIONS

Although, according to the data, participants agreed that the implementation of the NCS in Mathematics at FET level was successful, there is always opportunity for improvement. In the interviews recommendations were raised regarding various aspects of the curriculum implementation. At district level it was recommended that a plan should be in place to provide on-going support to educators after the initial implementation. This should be provided by the departmental officials in the form of in-service training and the provision of materials for teaching and learning. Linked to the support is monitoring. Through monitoring, areas which need support and development can be identified. A suggestion by a participant was that the roll-out of the NCS be piloted before the actual full-scale implementation took place.

The professional development of educators is vital to the successful implementation of a curriculum. It is therefore imperative that educators receive adequate and on-going training to prepare them for the initial and continuous presentation of the new curriculum. Subject advisors could also be included in this process of training and these teams could work collaboratively with NGOs. Aspects that could be addressed include training in assessment, record keeping, promotions, the use of team teaching, the development of supplementary materials and policy interpretation in Mathematics. The training teams should be deployed to work directly with school clusters providing on-site support to educators and to serve as mentors. All trainers should be accredited through an appropriate process, however.

The following could be possibilities for further research. The sample of this study was drawn from educators in the Motheo district of the Free State province only. It is therefore not representative of the entire population of educators in the Free State province. Further studies could be conducted in other districts of the province to confirm the findings. Furthermore, only educators from public schools participated in the study. Research focusing on educators from private schools could add an interesting perspective to the study.

This study furthermore focused on the implementation of a new curriculum in the FET band. Similar studies on the implementation of new curricula in the Foundation, Intermediate and Senior Education and Training bands could also be performed. More research, with a bigger sample, preferably nation-wide, is essential to generalize results nationally with greater confidence.

As the NCS is no longer being taught, an investigation into the 2012 implementation of the new Curriculum and Assessment Policy Statement (CAPS), should now be conducted. Constructs similar to those addressed in this first study, should be researched further. This exercise could enhance the applicability of the results, as comparisons between the two studies could provide evidence for needs that have to be addressed or aspects that should be improved.

6. CONCLUSION

This article addressed the experiences and challenges that FET Mathematics educators faced during the time frame in which the NCS was implemented in schools by the National Department of Education. The researchers found that educators experienced the success of the NCS-implementation at different levels, but on average, agreed that the implementation was successful and that it contributed to better teaching. It was established; however, that direct, clear and appropriate guidance from the Department of Education on the implementation of the NCS in Mathematics in Grades 10 – 12 specifically, can contribute to educators coping with implementation difficulties in a more effective manner.

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