IMPLEMENTING A RESOURCE BASED INSET PROGRAMME: A CASE STUDY OF NATURAL SCIENCE TEACHERS.
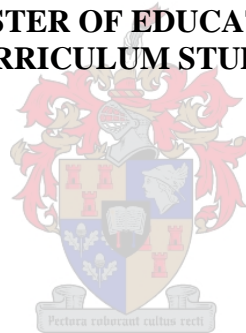
BY

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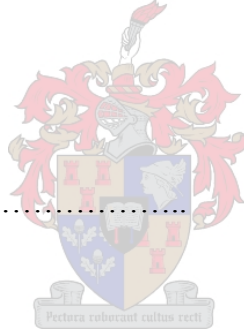DEPARTMENT OF CURRICULUM STUDIES, FACULTY OF EDUCATION

STELLENBOSCH UNIVERSITY

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Declaration

I, the undersigned, do hereby declare that the work contained in this thesis is my original work, and that I have not submitted part or whole thereof for the purpose of securing a degree at any university.

Signature: …………………………………………..

Date: …………………………………………..

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ABSTRACT

This thesis analyses the potential of resource materials to facilitate NCS (National Curriculum Statement) curriculum development processes related to the teaching of Natural Science in the Primary School. The resource, *We Care* learning support materials, was presented to teachers within the context of an INSET programme. During the course of investigating two teachers' curricular activities as they engaged the *We Care* materials, their professional development is traced as an outcome that parallels their curriculum activities. Case study research, consistent with the interpretive paradigm, served this study. With respect to the evidence acquired, the curriculum development activities and associated indications of teacher learning were scrutinized concomitantly. Working within a guiding framework, I chronicled the teachers' involvement with the *We Care* learning support materials and detailed their curricular processes. At the same time, I monitored indications of professional development that associated with these processes. Likewise, professional development indicators were used to establish teacher learning.

SAMEVATTING

Hierdie tesis analiseer die potensiaal van hulpbronmateriaal om NKV (Nasionale Kurrikulumverklaring) kurrikulumontwikkelingsprosesse, wat verband hou met die onderwys van Natuurlike Wetenskap in die primêre skool, te fasiliteer. Die hulpbron *We Care* leerondersteuningsmateriaal, was aan opvoeders aangebied binne die konteks van ´n Indiensopleidingsprogram (INSET). Gedurende die verloop van die ondersoek van twee opvoeders se kurrikulumaktiwiteite, terwyl hulle besig was met die *We Care* materiaal, is hulle ooreenstemmende professionele ontwikkeling as ´n uitkoms (outcome) gevolg. Gevallestudienavorsing, wat konsekwent is met die ontledingsparadigma, het hierdie studie ondersteun. Met in agneming van bewyse wat gelener is, was die kurrikulumontwikkelingsaktiwiteite en gepaardgaande aanwysers van onderwyser onderrig, terselfdertyd deeglik ondersoek. Deur binne´n rigting gewende raamwerk te werk, het ek die onderwysers se betroktenheid by die *We Care* hulpbron kronologies aangeteken en verslag gedoen van hulle kurrikulumprosesse. Op dieselfde manier het ek die professionele ontwikkelingsaanwysers, wat met die prosesse te doen het, gemonitor. Net so was professionele ontwikkelingsaanwysers gebruik om opvoederonderrig te vestig.

ACKNOWLEDGEMENTS

This work is dedicated to my parents, Mohamed Amien and Zohra Dharsey,

and my brothers, Abdul Carrim Dharsey

and the late Zunade Dharsey.

TABLE OF CONTENTS

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

X

CHAPTER 1

INTRODUCTION

1.1. BACKGROUND

Transformation and reconstruction have characterised the South African educational arena for more than a decade. Radical change, occurring in almost every facet of education, was imperative in view of the fact that "when the new government took over in 1994, it was faced with the task of dealing with a segregated, fragmented, authoritarian and dangerously unequal and inefficient education system" (Welch, 2002: 22). Much attention therefore focused on drastic transformation and reformation in order to address these concerns, as well as incorporating measures to attend to other equally pressing challenges pertaining to, amongst others, global economic competition and technological advances.

The new national curriculum, Curriculum 2005, launched by the national Department of Education (DoE) in 1997, was informed by the principles of outcomes-based education, an approach that in effect constitutes the foundation of the post-apartheid school curriculum (Chisholm, 2005: 193). According to Janse van Rensburg and Lotz, (1998: 11), this new outcomes-based curriculum and the defining of specific outcomes for a new education dispensation in South Africa, are the direct outcomes of democratisation and a concerted struggle to address the political injustices of South Africa's past through the transformation of the national system of education and training.

According to Nair (2003: 70) change was not only necessary to address the shortcomings in the educational system brought about by South Africa's apartheid past, but also because education was changing everywhere else in the world. The new approach to education, OBE, offered innovative alternatives to obsolete practices such as rote-learning and examination-driven learning (Pretorius & Lemmer, 1998:2).

Subsequent to its countrywide introduction, the national curriculum was reviewed and subjected to an intense programme of revision, and its amended version is known as the Revised National Curriculum Statement (RNCS). The RNCS, as the 'streamlined' C2005 was called, became official policy in April 2002, and its phasing-in was initiated in 2004 (Chisholm, 2005: 193). Adler, Reed, Lelliott and Setati (2002: 58) state that Curriculum 2005 had transformation intentions as school education throughout this new curriculum was to play a major role in the development of a vibrant and flourishing post-apartheid democracy.

Traditional education was content bound, incorporating evaluations and examinations as a measure of learning content mastered (Pretorius & Lemmer, 1998:2). Curriculum 2005 and the RNCS, "based on principles of Outcomes-Based Education (OBE)" (Chisholm, 2005: 193), deviates radically from the content-based teaching and learning approach. According to Pretorius and Lemmer (1998:2) the desired outcomes in an outcomes-based approach are used as the basis for all curriculum processes. In terms of this approach the curriculum developer works from the outcomes within a particular context or field of learning to design programmes of learning that will guide learners towards the achievement of the desired outcomes. Moreover, they indicate that an outcome is not a mark or percentage, but represents a culminating demonstration, which is the result of meaningful learning in context. This refers to what the learners are able to do in a significant and authentic context. The learner's progress is measured against agreed criteria, described as learning outcomes and assessment criteria, and particularly in terms of his/her prior performances (Pretorius & Lemmer , 1998:3).

Williamson and Lemmer (2003: 138) write that OBE is an approach to teaching and learning aimed at effecting a paradigm shift from content-based transmission mode to a competency-based one. Nair (2003:70) refers to two transformative approaches, namely competency-based learning and mastery-learning constituting the basis of OBE. He explains that while competency-based learning aims to prepare learners for success in fulfilling various life roles, mastery learning focuses on maximising the quality of

teaching and the quality of understanding by the learners. Meier (2003:223) regards the development of learners' critical thinking and problem-solving abilities as two key aspects at the heart of an outcomes-based approach.

Curriculum 2005 and its modified version, the RNCS, dictated revised content as well as advocated the application of new methodologies in teaching and learning. Located within the new curriculum is a specified demand for revision of the teacher-dominated pedagogy to a pedagogy that calls for a more learner-centred approach. Meier (2003: 237) states that child-centred education, as one of the cornerstones of OBE, was adopted in reaction to traditional schooling with its emphasis on information storage.

According to Brodie, Lelliott and Davis (2002: 98) learner-centred pedagogy involves teachers establishing links between learners' current meanings and new knowledge, and is informed by theories of learning and development, particularly those theories presented by Piaget and Vygotsky. They distinguish Piaget's theory of knowledge construction in terms of which learners construct new knowledge in relation to their current understandings, and Vygotsky's zone of proximal development, where the teacher mediates between the knowledge of the learner and the knowledge of society, as essential theories that have informed child-centred teaching. Key aspects of learner-centred teaching that can be discerned in the relevant literature, and that feature in current education policy include: interpersonal relations in the classroom; negotiated, relevant and integrated curricula; and pedagogical interactions in the classroom (Brodie et al., 2002: 100).

Brodie et al. (2002: 100) maintain that the substance of learner-centred teaching involves the selection and sequencing of tasks in relation to learners' existing knowledge base and providing for the conceptual development in a subject area, or across subject areas. In planning and structuring the learning programmes and tasks for the learners, teachers do so relative to the learners' particular strengths and difficulties. During task enactment processes in the classroom, the teacher focuses on identifying the learners' meanings and scaffolding their current knowledge to develop new knowledge. In this context, the

process of scaffolding allows the teacher to shape learner expression and participation in particular ways to serve particular purposes or outcomes of learning. Furthermore, Brodie et al. (2002: 100) write that such processes "are problematic in overcrowded and potentially conflictual classrooms". Challenging issues such as these appear to be noticeable within certain South African schools.

According to Meier (2003: 237-238) child-centred models recommend that the class size should not exceed 20 learners, otherwise learners might have to wait very long to participate in an activity or might have limited access to resources and activities. In addition, he sites building constraints such as a lack of electricity and ample storage space in the classrooms as factors impeding the effectiveness of classroom learning. Meier (2003:238) states that these constraints, which educators have to deal with in their classrooms at this stage in South Africa, characterise education as child-conscious rather than child-centred.

The new educational dispensation in the form of Curriculum 2005 and the Revised National Curriculum Statement, with its focus on Outcomes-Based Education and child-centred pedagogy, pose serious challenges for education in South Africa.

1.2. INTRODUCTION

The implementation of a new curriculum invariably challenges elements of teaching practice, particularly with respect to content and pedagogy. A reform of pedagogy or shifting practices as Adler et al. (2002: 54; 58) refer to it, inevitably entails resources for, and a re-sourcing of these practices. They add that an accompanying feature of changing teaching practice is the demand for new and different resources, or the development of new strategies for existing resources. Meier (2003:235) agrees that resource provision is an issue in the new curriculum based on a child-centred approach. He indicates that the custom of having multiple copies of the same textbook for the learners to work from is being replaced by the notion of using a variety of books to support the thematic work, which is central in current OBE practice.

The issue of re-sourcing posed serious challenges for the new educational dispensation in South Africa, because as Adler et al.(2002 :54) point out, educational resources are not only seriously limited, but are also unequally distributed. They indicate that there is a definite disproportionate distribution of material and human resources in school education that is highly visible across the country. Moreover, these authors contend that a central educational challenge in South Africa, in conjunction with the implementation of a new curriculum, is the provisioning and (re)distribution of human and material resources for learning and teaching in schools.

Also, according to Adler et al.(2002: 58, 63) although new teaching practices often necessitate 'more' resources (new resources or different uses for existing resources), more resources do not lead to better practices in an unproblematic and linear way. Related to this is their concern that textbooks or learning support materials that are too structured encourages teachers to develop a reliance on a single textbook as the main source of knowledge shaping teaching and learning practice. However, re-sourcing, according to Hall (1997: 38), is almost always a major issue where curriculum change occurs, and he adds that this is especially true when the curriculum specifies the use of an enquiry approach to learning.

Van der Horst and McDonald (1998: 27) suggest that the new curriculum in South Africa prescribed a definite move away from a content-driven rote-learning approach to one of enquiry and self-discovery. According to Meier (2003:223) the new approach to teaching and learning introduced a shift in focus, which advocated that educators had to change from being primary suppliers of knowledge to facilitators, while learners had to assume greater responsibility for their learning. He adds that this changing focus "impacted virtually every aspect of classroom interaction and didactical aspects of teaching and learning" (Meier 2003:223), as it radically deviated from previous practice.

Moreover, Meier (2003:237-238) points out that child-centred teaching in South Africa can become more rhetoric than reality because of certain constraints faced by educators. He maintains that two of the main factors inhibiting a total child-centred approach are

class size and appropriate teacher training. Individualisation of the learning/teaching process is a necessary feature of this approach, but this is problematic with a class of 30 or more learners. In addition, he indicates that this approach is complicated, challenging, exhausting and sometimes overwhelming, further complicated by the insufficient training received by the teachers. Moreover, he contends that the lack of training can contribute to teachers feeling inadequate to effect the paradigm shift (Meier 2003:238).

Remillard (2000: 332) agrees that changes in the field of teaching will require learning on the part of educators, because ideas central to the changing focus may be foreign to the teacher. She expands on this view, and suggests that the difficulty teachers experience in altering their pedagogy may be because they are being asked to teach in ways that are unfamiliar to them, ways that they did not experience as students.

It follows that appropriate curricula materials are especially critical to teachers during the introductory phase of transformation serving as a guide and inducting teachers into the process of reform. In support of this view Remillard (2000: 332) notes that some studies of teacher development projects have identified a need for teachers, in the midst of pedagogical change, to have well-designed curricular materials. This, she indicates, was noted because teachers who had begun to think about (mathematics) teaching and learning differently, were struggling with ideas as to how these ideas could be used in the classroom.

With regard to the essential role of curriculum materials in conjunction with teacher and curriculum development, Eisner (1990: 63) maintains that no curriculum teaches itself, and how teachers interpret what they receive is crucial to the kind of education students receive and the kind of growth teachers have an opportunity to experience. Love and Pimm (1996: 398) agree that the curriculum is also how a teacher interprets or uses text, stating that text materials - even textbooks - are resources, not the curriculum.

According to Eisner (1990: 65) the need to interpret and mediate a programme is an unavoidable aspect of any teacher's work and is further complicated by the

unpredictability that is an inherent feature of all teaching. Hence, if teachers are relatively untrained, or inexperienced, or if there is a lack of support services in the school, expecting the teachers to cope with curriculum choices when they are clearly unprepared to make such choices, can be counterproductive. Furthermore, he notes that while some teachers may need much guidance and direction, others may need far less and are able to cope with much more complexity. Therefore, he suggests that good curriculum materials should both educate and emancipate teachers (Eisner,1990: 65).

In view of the above perspective, the interpretive function of the teacher is considered critical to curriculum development processes. Remillard (2000: 331-332) emphasises this function and indicates that the task of teachers, rather than text, is critical to the process of curriculum development since teachers ultimately determine what is taught. She maintains that the curriculum is not what is written in textbooks or in policy guidelines, it is what actually takes place in the classroom (Remillard, 2000: 335). Thus, the materials most likely to foster teacher learning are those that engage teachers in learning opportunities (Remillard, 2000: 331).

Learning support materials, such as the *We Care* materials, can play a major role in teaching and learning. Reys, Reys, Lapan and Holliday (2003:74) write that curriculum materials provide guidance and structure to teachers as they enact the intended school (mathematics) curriculum. In addition, they maintain that instructional approaches suggested by materials often influence teachers' pedagogical strategies, particularly if the content and pedagogical approaches in the curriculum materials closely mirror the implemented curriculum.

Curriculum materials can provide the means allowing the resources to be accessed for the purpose of structuring the learning and teaching situation. Bridgeham (in Remillard 2000:346) notes that 'good' curriculum material should provide multiple possible routes for teachers and learners through a defined pedagogic field. Remillard (2000:346) considers this flexibility of curriculum materials indispensable because the paths that teachers and students take through the pedagogic space cannot be

predetermined by writers, but are the results of day-to-day and moment-to moment decisions.

Eisner (1990:66) agrees with the view that available materials should present multiple options for teachers to pursue. Therefore he suggests that those who design the intended curriculum should build into them different paths that teachers can take, without providing so much information that the sheer volume of reading becomes a disincentive (Eisner, 1990:69). Moreover, in strengthening the teacher's ability and extending their power to exercise professional judgement, good curriculum development not only teaches students, but it also helps the teacher learn as well (Eisner, 1990: 65).

Despite this acknowledgment of the vital role of curriculum materials in teaching and learning, Adler et al. (2002: 63) raise two issues of concern associated with the form and function of textbooks in school mathematics, science and language teaching. The first concern is that dominant textbooks in use present a narrow approach to these subjects. Furthermore, they report that in a recent study of science textbooks, the conclusions drawn indicated that many of the textbooks covered too many topics, and also failed to develop any of the topics well. The second relates to their concern that textbooks or learning support materials that are too structured contribute to the disempowerment and de-professionalisation of the teachers (Adler et al., 2002: 63).

Given that appropriate resources, such as textbooks and their accompanying teachers' guides, are especially helpful to teachers during periods of change and innovation, "as significant sources of content and pedagogical knowledge" (Kesidou & Roseman 2002:522) they are generally considered to be an important means of promoting high-quality teaching and learning. An essential contribution of curriculum materials extends to include its impact on teachers and teacher learning. In this regard, Wade (1996:14) expresses concern that "today's dominant approach to staff development is that teachers are spoon-fed pre-packaged activities and treated as curricular consumers rather than professional educators".

Moreover, Remillard (1999: 317) rationalises that in order to investigate the role of textbooks or text material in teaching and teacher learning, this process would entail a study of teachers' processes of constructing the enacted curriculum and the role that resources such as texts play in it. Demonstrating due cognisance of this recommendation, this study aims to examine the function of the *We Care* learning support materials in the teaching of Natural Science during processes of curriculum engagement and implementation by Intermediate and Senior Phase (Grade 7) teachers. Essentially, this study explores the relationship between the materials, purposeful curriculum development and the professional growth of the teachers.

1.3. PROBLEM STATEMENT

The fundamental question motivating this research is: Can the *We Care* learning support materials foster curriculum development and teachers' professional growth?

Derived from the central question of this investigation, key questions include:

1. Can the *We Care* materials facilitate the implementation of the Natural Science curriculum in the Primary School?
2. Can the *We Care* materials promote teacher development?

1.4. *WE CARE* REVIEW

The learning support materials developed by Environmental Education Programme: University of Stellenbosch, known as the *We Care* Material were used as resources in an INSET (in-service training) programme with Intermediate Phase Natural Science teachers in the Western Cape, Metropole South school district. This investigation examines the contribution of the materials to the teaching of Natural Science in the Primary School, and more specifically to its role in curriculum development, as well as the professional development of teachers.

The Environmental Education Project: University of Stellenbosch (EEPUS) was established by the Education Faculty of Stellenbosch University in 1987. The main purpose of this establishment was to support and promote environmental education. Danie Schreuder, 2004 EEPUS Programme Leader, indicates that the original *We Care* materials (*We Care* Manual 2004: v) were developed in response to the SA Nature Foundation's commitment to producing resource materials that would assist teachers in focusing on environmental issues and ecological concepts when developing learning programmes.

We Care is an educational resource pack, states Schreuder and Le Roux (1990: 7), which has been designed to assist teachers, youth leaders and environmental educators in formal and non-formal education situations to involve learners actively when teaching positive attitudes towards the natural environment. This resource pack, which consists of fifty activities, includes ideas for classroom demonstrations and learner projects and focuses especially on:

- an increased awareness and knowledge of basic ecological and conservation concepts;

- fostering positive values towards the natural environment; as well as

- allowing young people to become actively involved in an exploration and investigation of the natural environment and its conservation.

To assist teachers using this resource package, each of the activities is accompanied by a comprehensive set of guidelines, as well as a specific set of objectives formulated in respect of cognitive, affective and psycho-motor learning. In addition, these learner-centred, activity-based lessons are designed to make minimal demands on the resourcefulness of the teacher.

An important feature of the *We Care* resource materials is that learners are encouraged to become active participants in their own learning by engaging in exercises of information gathering and conducting their own investigations. Schreuder and Le Roux (1990: 10)

indicate that the maximum number of senses is incorporated into the activities, the children have fun while learning, and there are ample opportunities for communication between learners, as well as between the teacher and learners.

Initially attention focused mainly on outdoor type activities related to biophysical issues in the environment, according to Reddy and Schreuder (2004: 302). However, as educators developed a broader understanding of the concept 'environment', approaches and practices with a broader focus covering a range of environmental issues were developed.

In studying the effect of *We Care* enriched teaching on pupil orientation towards the natural environment and conservation, Schreuder and Le Roux (1990: 52) report that the resource pack had a definite and positive impact on the teachers who participated in the study. Furthermore, Reddy and Schreuder (2004: 302) indicate that the activity-based materials developed for the *We Care* series were well received and widely used by teachers. This is confirmed by Schreuder (*We Care* Manual 2004: v) who states that through surveys that were conducted, teachers indicated that they found the materials to be very useful.
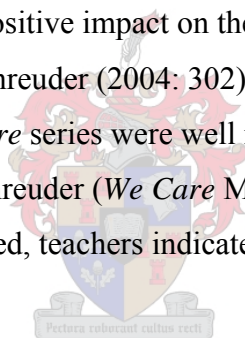
Through research-oriented processes of refinement and adaptation, the development of new *We Care* Primary materials was undertaken in collaboration with teachers, by way of in-service programmes (Reddy & Schreuder 2004: 302). This involved arranging workshops where teachers were afforded the opportunity to become acquainted with the necessary practices and needs-based materials. During the initial briefing session, the theoretical background of the *We Care* resource pack was discussed, as well as the techniques required to realise the objectives stated with each of the activities. This was an essential part of the process and ensured that teachers became thoroughly familiar with the materials and could then confidently use the materials in their teaching. Armed with the necessary knowledge and skills, teachers were then required to implement and experiment with the new ideas in the classroom situation.

During the next phase of the process in the follow-up workshops, the materials were refined in collaboration with the participating teachers. This process of refinement ensured that the teachers were able to adapt the material contained in the resource pack to differing teaching and learning contexts. The last phase of the process involved the dissemination of the revised materials to the schools participating in the programme.

In addition to providing many teachers with resource materials that respond to local or contextual challenges, these research processes that were conducted with teachers also contributed to the publication of a number of articles in local and international journals (Reddy & Schreuder, 2004: 303).

Curriculum materials selected and formulated by "experts" tend to have only academic value. Its sole impact on curriculum development is that the teachers make use of these materials unquestioningly and uncritically in their teaching. To obviate this kind of situation, EEPUS elected to workshop this resource material with teachers, thereby providing teachers with ample opportunities to familiarise themselves with the approaches and practices contained therein. This preference for the active participation of the teachers in a collaborative process is regarded as an imperative for more purposeful and productive integration of the material into the various teaching and learning programmes.

The *We Care* materials have since been redeveloped in order to help teachers interpret the National Curriculum Statement (NCS), and to facilitate the development of outcomes-based learning programmes that focus on local and contextual environmental issues and concepts.

This study is primarily concerned with the specific functions of the *We Care* materials in the context of Primary School Natural Science teaching, as it relates to the development of the RNCS, and extending the professional capacity of the teachers involved with the materials. The *We Care* programme reported on here essentially addresses the need for an

academic context to validate, and facilitate the teachers' engagement with the learning support materials.

1.5. CHAPTER OUTLINE:

In Chapter 1 I have formalised the focus of this enquiry, the relationship between the *We Care* materials, curriculum development and teacher development. In addition, I have presented an overview of the *We Care* learning support materials that form the focus of this investigation, and I have elaborated on the collaborative (teacher development) programme through which teachers are inducted into the effective use of these materials.

Chapter 2 represents a literature overview. I compared key aspects critical to this investigation, namely learning support materials, curriculum development and teacher learning with prevailing viewpoints in the field, focusing especially on the special relationship between the above-mentioned three elements. Literature relating to teacher development, traditional forms of teacher development programmes in South Africa, and alternative models of teacher development programmes for achieving the curriculum reform agenda in school education, are also examined.

Chapter 3 contains a detailed description of my research methodology. Chapter 4 focuses on presenting the results of the case study research that was used to identify the essential aspects of the relationship between the *We Care* materials, curriculum development and teacher development, as well as a discussion of the significant findings in this regard.

In Chapter 5, I consider the findings of my investigation, focusing on the essential contributions of the *We Care* materials to the teaching of Natural Science in the Intermediate Phase and Senior Phase (Grade 7) in a specific context. I also consider the purpose and importance of collaborative approaches to teacher development.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

This chapter is concerned with providing evidence of research into the critical aspects central to this investigation, namely the role of learning support materials relative to curriculum development and teacher learning.

2.2. LEARNING SUPPORT MATERIALS

The design and production of learning support materials are an integral part of curriculum development, and well-designed materials can function as a means of promoting 'good' teaching and learning. These resources, especially textbooks and their accompanying teachers' guides, play a major role in teaching and learning, as "teachers often come to depend on them for some or all of their content and pedagogical content knowledge" (Kesidou & Roseman 2002:522). As such, these materials provide a framework for guiding teaching and learning interactions, and a structured framework for planning and implementing learning programmes as stated by Russo and Lotz-Sisitka (2003:15).

The term 'materials' is often used in reference to learner work-cards or sheets, computer programmes, work-books, text-books and teachers' guides, booklets as well as non-standard materials such as slides, overhead transparencies, science-kits and posters (Russo & Lotz-Sisitka, 2003:15). Adler (et al., 2002: 54) maintain that teachers, as reflective or critical practitioners, draw on a wide range of additional resources (material and socio-cultural) besides the chalkboard, learners' class work books and prescribed textbooks to create a rich mathematical, scientific, linguistic and social environment for their learners. It would seem then that learning support materials evidently encompass more than just textbooks, and according to the Western Cape Education Department Website on learning support materials the design and production of such materials are not the exclusive preserve of publishing houses or educators.

According to the WCED (2002) a variety of sources serve this function, and amongst others can include commercial publishers; formal support material committees, structured on provincial or regional basis; informal support material committees, such as teacher centre working groups, voluntary teacher groupings, subject interest groups, and NGOs; knowledgeable individuals in the community; support material committees within schools; the teacher in the classroom; the learners' projects, notes and reviews, as well as parents.

These demonstrate that the manner in which learning support materials are prepared today varies significantly from earlier practices, as former methods of developing materials involved mainly 'top-down', 'expert driven' and 'package-centred' approaches. These, according to Russo and Lotz-Sisitka (2003:9) almost exclusively emphasised the role of the expert in deciding what had to be included in different materials and how they had to be used. They write further that these approaches were premised on the assumption that the development of materials should exclusively be the concern of 'experts' in the field, and these approaches are still very much in evidence today.

This approach that emphasises the role of the experts in materials design and development has been termed the RDDA (Research-Design-Disseminate-Adopt) approach (Robottom in Russo and Lotz-Sisitka, 2003:9). It largely supports the view that materials should preferably be developed by experts and then circulated to schools, communities and centres, where they are to be implemented by educators and learners. While the RDDA approach is often criticised for social engineering, Russo and Lotz-Sisitka (2003:9) maintain that it is often the most cost-effective, and time-effective approach.

As a response to the various concerns associated with RDDA-style material development programmes, more participatory approaches achieved greater prominence according to Russo and Lotz-Sisitka (2003:9-10). These new approaches permitted greater educator involvement. Moreover, they point out that the rationale offered in support of such developments includes the fact that existing approaches to materials development

demonstrate a lack of consultation, and often impose a fixed set of ideas that is not sufficiently responsive to either context or learners' needs.

Russo and Lotz-Sisitka (2003:10) identify several advantages associated with a more participatory approach to materials development, among others:

- the design and production of more germane materials that are more in keeping with

   learner needs and that are more responsive to contextual factors; and

- the fact that involvement in such development processes is extended to engage

   many more people in such practices.

However, the overemphasis of participation produced other concerns associated with the quality, purpose and use of learning support materials. In addition Russo and Lotz-Sisitka (2003:10) point out that greater participation in the development process is a time-consuming process, and often leads to problems concerning the integration of differing viewpoints without compromising the focus of the materials. Consequently, the role of the expert in materials development is being reconsidered and redefined, while an approach that seeks to combine the RDDA approach with participatory approaches has emerged (Russo & Lotz-Sisitka 2003:11).

Developing materials on the basis of a collaborative process and by means of interactive discussion is advantageous insist Russo and Lotz-Sisitka (2003:30) since this approach contributes to teachers developing a greater understanding of the issues being considered. More importantly, they indicate that when materials are developed "with people rather than for target groups" Russo and Lotz-Sisitka (2003:30) , a sense of ownership is encouraged, and the materials would most likely be used more extensively and also be more relatable to the teacher's needs.

Learning support materials are designed and developed for specific situations and used in particular contexts (Russo & Lotz-Sisitka, 2003: 24). For this reason due consideration of the context of learning forms an integral part of the materials development process, as

the particular context of learning guides the selection of examples and information that would ultimately be reflected in the materials.

Furthermore, Russo and Lotz-Sisitka (2003:11-13) also note that sufficient evidence exists to support their contention that materials development processes often do not reflect due consideration for the manner in which the materials are actually incorporated into teaching and learning situations. In support, they cite specific problems associated with this tendency which includes the 'commodification' and the 'trivialisation' of learning support materials. Where 'commodification' points to an overemphasis of learning support materials as 'objects' or 'commodities' and the neglect of the critical relationship between product and process, problems associated with the 'trivialisation' of materials point to a lack of clarity concerning how learning processes occur, and a lack of reflexivity in consideration of the role of learning support materials in the learning processes.

Further evidence pointing to a lack of reflection on how materials are actually used to promote learning, can also be observed when learning support materials are 'adopted' indiscriminately without due consideration for the context of its use, and the selection of 'easy' materials that might lead to poor and inappropriate learning. For the reasons supplied above, Russo and Lotz-Sisitka (2003:11-13) demonstrate a preference for research-based learning approaches, emphasising that these approaches involve the adaptive use of learning support materials in context, and ongoing reflexive research into how learning support materials can promote (environmental) learning.

Roseman, Kesidou, Stern and Caldwell (1999: 1-10) also express concern about how well textbooks or text materials can help students to learn key ideas in science. Moreover, they give an account of an in-depth evaluation of middle grades science textbooks and stand-alone units that formed part of a larger study known as Project 2061. This study focused primarily on determining which materials had the potential for helping students learn key ideas. Using criteria obtained from the best available resources about how students learn, the study set out to examine the text's quality of instruction in terms of key ideas in

science, and found that none of the science texts evaluated by Project 2061 was rated as satisfactory. However, the stand-alone units that were developed by the Michigan Department of Education, based explicitly on research about how students learn, were rated much higher than the textbooks. Roseman (et al., 1999: 2), indicate that these results were significant as they indicated that good science materials can indeed be developed.

At this juncture it is significant to reflect upon the various categories of criteria identified by Project 2061, which supported the evaluation of the quality of instructional support offered by science texts. These categories, as described by Roseman (et al., 1999: 8-10), include:

- Category I: Providing a sense of purpose – conveying unit purpose, conveying lesson purpose, and justifying activity sequence.

- Category II: Taking account of student ideas – attending to prerequisite knowledge and skills, alerting teachers to commonly held student ideas, assisting teachers in identifying students' ideas, and addressing commonly held ideas.

- Category III: Engaging students with relevant phenomena – providing a variety of phenomena, and providing vivid experiences.

- Category IV: Developing and using scientific ideas – introducing terms meaningfully, representing ideas effectively, demonstrating use of knowledge, and providing practice.

- Category V: Promoting student thinking about phenomena, experiences, and knowledge – encouraging students to explain their ideas, guiding student interpretation and reasoning, and encouraging students to think about what they have learnt.

- Category VI: Assessing progress – aligning assessment to goals, testing of understanding, and using assessment to inform instruction; and

- Category VII: Enhancing the science learning environment – providing teachers with content support, encouraging curiosity and questioning, and supporting all students.

These categories were clearly formulated to address the need for a science text to attend to a dual function, simultaneously attending to the learners' requirements while also serving the instructional needs of teachers. Therein lies a valuable contribution of science texts to teaching and learning.

While Project 2061 did not write textbooks, this type of research aimed to provide guidance to those who do, state Roseman (et al., 1999: 5). These writers acknowledge that teachers may understandably be concerned about using science texts that are considered lacking, but they make an important suggestion that schools should rather invest in the professional development of the teachers to help teachers recognise and compensate for shortcomings identified in science learning support material. Russo and Lotz-Sisitka (2003: 18) indicate their support for continuous research into materials development, emphasising that such studies form an integral part of the process of developing learning support materials, and could contribute valuable insights into learner needs, the content of materials, how the materials correspond to the 'bigger picture', as well as its related context.

With regard to the specific contribution of materials to teaching and learning, Eisner (1990: 65-66) maintains that creative curriculum development, that is to say the development of materials that teachers work with, should essentially enable teachers to provide students with activities that meet five criteria:

- The activities the materials suggest should teach ideas, skills, or forms of perception that are educationally important.

- The suggested activities should be intellectually challenging to students and stimulate higher order thinking.

- The content that students study should be presented through various forms of representation and should not be restricted to text alone.

- The content students study should help them make connections with what they learn

- in other areas, including those outside the school.

- The available materials should provide multiple options for teachers to pursue.

Kesidou and Roseman (2002:523) assert that educators themselves have different views on curriculum materials. They indicate that these views range from the view that curriculum materials need to be prescriptive and specifically direct teachers as to what to do, when to do it, and in what order; to the view that curriculum materials are not needed at all, and that the teacher must develop his or her own materials in accordance with the students' particular learning needs. They also note that between these two radically opposing viewpoints there are various other viewpoints, such as that curriculum materials are a necessary evil and provide structure and guidance to novice teachers or teachers who are not adequately equipped to teach science, or that curriculum materials are useful reference materials that teachers can consult while formulating materials of their own.

Marsh and Willis (1999: 332) note that "occasionally, educators defer important curriculum decisions to a publisher by adopting a textbook and letting it be their curriculum". Their concern extends to the fact that in this case, "some decisions about content and organisation are actually made by publishers, not educators". Moreover, to increase the possibility of widespread approval and use, textbooks often omit controversial topics altogether or approach them extremely cautiously. They note that frequently textbooks are deliberately written down to the lowest reading levels of all students. For these reasons, textbooks are often written with much of their potentially educative value drained from them (Marsh & Willis, 1999: 333).

Kesidou and Roseman (2002:523), however, demonstrate a preference for the view that curriculum materials (textbooks) are indispensable tools that allow teachers to do their best work with students as these materials provide a coherent science programme for students based on the best thinking available in the field, and support teachers in making more judicious and informed decisions about their own students' science learning.

In this study, I have used the terms 'learning support materials', 'resources', 'text' 'textbooks' and 'curriculum materials' interchangeably to refer to text materials used in the teaching-learning situations. Remillard (1999: 340) indicates that practitioners and curriculum developers prefer to distinguish between these terms, specifying that curriculum materials are viewed as alternatives to textbooks. For the purpose of this investigation, I have not emphasised the specific differences between the essential use of these terminologies, electing rather to focus on the particular functions of the *We Care* materials, specifically as they relate to teacher and curriculum development.

2.2.1. THE NORMS AND STANDARDS DOCUMENT FOR TEACHERS AND THE ROLE OF RESOURCES

A review of recommendations contained in the Revised National Curriculum Statement, regarding the role of text in curriculum implementation is necessary, since these state explicit challenges for teachers and teacher development. The precise challenges pertain to the kinds of knowledge and skills it specifies for teachers.

The *Norms and Standards for Educators (DoE,2000*) identify seven roles and their associated competencies for educators. These indicators effectively provide the norms guiding educator development, and should figure prominently in all initial educator learning programmes and qualifications.

According to these specified roles, an educator is required to function as a learning mediator; interpreter and designer of learning programmes and materials; leader, administrator and manager; scholar, researcher and lifelong learner; a community, citizenship and pastoral role; assessor; and learning area/subject/discipline/phase specialist. Essential indicators associated with each of these roles have been further subdivided into categories of practical competence, foundational competence, and reflexive competence.

This document contains numerous stipulations informing and guiding educators' tasks with respect to the judicious use of learning support materials. For instance, as learning

mediators, educators are required to demonstrate practical competencies with regard to using media and other resources, such as textbooks and other text material, appropriately in teaching.

As interpreters and designers of learning programmes and materials, educators are expected to demonstrate practical competencies as regards understanding and interpreting provided learning programmes; designing original learning programmes; identifying the requirements for a specific context of learning, and selecting and preparing suitable textual and visual resources for learning. The selected or adapted learning resources should be appropriate for the subject/learning area, the age level, language competence, gender, culture of the learners, and should also take into consideration the barriers to learning. The educator is also required to design original learning resources including charts, models, worksheets and more sustained learning texts in order to ensure that these meet the particular needs of the learners.

With regard to the foundational competencies, educators are required to possess sound knowledge of the curriculum, learning programme and learning materials design, reflect on how learners learn from texts and resources and also demonstrate an understanding of common barriers to learning and how materials can be used to construct more flexible and individualised learning environments. Concerning reflexive competencies, educators are required to reflect on changing circumstances and conditions and adapt programmes and materials accordingly. The tasks that fall within the ambit of the educator as a learning area specialist include the analysis of lesson plans, learning programmes and assessment tasks, as well as the selection, sequencing and pacing of content.

In terms of the above-mentioned competencies, much is therefore expected and demanded from teachers with regard to the perspicuous use of learning support materials in teaching and learning. Teachers develop these competencies over time, while engaging in processes of implementing the curriculum using the relevant curriculum materials.

Given the level of importance ascribed to the teacher's competencies with regard to curriculum materials in the *Norms and Standards for Educators (2000),* it seems that teacher professional programmes would do well in their function to recognise and accommodate the development of curriculum materials in relation to curriculum development as an essential component of such development programmes for both pre-service and in-service programmes.

2.3. CURRICULUM DEVELOPMENT

The term 'curriculum development' is often associated with processes of preparing and organising curriculum materials for teachers. The traditional view holds that this task is usually undertaken by 'experts' in the field, and that the teacher is mainly responsible for the transmission of the prescribed curriculum (Haberman, 1992: 13).

On this subject, Remillard (1999: 318) suggests that the curriculum development process extends beyond the preparation of materials, and continues in the classroom where teachers purposefully engage learners in experiences designed to promote learning. This view, she adds, develops Ben-Peretz's conception of two levels of curriculum development, namely what curriculum writers do when they conceptualise curricular plans and then construct resources for teachers, and what teachers do as they alter, adapt or translate textbook offerings to make them appropriate for their students.

The teacher's role as curriculum developer, states Remillard (1999: 318), involves more than simply selecting and redesigning curriculum plans; it also involves enacting those plans in the classroom situation with the learners. She adds that regardless of how teachers depend on and use curriculum materials, their work in relation to planning and teaching (mathematics) can be viewed as curriculum development. Curriculum development is therefore inclusive of all processes used by teachers to structure curricular plans and transform them into learning experiences.

An essential component of such processes involves the selection of materials for teaching and learning. During the course of selecting materials, teachers may select an entire

learning programme on offer, or sections of various programmes, change the order of topics and activities, make changes in the depth of coverage and level of difficulty, or bring about changes in the type and nature of the messages contained in the materials. These activities are essential for they ensure the 'match' between the school, learners, teacher and curriculum materials (Elbaz, 1991: 366).

It seems that teachers who endeavour to implement guidelines and suggestions offered by curriculum materials as closely as possible, may be required to make adjustments to selected tasks even while learners are working on them. This indicates that curriculum-development decisions are not confined to the planning and structuring phases, but are an essential feature of classroom interactions as well.

The modification of tasks becomes necessary given that the course that teachers and learners take cannot be predetermined by writers or even educators, but are the results of day-to-day and moment-to-moment classroom events (Remillard, 2000: 346). However, the adjustments to tasks that teachers are called on to make during processes of engagement, demonstrate the responsive, interactive and emergent nature of the constructed curriculum (Remillard, 1999: 318).

As the principal conduits for the curriculum, the teachers' role in curriculum development is a significant and essential element of the process. Haberman (1992: 11) views teachers as curriculum leaders since they still retain the most powerful influence on students' learning, and this influence extends to include what they actually choose to teach and what the students learn.

Marsh and Willis (1999: 340) write that it is still the teachers who ultimately enact curricula and create the conditions under which curricula are experienced by students. They note that even though teachers are compelled to implement someone else's curriculum priorities, their influence is felt in the classroom for they are the real enactors or implementers of the curriculum.

According to Haberman (1992: 15-17) the benefits of greater teacher involvement in curriculum development are numerous, since it will lead to improved teacher self-concept, a greater sense of responsibility and commitment to the school and the curriculum, and increased student motivation. He specifies in support that the teachers' personal commitment to the curriculum can be a primary factor in motivating the students to be more interested in the materials being presented, in effect also contributing to improvements in the teacher-student relationship. Furthermore these improvements in the teacher-student relationship will not only enhance teaching, but will be evinced in students' achievements.

For the purpose of this study, curriculum development focuses on those activities that teachers engage in during the course of implementing National Curriculum Statement (NCS) recommendations with respect to the teaching of Primary School Natural Science.

2.4. TEACHER DEVELOPMENT

2.4.1. INTRODUCTION

There is nothing new about educational change according to Sikes (1992: 36), and this change may emanate from a variety or a combination of factors such as economic growth and expansion; political, social and cultural developments; or technological advances. However, these changes translate into a continually shifting environment in which teachers have to operate. The consequence for teachers functioning in such situations is that they are regularly obliged to modify their administrative and organisational systems, their pedagogy, curriculum content, the resources and technology they use, and their assessment procedures in accordance with the new specifications identified by educational reform measures (Sikes,1992: 37).

Given that educational change depends largely on what teachers do and think (Fullan, 2001: 115) teacher development programmes become crucial for the realisation of successful educational reform. The logic and evidence of linking teacher development to

successful implementation of innovations are quite straightforward according to Fullan and Hargreaves (1992: 1). In a previous study they observed that effective implementation involved changing curriculum materials, instructional practices and behaviour, and beliefs and understandings on the part of teachers involved in given innovations. Based on their findings, Fullan and Hargreaves (1992: 1-2) conclude that successful change involves learning how to do something new. They elaborate that the process of implementation is to a large extent a learning process, and when this process is linked to specific innovations, teacher development and implementation go hand in hand. Thus, they recommend that teacher development should be innovation-related, should be continuous during the course of implementation, and involve a variety of formal (e.g. workshops) and informal (e.g. teacher-exchange) components.

Bell and Gilbert (1994: 484-493) agree that teacher development is essentially a learning process, and they distinguish between various dimensions of professional (developing their beliefs and ideas), personal (attending to feelings about changing) and social (relating to other teachers) development as essential constituents of this learning process. Here, the emphasis of teacher development is placed on teachers developing and changing with respect to these dimensions, rather than on others causing teachers to change. In teacher development processes, learning should be perceived as a purposeful inquiry explains Bell and Gilbert (1994: 493), since teachers are inquiring into or investigating the professional, personal and social aspects of their teaching.

Educational change programmes have an objective reality that may be described in terms of which beliefs, teaching practices, and resources they encompass, asserts Fullan (2001:44). Moreover, he points out that while teachers may experience great difficulty altering their teaching approaches or styles as they incorporate new materials, changing beliefs are even more problematical, since this challenges the core values held by individuals regarding the purposes of education.

Furthermore Fullan (2001: 44-45) notes that while the use of new materials by themselves may accomplish certain educational objectives, developing new teaching

skills and approaches, and understanding conceptually what and why something should be done, and to what end, entail much more fundamental change. For this reason, he supports a change in beliefs and understanding as the basis for achieving reform. He indicates that the development of new understandings is essential since it provides a set of criteria for overall planning, and a screen for distinguishing the valuable from the not-so-valuable learning opportunities.

According to Loucks-Horsley, Love, Stiles, Mundry and Hewson (2003: 48), all educational transformation of value require individuals to act in new ways (established by new skills, behaviours, or activities) and to think in new ways (beliefs, ideas and understandings). They maintain that changing deeply held beliefs, knowledge and practices with regard to teaching and learning is a process that essentially necessitates transformative learning. In distinguishing this form of learning from 'additive' learning, they indicate that 'additive' learning merely encourages the acquisition of new skills and knowledge. They write that transformative learning promotes the development of new practices in conjunction with the development of new understandings (Loucks-Horsley et al., 2003: 44-46).
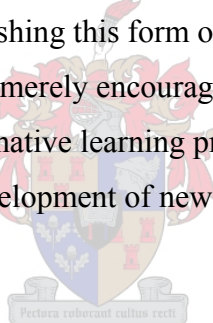
Historically, professional development largely focused on additive learning, and neglected to support teachers in transforming thinking and beliefs, states Loucks-Horsley et al. (2003: 46). They demonstrate a preference for the view that teachers are in need of learning opportunities to help them understand the basic intentions of reform and the reconstructed curricula, and how both relate to knowledge of how people learn; otherwise teachers may inadvertently make choices that detract from student learning.

In -service teacher development is intended to strengthen the professional potential of teachers, and provide opportunities for further teacher growth and development. According to Loucks-Horsley (in Remillard, 2000: 333) professional development projects have provided sufficient evidence that the kind of learning that leads to fundamental change in teaching occurs via extensive support and multiple opportunities for teachers to experiment and reflect.

The aim of this investigation is to establish evidence of professional, social and personal learning as demonstrated by teachers participating in the study, and is not concerned with assessing the *We Care* teacher development programme itself. The main purpose is to establish a possible connection between the three elements of the research question, namely curriculum materials, curriculum development and teacher learning as demonstrated by the use of the materials supplied by the programme. The *We Care* programme mentioned here merely provides the means for connecting teachers with the learning support materials.

In this section, I also review the essential features of teacher development programmes used in South Africa and elsewhere. The purpose of this review is to identify the essence of teacher development programmes as they relate to this study. The specific focus is therefore the importance attributed to the link between curriculum materials, curriculum development and the professional development of teachers as reflected in teacher development processes.

2.4.2. TEACHER DEVELOPMENT IN SOUTH AFRICA: A BRIEF OVERVIEW

South Africa had not formulated a coherent national policy on teacher development or governance during the period prior to 1994 according to Pretorius and Lemmer (1998: 110). Governance of education was essentially divided between 18 departments of education and 15 ministers of education. Within this system, teacher education was not only disastrously authoritarian, fragmented and inefficient, but also racially and regionally administered.

The national government exercised strict control over issues pertaining to the funding and curricula for teacher education, as well as to the employment of teachers. This control of education was exerted through the various provincial and homeland governments, the Department of Education and Training, the House of Delegates and the House of Representatives, as well as via several institutions of higher learning.

Teacher training colleges or colleges of education provided for Pre-service (PRESET) teacher education. In addition to these colleges, faculties or schools of education located at a number of universities and technikons also served the training of teachers. In-service teacher education (INSET), also not guided by any coherent policy, was accomplished through various education departments, non-governmental organisations (NGOs), distance education institutions and the private sector (Pretorius &Lemmer, 1998: 114).

Subsequent to the establishment of a democratic government in South Africa in 1994, a single system of educational governance was instituted. In view of the nature of its legacy, initial efforts focused on addressing the imperatives of redress and equity. Governance of teacher education was dramatically transformed, and Welch (2002: 25) observes that the most profound change impacting teacher development that emanated from this transformation was the incorporation of teacher education into higher education. This inclusion into higher education was accompanied by the closure of numerous colleges of education, resulting in the loss of a considerable number of new recruits for the teaching profession. The decrease in aspiring teacher enrolments was further exacerbated by the rather daunting and highly-priced teacher education options made available at higher education and training institutions (Welch, 2002: 26).

At the time, the closure of teachers' colleges encouraged private sector involvement in teacher education, which increased noticeably during the 1990s. This level of involvement of the private sector, states Welch (2002: 18), raised concerns about quality assurance, particularly with regard to the large-scale provision of distance teacher education, whether public or private, or offered through public/private partnerships. Consequently, institutions of higher education providing for teacher education were under pressure to explore and expand alternative modes of delivery in order to increase their capacity for teacher training as well as to address the demands for the provision of quality education and training.

With regard the design and delivery of teacher education programmes, clear policy directions contained within the *Norms and Standards for Educators*, published in the

Government Gazette 4 February 2000, serves to inform and guide teacher development processes. This policy document defines educator development as the ongoing education and training of educators as a continuum, including both pre-service and in-service education and training.

 In accordance with the directives contained within this document, traditional structures providing for teacher education were compelled to review their teacher development programmes, especially in view of the need for higher education institutions to provide for in-service and initial teacher education in the same programme, as well as the need for a school focus in teacher education programmes (Welch, 2002: 29).

A focus on schools entails the integrated assessment of applied competence in authentic contexts explains Welch (2002: 30). In expanding on this, she maintains that the development of applied competence can be viewed as a process through which teachers learn from the application of their foundational knowledge in practice in authentic contexts. A significant aspect of this process involves a reflection of classroom practices, enabling teachers to effectively relate theory to their practical teaching experiences.

With regard to teacher education curricula, Pretorius and Lemmer (1998:115) emphasise that the principles guiding the development of such curricula are required to observe the following: sensitivity to the diverse contexts in which teachers work; lifelong learning which seeks to increase access to education over a longer period; congruence of teacher education curricula with the principles of the South African Constitution; and increased communication between various teacher education programmes.

Furthermore, with the introduction of a new national curriculum, Curriculum 2005, and later its revised form, the Revised National Curriculum Statement (RNCS), key curriculum elements of content, pedagogy and assessment were drastically transformed. The new curriculum advocated a definite shift from former teaching and learning practices, emphasising a preference for integration rather than fragmentation, for high-order rather than low-order knowledge and skills, and for an active, critical engagement

in learning as opposed to rote learning (Adler, 2002: 7). With regard to the curriculum reform and transformation process, new and distinctly different roles are specified for teachers.

Teachers play a pivotal and critical role with respect to the implementation of a new curriculum or curriculum reform. As the key agents of change, their function is crucial for repairing, redressing, professionalising and changing current educational practices (Adler 2002: 2). This changing function, she adds (Adler, 2002: 7), indicates significant and necessary roles for INSET, both short-term and long-term teacher development and support, as regards new orientation to knowledge and pedagogy.

The above discussion serves to illustrate the extent of the transformation process as it pertains to teacher development in South Africa. On the subject of these extensive changes that have been implemented, Welch (2002: 33) states positively that the basis has been laid for an integrated and democratic system and curriculum policy reflects best practice internationally as well as being tailored to meet the needs of the country.

2.4.3. TEACHER DEVELOPMENT PROGRAMMES

With regard to teacher development, Dennis Sparks (in Loucks-Horsley et al., 2003: ix) expressed concern that far too often what passes for professional development planning is the identification of a topic for an in-service session with teachers and the selection of a speaker. The resultant event, he adds, is deemed a success if the presenter has somehow managed to motivate or inspire the audience with little thought given to the long-term effects on teachers' practice and student learning.

This is a legitimate concern, and it has inspired my reflection of the teacher development programmes that are made available to in-service teachers, and more particularly to those teachers involved in this study. However, this review is limited to surveying only two of the teacher development programmes that have been conducted at the school where the teachers participating in this study, are located. These include the *We Care* programme designed by (EEPUS) Stellenbosch University, and the 'Out of the Box' programme

sponsored by the British Council and Old Mutual. These programmes, as well as the in-service training (INSET) programmes presented by the education departments (national and provincial), are briefly discussed with a view to elaborate on the interconnectedness of elements of teacher, curriculum and materials development that is achieved by these processes.

A further dimension of this discussion is the offering of professional development activities conducted in Australia, Canada, Portugal and Zimbabwe, as reviewed by Marx, Freeman, Krajcik and Blumenfeld (1998:670-672). Their transnational analysis of particular professional development events structured for science teachers in these locations, provides a means of contrasting international initiatives with local programmes.

2.4.3.1. THE *WE CARE* PROGRAMME

The Environmental Education Programme (EEPUS) focuses on enabling professional development through a resource-based INSET process. Two aspects essentially serving this teacher development programme involve:

- The input of new theoretical ideas and new teaching suggestions; and

- Trying out, evaluation and practice of these new theoretical and teaching ideas over an extended period of time in a collaborative situation (Bell & Gilbert 1994: 494).

This school/classroom-focused, certificated, in-service programme is conducted over a period of six months, incorporating formal components such as workshops with teachers, as well as informal components such as teacher exchange sessions. Support for teachers is provided during the feedback and evaluation sessions, as well as by way of classroom visits.

The introductory workshops focus on providing the theoretical background of the resource pack to the teachers. During these sessions, aspects such as content and pedagogy, as well as the layout of the manual with respect to the guidelines and the stated objectives for each activity, is communicated to the teachers. Teaching and learning

practices associated with each of the activities, as well as suggestions for the incorporation of the materials into learning programmes is discussed. This ensures that teachers became thoroughly orientated with regard to the content and pedagogy addressed in the text.

This process also serves to advance teachers' knowledge and skills, and consequently imbues greater confidence in relation to teachers' preparedness to alter pedagogical strategies with regard to the teaching of Natural Science. Teachers thus empowered through this process are then encouraged to implement and experiment with the new ideas in the classroom situation.

During the next phase of the process in the follow-up workshops, teachers are afforded ample opportunity to reflect on and share their experiences with a larger group. At the same time teachers are encouraged to establish networking links with neighbouring schools as a way of securing that the process encourages greater reflection, interaction, and sharing amongst teachers.

Through this process participating teachers develop new understandings and new teaching practices, while engaging the curriculum. In this respect productive, professional and curriculum development is effectively accomplished in the course of engaging a set of pre-designed learning support materials, the *We Care* resource pack.

FIGURE 1: ESSENTIAL FEATURES OF THE *WE CARE* PROCESS.

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┌─────────────────────────────────────────────────────────────────────┐
│                        THE WE CARE PROCESS                            │
│                                                                       │
│                   ┌──────────────────────────┐                        │
│                   │        WE CARE           │                        │
│                   │    RESOURCE MATERIAL     │                        │
│                   └──────────────────────────┘                        │
│                             THEORY                                    │
│               - NEW UNDERSTANDINGS (CONTENT & CONTEXT)                │
│               - NEW SKILLS / APPROACHES                               │
│                                                                       │
│   ┌────────────────────┐              ┌────────────────────┐          │
│   │    COLLABORATION   │              │   IMPLEMENTATION   │          │
│   │          &         │              │                    │          │
│   │      SUPPORT       │              │                    │          │
│   └────────────────────┘              └────────────────────┘          │
│   - CLASSROOM OBSERVATION              - CURRICULUM LINKS             │
│   - EVALUATING / SHARING               - LEARNER NEEDS               │
│   - FORMING NETWORKS                   - ADAPTING TEXT               │
│                                        - EXPERIMENTATION             │
└─────────────────────────────────────────────────────────────────────┘
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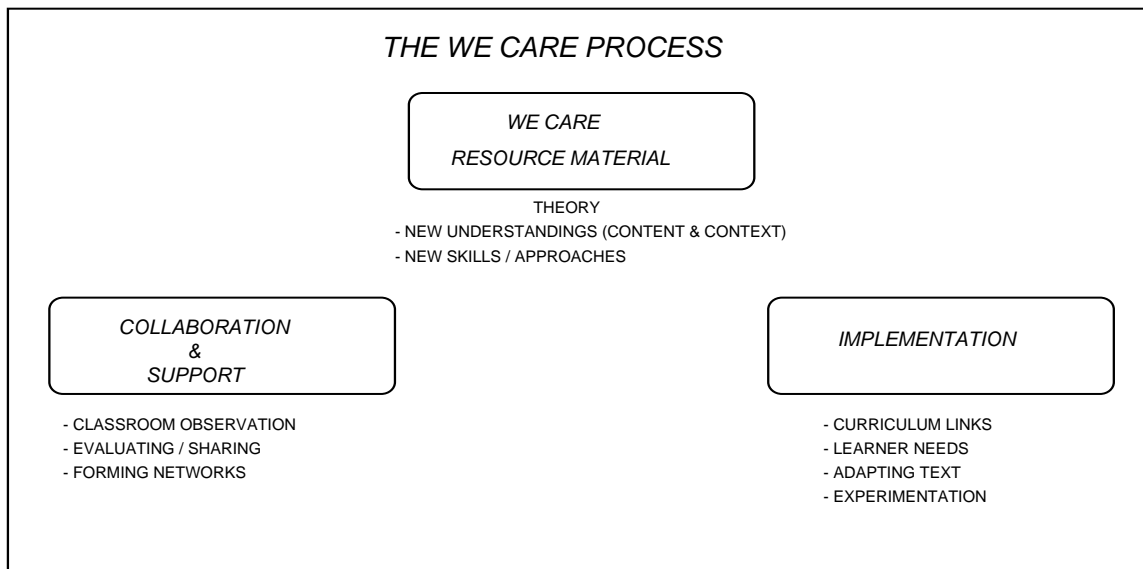
The *We Care* programme is designed to address the advancement of applied competencies and its three interconnected components of practical, foundational and reflexive competencies in authentic contexts. Also, knowledge of subject specialisation as per the *Norms and Standards for Educators (2000)* dictates that the development of knowledge of the specialism (subject/learning area) should embrace content knowledge (knowing that), concepts and theories (knowing why), procedural knowledge (knowing how), and strategic knowledge (knowledge about why, when, where and who). These types of knowledge functions are promoted via the *We Care* programme.

It is important to note though that the advancement of the professional capacity of the teachers is attended to through the use of the *We Care* learning support materials. This approach effectively combines the three elements of the research question.

2.4.3.2. THE 'OUT OF THE BOX' PROGRAMME

The Global School Partnership programme, operating under the auspices of the British Council, encourages the establishment of partnerships between schools in the UK and schools in Africa, Asia, Latin America and the Caribbean. The programme provides guidance, professional development opportunities and grants to schools that are using school partnerships as a means for developing a global dimension within their curriculum.

The programme ultimately hopes to increase awareness amongst education professionals of the benefits of school partnerships and the value of embedding a global dimension within the formal curriculum. They also aim to contribute to a greater appreciation within the wider community of the value of partnerships between developed and developing countries.

As a participant of the Global School Partnership programme, the school where this study was done was further offered the opportunity to become involved in the 'Out of the Box' teacher development programme. This programme was facilitated by members of the Western Cape Primary Science Programme. At this point, I need to point out that the 'Out of the Box' programme will be discussed later and details of the programme provided here is largely based on my own experiences of the process.

Schools involved in this programme received a science-kit containing basic science equipment, for example seeds, magnifying glasses, earthwormery, spring balances, thermometers, etc. and a training manual outlining various activities. In addition, the PSP facilitator regularly visited the school, offering support and providing feedback to teachers.
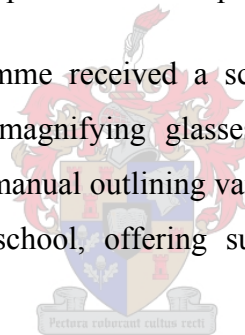
This school/classroom-focused, non-certificated, in-service programme is conducted during the period that the school is a participant of the Global School Partnership programme, essentially for a period of three years. This programme is inclusive of formal components such as workshops with teachers, as well as informal components such as feedback sessions with teachers. The facilitators visited the school frequently to provide relevant updates, informally assessed the work done by the teachers and learners, and generally provided support and encouragement for the teachers.

The preliminary workshops focused on providing the theoretical background for the materials contained in the box, as well as the text offered in the manual. During these sessions, aspects such as content and pedagogy were discussed with the teachers. Teachers were encouraged to explore different ways of incorporating supplies from the

kit, as well as the text provided in the manual across all the learning areas. These workshops served to familiarise teachers with the necessary teaching and learning practices involved, as well as to offer suggestions for the integration of the materials into learning programmes.

This phase of the process ensured that teachers became thoroughly acquainted with the content and pedagogy addressed in the manual thereby promoting the sensible use of the materials during processes of enacting the curriculum. During the course of using the materials, teachers were encouraged to construct a portfolio providing evidence of the tasks that the teachers and learners had engaged in. This portfolio was then analysed by the sponsors in their assessment of the progress achieved by the programme itself.

Although the 'Out of the Box' programme took place over a longer period, its design and procedures were largely similar to those identified within the *We Care* programme. The development of applied competencies and its three interconnected components of practical, foundational and reflexive competencies, in authentic contexts were also accomplished via the use of curriculum materials.
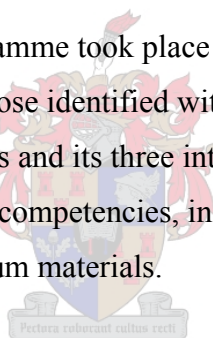
As with the *We Care* programme, regular support and feedback form an essential feature of this process. The basic difference between the two programmes is that in this case science equipment is provided with the suggested materials, while the *We Care* programme encourages the formation of networks of teachers to promote interaction and exchange. Here again, the curriculum materials feature prominently in conjunction with the promotion of teacher and curriculum development. This programme also effectively merges the three elements of the research question.

2.4.3.3. IN-SERVICE TRAINING (INSET) PRESENTED BY THE WESTERN CAPE DEPARTMENT OF EDUCATION.

INSET and professional programmes currently offered to teachers in South Africa are related to school reform and educational transformation, maintains Reddy (2004: 138; 2005:2). The programmes discussed in this chapter which are largely based on the efforts of higher learning institutions, *We Care*, and organisations such as The British Council and Old Mutual, 'Out of the Box', to contribute to the professional advancement of teachers forms part of this process of transformation. At this stage it is relevant to consider the manner in which the education and training of teachers have been addressed by the various departments of education to achieve reform and transformation goals.

Reddy (2005: 2-3) indicates that previous INSET programmes presented by the education departments, both national and provincial, appear to have adhered to a specific pattern. These processes usually involved the removal of teachers from the classroom situation to specified locations, where trained department officials or practitioners engaged teachers in various learning programmes. Resource materials for these training sessions were prepared by national education departments or by teams authorised by the national department of education. Further INSET programmes were either facilitated by curriculum staff attached to the provincial education departments, or in some cases by teachers who were identified as facilitators (Reddy, 2005: 3).

Reddy (2005: 3) maintains that these processes adopted by the education department can be explained in terms of a cascade model. This model is characterised by advocacy campaigns to raise awareness of new developments (normally new policies or priorities that come from national level), and training of trainers, who in turn then train others, as stated by Reddy (2004: 141). He notes that a key feature of this approach is the development of materials (manual, exemplars) to support trainers in the field. Moreover, he maintains that the trainers essentially become "message bearers" and their main focus is to "get the message across" to teachers/district officials and others in the system. However, despite the fact that the limitations of this approach to further curriculum transformation are highlighted in the Curriculum 2005 Review of 2002, it continues to serve as the dominant model used by curriculum support service directorates for the

purpose of supporting curriculum implementation and curriculum transformation (Reddy, 2004: 141).

A variation on this approach, as indicated by Reddy (2004: 141), is the "cascade plus cluster approach". It was mainly developed in response to problems experienced with the effectiveness of the cascade model. He observes that some departments appear to be implementing variations of the cascade model by establishing various cluster structures linked to decentralised Education Management Districts. Moreover, he maintains that these appear to be primarily organisational structures, and are not established with the express purpose of fostering reflective practice or applied competence, but rather as a means of more efficient cascading.

A teacher development programme that has recently been implemented by the education department, the RNCS training programme, appears to be more structured, writes Reddy (2005: 3). As part of this programme, teachers were requested to attend a week-long training session during a school holiday at a central venue selected by the local district office. During this training session, personnel who had been specifically trained by the provincial or national core training teams facilitated the process. In the Western Cape Province (WCED 2004), these training sessions primarily revolved around the contents of a training manual that had been formulated based on national training imperatives.

At the start of the workshop each teacher is presented with a training manual that details information regarding the activities for the week as well as the those activities that are expected of them during the period following these training sessions. Reddy (2005: 3-4) specifies that the manual includes activities related to learning area statements, curriculum principles, assessment standards, outcomes and learning programme development. At the end of this week-long training session, teachers are tasked with the development of learning programmes and lesson plans, often in collaboration with schools in the surrounding area. These learning programmes and lesson plans are then

scrutinised by visiting departmental officials, as evidence that development has indeed been successfully realised.

Based on interviews with teachers and his own experiences of the programme, Reddy (2005: 5) concludes that the process was strictly controlled and inflexible, one-sided and focused on the development of specific skills, particularly regarding the development of learning programmes and lesson plans. Furthermore, Reddy (2005: 7) points out that while much information is imparted during the programmes, not much follow-up support is or has been forthcoming. This support is also seriously lacking as far as the transfer of ideas, presented within the context of these centralised INSET programmes, to classroom practice is concerned. It appears that the approach adopted by the Education Departments has contributed very little, if any at all, to the transformative function it seeks to address.

Teacher training and classroom practice, specifically with regard to the appropriation and modification of learning support materials to ensure relevance to particular contexts and the promotion of teaching and learning are therefore also not addressed by these programmes. This is in stark contrast to the previously mentioned initiatives, namely the *We Care* and 'Out of the Box' development courses.

2.4.3.4. INTERNATIONAL PROFESSIONAL DEVELOPMENT INITIATIVES

Professional development activities directed at affecting improvements in science teaching and learning are common throughout the world, and the preferred approaches to development take many perspectives as their points of departure, writes Marx et al. (1998:670-672). According to these writers, not all of these approaches appear to be successful, nor do any of them appear closely related to more extensive research on teacher knowledge and teacher development. As part of their research into the professional development of Science Teachers, they conducted a transnational analysis of particular events in Australia, Canada, Portugal and Zimbabwe, offering succinct

descriptions of the professional development activities that were utilised in these locations.

Marx et al. (1998: 670-672) reports that in Australia researchers recommended that the apparent apathy demonstrated by science teachers towards professional development could best be served by the formation of networks for science teachers, and by means of the implementation of extrinsic rewards in recognition of knowledge and skills achievements. A resource base of case studies reflecting the teaching of key science concepts constituted an essential component of the networks, and the reward was linked to a newly-established category of teacher, the Advanced Skills Teacher.

Within the field of in-service teacher education in Canada, Marx et al. (1998: 670-672) noted conflicting viewpoints as supported by the science teachers, and the British Columbia provincial government. While the government favoured the standpoint that professional development did not need to be subject-specific, science teachers considered this the best approach for improving science teaching.

Also, according to Marx et al. (1998: 671) a two-stage professional development strategy was suggested for Portuguese science teachers. During the first stage of the process, teachers were presented with information about conceptual change, and during the second stage teachers were required to compare different teaching methods, and to reflect on their own teaching practices.

Government attempts to address the professional development of science teachers in Zimbabwe, involved the implementation of a set of inexpensive and 'teacher-proof' materials (ZimSci). Marx et al. (1998: 671-672) indicates that the original plan involved the introduction of the ZimSci materials within the context of an intensive in-service programme. However, since the support did not materialise, the teachers were eventually expected to implement the ZimSci programme without the necessary assistance. This

proved to be a serious disadvantage, as Marx et al. (1998:672) observed that the teachers resented the implication that their work could be represented in a paper format.

Based on their investigation, Marx et al. (1998: 672)   highlighted four issues relating to in-service education for science teachers as reflected by these international examples. As per their observations, these issues include:

- The professional development initiative in Australia, expressed in terms of support networks and the use of extrinsic rewards, emphasised the context of professional development.
- The situation in Canada highlighted the need for consensus on the issue of managing more general needs versus meeting individual teacher's needs.
- Portuguese researchers focused on the pedagogical content knowledge of science teachers, a topic that is often neglected when professional development is treated generally and as 'subject-free', writes Marx et al. (1998: 672).
- The Zimbabwean attempt at professional development via a set of materials, illustrated the importance of demonstrating due respect for teachers as competent professionals who must be provided with choices about what to teach and what to learn.

The international examples mentioned here indicate, according to Marx et al. (1998: 678), that professional development programmes should rather be situated within a larger framework that productively integrates issues of policy, context and professionalism.

Russo and Lotz-Sisitka (2003: 24) support this view and assert that it is often useful to consider issues of policy, country strategies and protocol when thinking about purpose, context and relevance in the design of materials. They indicate that these documents can offer background information and support to make the learning support materials relevant

to the country context and its priorities. Likewise, the purpose and context of learning support material can also be informed by institutional priorities at a more local level (school).

Marx et al. (1998: 670) is of opinion that teachers, like other learners, construct their knowledge through social interaction with their peers, through the practical application of acquired knowledge, and through reflection and modification of their ideas and practices. They prefer the standpoint that activities designed to offer support and feedback, in combination with observation of modified practices, essentially help teachers to teach in new ways.

2.5. CONCLUDING REMARKS

While we need to acknowledge that learning support materials cannot replace an educator, and on their own guarantee learning, "successful teaching and learning depend to a large extent on the ability of the teacher to identify the appropriate resources, then modify or use these to construct effectual and contextually relevant learning support materials" (WCED 2002) . Purposeful curriculum development, in conjunction with the judicious use of learning support materials, dictates that teachers develop a measure of professional competence with respect to conducting both activities. The development of the required levels of professional proficiency that is demanded of teachers in order to implement the transformation in their classrooms successfully thus has serious implications for teacher learning and teacher development programmes.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. INTRODUCTION

This chapter focuses on clarifying and justifying the particular research design used for this enquiry. Durrheim (2006: 36) states that a research design is a strategic framework, adding, that it is a plan that guides and structures research activity. Also, that as a strategic framework of action, the research design specifies the activities involved in securing valid and reliable findings from the study. Decisions regarding the selection of a research design for this study were accordingly influenced by the research question and the nature of this investigation.

The elucidation of the particular research design employed for this study was informed by the four dimensions of research design identified by Durrheim (2006: 37), namely:

• the purpose of the research (Established in Chapter 1);

• the theoretical paradigm informing the research;

• the context within which the research is conducted; and

• the techniques employed to collect and analyse data.

This chapter concentrates mainly on two of the elements mentioned above, namely expanding on the theoretical paradigm of this study; and detailing the technical methods used in the collection, processing and analysis of the data. A detailed description of the particular context of the research is provided in Chapter 4. In this chapter, mention is also made of the measures adopted to ensure the validity of the study, as well as ethical considerations observed during the investigation.

3.2. THEORETICAL PARADIGM

The research process was largely interpretive, incorporating research methods for the purpose of accumulating thick descriptions of qualitative data. Data were obtained/ processed by means of biographical questionnaires, interactive and semi-structured interviews with participating teachers, as well as by way of classroom observations. Lesson plans, as well as specimens of work done by the learners, were assessed as curriculum development products/artefacts.

The contention that the interpretive paradigm shaped the research process is based on the particular stance taken in this study, since the focus is primarily concerned with the views and experiences of the teachers engaging with and using the *We Care* materials. More specifically, how their experiences using the material contribute to improved praxis, as well as to more efficient curriculum development in Natural Science teaching.

Terre Blanche et al. (2006: 273-274) indicate that the interpretive paradigm, involves taking people's subjective experiences seriously as the essence of what is real to them, making sense of people's experiences by interacting with them, and employing qualitative research techniques to collect and analyse information. Making sense of feelings, experiences, views, social institutions or phenomena is a key aspect addressed. Thus, this approach focuses on people's subjective views and experiences as a means of establishing and developing an understanding of the subjective reasons and meanings that are attributed to social action.

The theoretical perspective of interpretivism, according to Gray (2004:31), views the world as too complex to be reduced to a set of observable 'laws'. The writer indicates that generalisation is less important than understanding 'reality'. Acquiring an understanding of (verstehen), rather than explaining or predicting, people's life experiences takes precedence and is crucial to the interpretive methodology.

In this regard, Terre Blanche et al. (2006: 274) add that this approach is not concerned with isolating and controlling variables, but with using and extending the power of

ordinary language and expression to help us understand the social world we live in. Moreover, they point out that interpretivists rely on first-hand accounts and try to describe their observations in rich detail, and then present their 'findings' in engaging and sometimes evocative language. For this reason, accurate observations and rich experiential data are deemed invaluable in the process of making sense of our social realities.

These first-hand descriptions of our social realities are formulated by way of a subjective relationship between the researcher and the subject, asserts Terre Blanche et al. (2006: 277). They indicate that this particular connection makes it possible for the researcher to understand personal and social realities empathically.

Two key principles of interpretive research, namely that the researcher is positioned as the primary 'instrument' by means of which information is collected and analysed, and that it involves understanding in context, is emphasised by Terre Blanche et al. (2006: 274). They contend that the meaning of human creations, words, actions and experiences can only be determined in relation to the contexts in which they occur. Pointing out (Terre Blanche et al., 2006: 276) that the commitment to understand human phenomena in context, as they are lived, is central to this research. In support, they refer to Mishler who maintains that meaning is always contextually bound, inherently and irremediably, and one only has to obtain access to the context to grasp meaning, (Terre Blanche et al., 2006: 276). In essence, a real understanding of human experiences necessitates an appreciation of the context, namely the social, linguistic and historical factors that have shaped such experiences.

Adler et al. (2002:58) too, regards the context of the teacher as an influential factor impacting on teaching and learning. They contend that teachers' emergent practices are simultaneously shaped by their histories and by the context in which they work. This viewpoint is also shared by Remillard (2000:332) who states that teacher' beliefs, knowledge about teaching and learning, and knowledge of the subject matter impact on their decisions about what and how to teach. In seeking to understand and elaborate on

the teacher's experiences using the *We Care* materials through this study, due consideration of their particular context was therefore an imperative.

The expressed views and experiences of the teachers, involved in a collaborative process while engaging the *We Care* materials, are the core concern of this investigation. Their experiences using the materials provided greater insight and understanding in respect of the mutuality existing between curriculum materials, curriculum development and professional development.

3.3. STRATEGY AND TECHNIQUES

3.3.1. CASE STUDY RESEARCH STRATEGY

Case study research, which is consistent with the interpretive paradigm, was used for this investigation. The case study research strategy, asserts Denscombe (2001: 30), focuses on one instance (or a few instances) of a particular phenomenon with a view to providing an in-depth account of events, relationships, experiences or processes occurring in that particular instance.

Furthermore, Denscombe (2001: 32) notes that case study research characteristically emphasises the:

- Depth of study rather than breadth of study.

- The particular rather than the general.

- Relationships/processes rather than outcomes and end-products.

- Holistic view rather than isolated factors.

- Natural settings rather than artificial situations.

- Multiple sources rather than one research method.

This approach has afforded me the opportunity to make an in-depth study of the particular experiences and perceptions of those teachers using the *We Care* materials. The precise views and insights provided by the teachers were pertinent to the research

question under investigation, and this approach provided the means to probe the potential of a link between curriculum materials, curriculum and teacher development.

The 'natural setting' or context of the teachers is a significant factor, and is duly noted and accommodated in this study (described in Chapter 4). The multiple sources, providing the means through which the data for this investigation were accumulated, include: biographical questionnaires, interactive and semi-structured interviews with participating teachers, and classroom observations. Lesson plans and learner worksheets developed by teachers were assessed as curriculum development products.

The notion of using varied forms of data processing is not intended to accumulate masses of data, but to provide multiple avenues through which the experiences of the teachers are described, and to provide varied means for teachers to comfortably express their opinions and experiences.

In describing the advantages of the case study approach, O'Leary (2004:116) maintains that on a practical level it offers one set of boundaries for the study. Also, on a strategic level, case studies endeavour to broaden holistic understandings through the development of rapport and trust. She argues that while an individual case study might not be generalised, it can still contribute much to the production of knowledge. Furthermore, she indicates that case studies can (O'Leary 2004: 116):

- have an intrinsic value

- be used to debunk a theory

- bring new variables to light

- provide supportive evidence for a theory

- be used collectively to form the basis of a theory.

While not exactly uncovering new variables, this interpretive case study focuses on developing an understanding in respect of the use of curriculum materials, and the

potential that lies therein to further teacher growth, as well as to promote effective curriculum development. This study sets out to shed light on this connection by using a specific set of curriculum materials, namely the *We Care* learning support materials. Significant insights and understandings, especially relevant to the nature of the relationship between curriculum materials, curriculum and teacher development, were formulated.

The advantages presented by case study research made it appropriate for this study, especially since it presented an ideal strategy by means of which an in-depth study of the particular perceptions and experiences, relevant to those teachers engaging the learning support materials, could be achieved.

3.3.2. SCALE

This is a small-scale study, limited to the involvement of only two female teachers. Participation in this investigation was purely voluntary. I needed to focus primarily on those teachers who demonstrated an inclination to experiment with new ideas, and who would be prepared to work in a collaborative process investigating the materials. Both teachers had demonstrated a keen interest in participating in this investigation.

In justifying their participation, I refer to Kelly (2006: 293) who maintains that the ideal respondent characteristics differ according to the purposes of the study. Furthermore, he indicates that if the study is to describe personal experiences of a phenomenon, the following are relevant:

• Personal experience of what is being researched.

• Good communication skills (ability to describe experience in detail).

• Openness and undefensiveness.

• Interest in participating, as well as the perception that it may, in some way, be of value to participate.

The teachers involved are consummate individuals, each with more than 10 years teaching experience. They have been involved with Natural Science teaching, particularly in the Intermediate and Senior (Grade 7) phases, for the largest part of their respective years of experience. They have demonstrated an openness and inclination to experiment with innovations with a view of expanding their teaching practices in this learning area.

Their extensive experience coupled with their enthusiastic approach to experimentation and innovation served as an advantage to this study. The value that their experiences brought to this study is significant, especially since they were well acquainted with a variety of approaches employed in the teaching of Natural Science, and regularly experimented with a variety of learning support materials while teaching this learning area. Their keen engagement with the "We Care" materials, and willingness to communicate their ideas and experiences as authentically as possible were critical to this investigation.

 Due recognition is given to the fact that the size of the sample used for this study compromises the propagation of generalisations in respect of its findings.
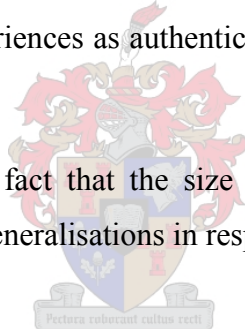
3.3.3. INTERVIEWS

According to Kelly (2006: 297), conducting an interview is a more natural form of interacting with people, and therefore fits well with the interpretive approach. Also, they point out that this approach provides an opportunity to really get to know people quite intimately, so that we can understand how they think and feel.

Although interviewing may pose challenges because of human interaction between the interviewer and respondent, a well-conducted interview can serve as a powerful tool for eliciting rich data on people's views, attitudes and the meanings that underpin their lives and actions (Gray, 2004: 213). Denscombe (2001: 112) adds that as an information-gathering tool, the interview lends itself to being used in conjunction with other methods as a way of supplementing their data, adding detail and depth.

Through interactive semi-structured interviewing, participants in this study were requested to verbally describe their views and experiences. These descriptions were transcribed for the purpose of analysis. An interview schedule was prepared prior to the interview to focus the interaction on key aspects of the research question under investigation (Appendix 1). This type of interview, maintains Gray (2004: 217), allows for probing of views and opinions where it is desirable for respondents to expand on their answers.

Both teachers were interviewed at school during their non-teaching periods (free time). The duration of each interview was approximately forty-five minutes. While the one teacher initially indicated that the interview could be taped, she later changed her mind. This was dutifully and respectfully accommodated, and the information was thus recorded as the teachers were interviewed.

3.3.4. QUESTIONNAIRES

According to Gray (2004: 187), questionnaires are an important data gathering tool through which people are asked to respond to the same set of questions in a predetermined order. He also points out that case studies using a combination of data gathering tools, may include the questionnaire as one of the tools of data production.

Gillham (2000: 1-2) agrees, and maintains that questionnaires have their place in research methodology as one method and of most value when used in tandem with other methods. He adds that a multi-method approach to real-life questions is important, because one approach is rarely adequate, and if the results of different methods converge (agree, or fit together), then we can have greater confidence in the findings.

Furthermore Denscombe (2001: 87 -88) states that it is appropriate to use questionnaires for research purposes when fairly straightforward information, relatively brief and uncontroversial, is required. In addition, he notes that questionnaires can vary a great deal in terms of their purpose, their size and their appearance, but to qualify as a research questionnaire, they should:

- Be designed to collect information which can be used subsequently as data for analysis.

- Consist of a written list of questions.

- Gather information by asking people directly about the points concerned with the research.

In this study, biographical questionnaires were used to generate data in respect of very specific information concerning the participants. (Appendix 2). For this reason a very short, one page questionnaire was sufficient to obtain the relevant background information of each teacher involved in this study. The series of closed questions focused mainly on the following in respect of each teacher:

- Academic qualifications, especially related to Science subject knowledge.

- Professional experience, specifically in terms of teaching Natural Science in the Intermediate Phase.

3.3.5. OBSERVATIONS AND FIELD NOTES

Observation offers a distinct way of collecting data, in that it does not rely on what people say they do or what they say they think, maintains Denscombe (2001: 139). He adds that preference is given to the direct evidence of the eye to witness events first hand, because in certain instances it is best to observe what actually transpires. Gray (2004: 238) concurs, and asserts that observation provides an opportunity to move beyond people's opinions and self-interpretations of their attitudes and behaviours towards an evaluation of their actions in practice.

Kelly (2006: 307-308) indicates that while interviews may be a good, direct way of getting to know about people's feelings and experiences, they usually come 'after the fact', and there is a reliance on the interviewee's recollection of the experience. On the

other hand, the advantage of this method is that an observation takes place while things are actually happening, ensuring that the researcher is closer to the action.

Even so, Gray (2004: 239) indicates that there are crucial disadvantages to this approach, namely that:

- The interpretation of what is observed might be influenced by the mental constructs of the researcher (including their values, motivations, prejudices and emotions). Consequently, the researcher could disregard phenomena that could prove important.

- If positioned among those who are being observed, the presence of the researcher may influence the events.

- While the data gathered from observation are often rich in evidence, extracting themes and concepts from the data can be quite challenging.

In this investigation, semi-structured descriptive observations of classroom interactions provided access to information regarding the teachers' particular use of the *We Care* curriculum materials (Observation Schedule: Appendix 3; Indicators for the Narrative: Appendix 4).
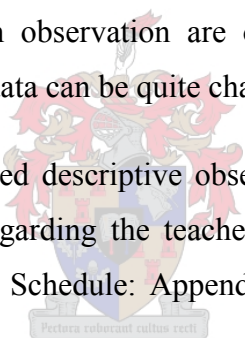
3.3.6. DOCUMENTARY SOURCES

Kelly (2006: 316) regards documentary sources such as letters, newspaper articles, official documents, and books as being very useful in all forms of qualitative research. He adds, that these sources are in some ways easier than doing interviews, because one does not have to literally 'think on one's feet' as in an interview, nor engage in the tiresome process of transcribing everything.

The particular documents relevant to this study are the lesson plans developed by the teachers, as well as worksheets completed by the learners. Each teacher was provided with a lesson template (Appendix 5), to facilitate recording the manner in which the *We Care* materials were incorporated into their teaching and learning situations. During a

collaborative planning session, I provided the necessary assistance in terms of guiding the teachers with regard to:

- Lesson suitability for the grade level.

- Adapting and re-contextualising the material to the grade level, and the particular contextual factors (in respect of learners and teachers).

- Incorporating the material into the learning programme.

These plans were assessed as curriculum development products. With regard to these products, the Natural Science learning outcomes for the grade level were used as specific indicators to establish productive curriculum development.

3.3.7. PHOTOGRAPHIC EVIDENCE

Photographs of the two classes of learners featuring in the observation lessons are included (Appendix 6). These photographs, together with photographs of the school context (Appendix 7), have been inserted specifically to offer support for the interpretations derived from the detailed descriptions provided. In this case, the photographs depict the actual context in which the teachers and learners have to function, more effectively than what is communicated through the written word.

In justifying this inclusion, I refer to Le Grange (2000: 169-173), who argues for the incorporation of photographs into case-study research, as a way of providing meaningful insights into, and clarifying the particular contexts of teaching and learning.

3.4. FRAMEWORKS FOR DATA ANALYSIS

Frameworks formulated with respect to other studies were used to guide the interpretation of the data acquired. These outlines were purposely selected because the issues examined in each corresponded with key aspects addressed in this investigation.

3.4.1. Professional development

The professional development of the teachers was examined specifically in terms of the following indicators, adapted from Janse van Rensburg and Le Roux (1998):

- New ways of doing (skills/approaches)
- New understandings (content/environment)
- New understanding of context (school)
- New networks (working with other teachers)

Together with this, a framework developed by Bell and Gilbert (1994: 483-497) was used as a guideline for professional development. According to Bell and Gilbert (1994: 493) teacher development should be viewed as teacher learning, rather than as others causing teachers to change. In their view, teacher learning involves teachers developing their ideas and beliefs, developing their classroom practice, while at the same time acknowledging and addressing their feelings about changing. They add that learning in the teacher development process can be viewed as purposeful inquiry, since the teachers were inquiring or investigating into aspects of their teaching. This inquiry into aspects of teaching practice focuses on those issues that teachers are concerned about and wish to change.

Bell and Gilbert (1994: 493-494) describe the development of teachers in terms of their personal, social and professional development. They indicate that personal development entails attending to feelings about the change process, being a teacher, and about science education. Social development involved working with and engaging other teachers and learners in new ways. Professional development involved transforming concepts and beliefs about science education, and in consequence effecting change in respect of classroom activities.

 In respect of this study the enquiry into the teachers' development, during processes of engagement with the *We Care* learning support materials was guided by the indicators as

proposed by Bell and Gilbert (1994:485) and Janse van Rensburg and Le Roux (1998). This is discussed in greater detail in Chapter 4.

3.4.2. Curriculum development

Remillard's (1999:315) framework for examining teachers' curriculum development served this study, specifically in terms of facilitating the appraisal of the teacher's tasks in respect of curriculum development processes. The main aim of the study she conducted was to develop insight into the potential for curriculum materials to contribute to reform in (mathematics) teaching.

Within this model Remillard (1999: 322) identifies three arenas in which teachers engage in curriculum development, namely design, construction and curriculum mapping. In her discussion, she specifies that each of the arenas defines a particular component of the curriculum development process, in respect of which teachers make different types of decisions.

The Design Arena, which involves the selection and designing of tasks for learners, forms an essential component of a teacher's role in curriculum development. The tasks that are selected, adapted and reconstructed by the teacher are representative and reflective of the teacher's assumptions about content (what students should learn) and pedagogy (how they should learn) (Remillard, 1999: 323) In addition, she states that within this arena, the teachers' task-selection choices are influenced by a number of factors, such as the teacher's ideas about the subject matter; their opinions about student learning, the teacher's own learning; the teaching context as well as the available resources. The teachers' beliefs,   knowledge and perspectives impact on their selection of tasks, particularly in terms of whether they make use of the suggested activities in the text, adapt the text or elect to design their own tasks.

The Construction Arena focuses on the enactment of the selected tasks in the classroom, and the feedback gained from the learners in respect of their encounters with these tasks. Remillard (1999: 322) positions the design and construction arenas within a third analytical domain, namely the Mapping Arena. This arena she explains entails making choices in relation to the organisation and content of the curriculum. She indicates that the mapping arena is not directly connected to the daily, classroom events, however, it impacts and is impacted by these events. It is important to note that decisions taken in this area contribute to the context in which the activities of the other two areas take place.

Remillard's(1999:315) model or framework for examining teachers' curriculum development emphasises the complex and multidimensional nature of teachers' curriculum processes, and distinguishes essential features of each arena that have implications for textbook use and changing pedagogy. The teachers' interaction with the *We Care* materials in this study was duly examined in accordance with the three arenas of curriculum engagement identified within Remillard's framework. The main aim was to develop greater insight into the potential for this specific set of materials to contribute to facilitating the process of curriculum development, as well as affecting positive developments in respect of initiating and sustaining processes of instructional change as far as the teaching of Natural Science in the Intermediate Phase and Senior Phase (Grade 7 level) is concerned. The discussion continues in Chapter 4.

3.5 ISSUES OF VALIDITY & CREDIBILITY

Validity refers to the degree to which the research conclusions are sound, while the credibility of qualitative research is established while the research is being conducted, maintains Van der Riet and Durrheim (2006:90,91). These authors indicate that credibility is achieved when the researcher continually notes discrepant evidence to the hypotheses he or she is developing as a means of producing a rich and credible account. Also, they point out that one way of doing this is to use triangulation as a means of identifying discrepant findings.

According to Kelly (2006: 287), 'triangulation' involves collecting material in as many different ways from as many diverse sources as possible. This approach allows the researcher to acquire a better understanding of the phenomenon by providing for different avenues and methods of investigation. In this regard, Gray (2004: 344) adds that for most qualitative approaches, reliability is improved, if not guaranteed, by triangulation, gathering information for example from multiple sources or by using multiple data gathering tools.

Data triangulation, using data acquired from different sources, and methodological triangulation, employing a combination of methods such as interviews, questionnaires, and observations, served this study. In this regard, Gray (2004: 33) observes that not only does the use of multiple methods assist in data triangulation; it helps to balance out any of the potential weaknesses in each data collection method.

3.6. ETHICS

The relevant ethical issues pertaining to this form of research were accordingly observed. The teachers involved in this investigation were duly informed as to the exact purpose and nature of the investigation, whereupon their informed consent was acquired. The voluntary participation of the teachers in an interactive process examining learning support materials was a significant and essential feature of this study. For this reason it was important that the teachers recognised and acknowledged the value of their involvement in this form of research.

In accordance with the applicable ethical principles, the participants will remain anonymous, and for this reason pseudonyms have been used to protect their identities. Also, the information acquired via the questionnaires, interviews and other germane documents are appropriately stored as a measure to guarantee protection of the confidentiality agreement entered into with the teachers.

The manner in which this enquiry was conducted, served not to harm (or wrong) any of the participants, nor any other person for that matter. Alternatively, I am assured that the findings can contribute to the improvement of all concerned, namely the participants, policy makers, researchers as well as educational practitioners in general.
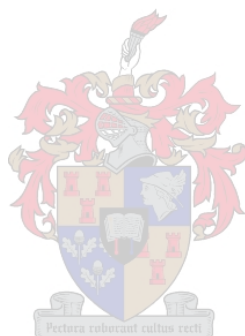
CHAPTER 4

DATA PRESENTATION AND DATA ANALYSIS

4.1. INTRODUCTION

In this chapter the research question and its derived questions are revisited, and examined in conjunction with the processed data. The body of the data supporting this process was largely assembled over a period of six months, and the procedure that enabled the accumulation of data incorporated various techniques including interviews, questionnaires, observation and field notes, as well as the compilation of several selected documents.

The research question is the focal point of this chapter, and therefore the essential effort here focuses on ascertaining whether using the *We Care* materials for teaching in Primary School Natural Science can indeed contribute to curriculum and teacher development, if at all. The two tasks identified for this investigation in Chapter 1 included:

- Establishing whether sufficient evidence indicates that the *We Care* materials can assist teachers with implementing RNCS recommendations in the teaching of Primary School Natural Science.

- Ascertaining whether the evidence acquired adequately supports the assertion that using the materials in teaching Natural Science can in effect promote teacher development.

The analyses of the teachers' curriculum development processes was guided by Remillard's (1999:315) framework, as described in Chapter 4, whereas the professional development of the teachers was examined specifically in terms of the indicators adapted from Janse van Rensburg and Le Roux (1998), as well as a framework

developed by Bell and Gilbert (1994: 483-497), also referred to in Chapter 4. These discussions are contained in section 4.5.

4.2. SCHOOL CONTEXT

The primary school selected for this case study is situated in the Metropole South school district, a subdivision of the Western Cape Education Department. The school, Fairview Primary, was built in 1975 and the initial plan specified that the prefabricated building serving the school would function as a temporary structure. At the time, the principal and staff were assured that this building would be replaced with a more permanent and solid structure at a later stage. However, these promises have since not been realised and 31 years later the school still manages to serve the Grassy Park community admirably (Appendix 7).

Fairview Primary School has a staff complement of 25 who are predominantly female, as males comprise only 20% of its total number. The average age of the teachers is 43, and there are no teachers under the age of 30. Most are qualified teachers in terms of having acquired their matriculation (Grade 12 level) certificates, and having completed at least 3 years of basic teachers' training. The professional training they received is limited to the Teachers' Diploma acquired through a teachers' college, and only a few of the teachers have extended their academic qualifications to include a B.A. degree.

This body of teachers serves an average of 1 000 learners a year, and consequently class sizes can be quite large. The class size ranges from 45 to 50 learners. Accommodating such a large number of children in a relatively small classroom can be problematic, and often contributes to very restrictive seating arrangements for learners, and cramped working spaces for the teachers.

As with most schools in the surrounding area, the school is moderately resourced, and makes a great effort to survive on limited funding made available through its various sources. One such source is the school fees contributed by the learners' parents. Since

most of the families connected to the school are by and large located within an average middle to low-income economic bracket, many of these families are not in a position to contribute much in terms of school fees. Consequently, the school is severely constrained in its efforts by a seriously reduced income.

Being forced to cope with limited financial resources is a noticeable factor restricting significant advancement, especially with regard to effecting necessary improvements of specific facilities, such as the building itself, the library and resource facilities, and security features of the school. Most of the funds acquired are allocated to salary payments of the additional staff employed by the schools' governing body. Thus, only meagre amounts of the accumulated funds can be allocated to other requirements, such as acquiring the science and sports equipment that the teachers and learners need.

The teachers generally responsible for Natural Science teaching in the Intermediate and Senior Phases are female. They indicate that in response to the limited financial provisioning for science equipment, they depend on recycled material to accomplish different tasks. They indicate that these materials have served the various purposes just as well as the authentic science apparatus. However, they emphasise that this accomplishment usually entails a great deal of thought, resourcefulness and effort in the preparation and presentation of particular science lessons. In spite of these challenges, the Natural Science teachers appear resolute and committed to doing their level best in teaching this learning area.

This determination and commitment to a high level of teaching and learning can be observed in the manner in which the teachers at the school have responded positively to the changes that were introduced, and in the manner in which they choose to work together. Noteworthy, is the fact that as part of the Integrated Quality Management (IQMS) Programme and the Whole School Development Programme, numerous teacher development programmes were attended and/or organised during the third term of this year, specifically to address the particular needs of the staff members. These programmes include: the "Out of the Box Programme" project, Leadership and Management, Phonics,

Safer School Leadership, Women in Leadership and Management, Computer Training, "SEED" (Schools Environmental Education and Development) and Bereavement Counselling. A few of these programmes were presented by external facilitators, but quite a number were in-house projects, designed and presented by staff members.

Long term experience is usually associated with teachers who are considered to be in a rut. I found that this was certainly not the case with the teachers at this school. Conspicuous is a collegial ethos, and this culture of collaboration promotes interaction, interchange and teacher learning. In addition, it provides a supportive environment for teachers to reflect on their practice, gain feedback, acquire professional information and direction, and learn from the experiences of their colleagues.

4.3. EDUCATORS' BACKGROUND INFORMATION

The two teachers involved in this study are stationed at the same school, namely Fairview Primary School. The school is situated in the district of Grassy Park and is a constituent of the larger Metropole South school district. While contextual details regarding the school are provided in section 4.2., particular details of each teacher are presented here mainly to report on the background information relative to each of the teachers, and to elaborate on the level of professional experience achieved, principally as it relates to the teaching of Natural Science in their respective grade levels.

Teacher A: Mrs. Peters

Gender: Female

Qualification Category: Matriculation and four years of teacher training.

Specific Training in Natural Science Teaching: College level

Years of Teaching Experience: More than 10 years.

Years of Teaching Natural Science: More than 10 years.

Phase/Grade Levels: Mainly the Intermediate Phase, and Grade 4 level.

Learning Areas Taught: Language and Literacy 1 (English)

Language and Literacy 2 (Afrikaans)

Mathematics

Natural Science

Social Science

Technology

Arts & Culture

Teacher B : Mrs. Percy

Gender: Female

Qualification Category: Matriculation and three years of teacher training.

Specific Training in Natural Science Teaching: College level

Years of Teaching Experience: More than 10 years.

Years of Teaching Natural Science: More than 10 years.

Phase/Grade Levels: Mainly the Primary School Senior Phase, Grade 7 level.

Learning Areas Taught: Language and Literacy 2 (Afrikaans)

Natural Science

Technology
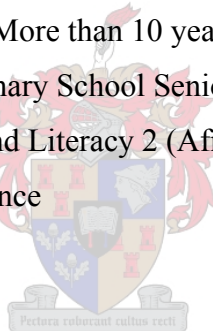
Through informal conversations with the management of the school, I established that its senior members consider both teachers highly skilled professionals, and this view seems to be readily shared by their colleagues. They have engaged in teaching Natural Science, particularly in the Intermediate phase, for the most of their respective years of professional engagement. They have also demonstrated an openness and inclination to experiment with innovations with a view to developing their teaching practice in this learning area. Their extensive experience coupled with their enthusiastic approach to experimentation and innovation has certainly been beneficial to this study.

Since they were considered au fait with a variety of teaching strategies employed in Natural Science teaching, and had regularly experimented with an assortment of learning support materials, they were considered ideal candidates for this study. Their keen

engagement of the *We Care* materials, and willingness to communicate their ideas and experiences as accurately as possible, were critical to this investigation.

4.4. COLLABORATIVE INTERACTION

The *We Care* materials, described in Chapter 1, were presented to the teachers within the context of the *We Care* programme, referred to in Chapter 1 and Chapter 2. The manner in which this process was communicated to the teachers was largely consistent with the design and delivery procedures advocated by the programme.

During the initial workshops I conducted with the teachers, the theoretical background of the resource materials, content and the related teaching methodologies, as well as the layout of the manual with its associated guidelines and stated objectives for each activity, were discussed in detail. This orientation process ensured that the teachers were well acquainted with the content and teaching methodologies emphasised in the manual.

Following the guidelines of the *We Care* procedure as closely as possible, I mainly assumed the role of mediator and facilitated the process with the teachers, offering guidance and support where I was called upon to do so. Within this collaborative framework, the teachers seemed at ease and confident enough to engage the materials supplied.

With minimal intervention on my part, they selected the activities that they considered appropriate for their respective grade levels, and which were relevant to the themes that they were investigating with the learners at that time. A lesson planning template I provided (Appendix 5) facilitated their preparation of the lessons. Thereafter, I observed the lessons the teachers had selected and prepared using the *We Care* materials.

The feedback and discussion sessions followed shortly, during which time lively debate further illustrated their essential understanding of the materials and their associated teaching methodologies, as they related to integrating the RNCS recommendations. Various samples of learners' work were acquired as evidence of learning, and to indicate

adaptations that had been made to the material provided in the manual (Appendix 9 & 10). The last phase of this process involved the semi-structured interview sessions, which were conducted at school and dutifully recorded (Interview Schedule: Appendix 1).

The data reported on here focus on elaborating on the key aspects of the research question, the teachers' learning and the curriculum development activities of the teachers, and are not concerned with making an assessment of the *We Care* programme. The programme, for the most part, provided the means for connecting the teachers with the materials.

4.5. CONCEPTUAL FRAMEWORKS USED FOR INTERPRETATION

AND ANALYSIS.

Frameworks developed in relation to other studies were used to guide the interpretation of the processed data. These frameworks were selected specifically because related issues examined in each correlated with the key aspects addressed in this investigation, and thus proved informative in the data analysis process.

4.5.1. CURRICULUM DEVELOPMENT

Remillard (1999:322) states that her analysis of two teachers' mathematics teaching revealed patterns in their curriculum development activities. Drawing on these patterns, she constructed a model of the teachers' role in curriculum development. The model she formulated served this study, particularly in terms of facilitating the analyses of teachers' curriculum development processes.

According to Remillard (1999: 315) this framework or model emerged from a qualitative study of two experienced, elementary teachers during their first year of using a commercially published, reform-orientated textbook that had been adopted by their district. The aim of the study was to examine teachers' interactions with a new textbook in order to gain insight into the potential for curriculum materials to contribute to reform in mathematics teaching. She indicates that the resultant model integrated research on

teachers' use of curriculum materials, as well as studies of teachers' construction of the curriculum in their classrooms (Remillard, 1999: 315).

This study corresponds to some extent with Remillard's investigation, since in this case two teachers' interaction with the *We Care* materials is examined in order to gain insight into the potential for the materials to assist teachers with implementing RNCS recommendations in teaching Primary School Natural Science. In making sense of the teachers' curriculum decisions and activities, I was guided by the aspects distinguished in each of the arenas described by Remillard, (1999).

Remillard (1999: 322) describes three arenas in curriculum development, namely design, construction and curriculum mapping. She indicates that each of the arenas defines a particular component of the curriculum development process, in respect of which teachers explicitly or implicitly make different types of decisions. While the design arena involves selecting and designing tasks for students, the construction arena focuses on the enactment of tasks in the classroom and responding to students' encounters with them. The design and construction arenas reflect the day-to-day decisions that impact the enacted curriculum. These arenas are situated within a third arena, the mapping arena, which involves making choices that determine the organisation and content of the curriculum (Remillard 1999: 333).

Remillard (1999: 322) uses the three arenas to delineate distinct aspects of the curriculum development process, but adds that this does not suggest that the choices teachers make in each occur in sequence or in isolation. Moreover, she points out that a teacher's task selection usually includes intentional or de facto curriculum-mapping decisions. Also, the process of enacting any task is likely to lead to further task selection, with possible modifications to the curriculum map. Figure 2 illustrates the interrelationship among the three arenas of the framework, as designed by Remillard (1999: 322). As part of my research project, I describe the two teachers' curriculum development processes in terms of these three arenas.
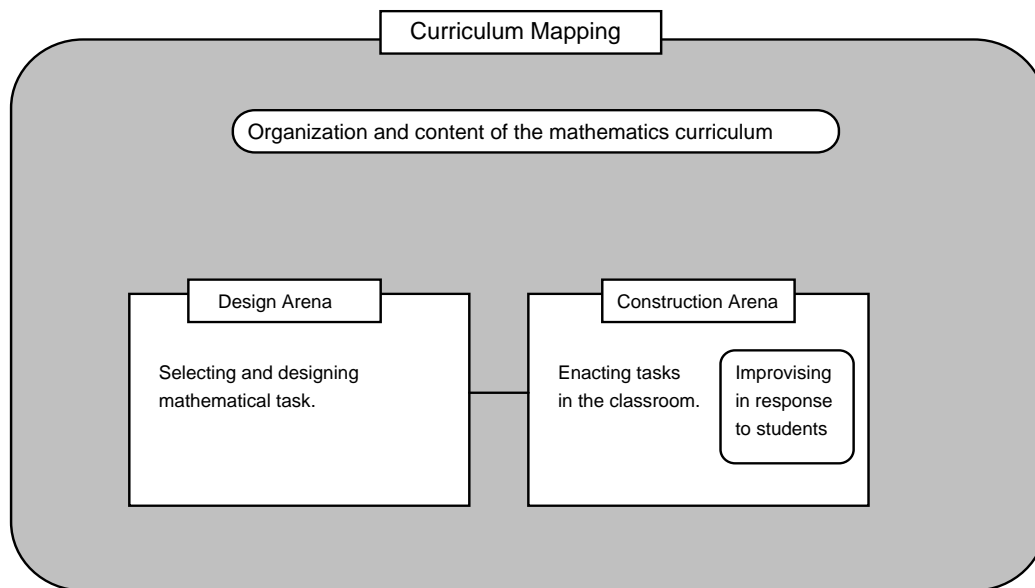
Figure 2: Overview of the three arenas and the relationships among them. (Adapted from Remillard, 1999: 322)

During the six months that I worked collaboratively with the teachers, I traced the teachers' curriculum development processes, mainly by way of relevant documents such as lesson plans and worksheets, classroom observations, interviews, and informal conversations with the teachers. The information acquired was organised into a descriptive, explanatory and logical format for the purpose of analysis.

The process yielded descriptive accounts of the two teachers' curricular activities, and features ample data that were analysed specifically in terms of Remillard's (1999: 315) framework. In terms of this framework, the decisions, actions, ideas and practices of the teachers as reflected in the evidence accumulated, constitute the basis for discussion on the teachers' curricular activities.

4.5.1.1.Design Arena

In terms of Remillard's framework, the Design Arena, which forms an essential part of a teacher's role in curriculum development involves the selection and designing of tasks for learners, (Remillard 1999: 322). This consultative interaction with text material characterised the initial phase of the *We Care* programme I conducted with the teachers.

During these introductory sessions, the teachers and I cooperatively reviewed the material contained in the manual, establishing links between the materials and the four Natural Science themes of Life and Living, Energy and Change, Earth and Beyond, Matter and Materials prescribed by the RNCS, as well as with other learning areas.

When the presentation of a lesson was requested from each teacher, they readily immersed themselves in the task of selecting activities from the manual that corresponded with the themes they were occupied with at the time. In the selection of particular activities from the manual, the teachers appeared to be intuitively guided by the learners' particular needs (Grade 4), as well as by curriculum needs (Grade 7), in essence responding to general learners' needs.

The planning phase, concretised in the lesson plans, provided valuable insights into the teachers' knowledge and beliefs about the learners' abilities and needs that impacted their task selection processes. A study of the lesson plans indicated that the guidelines and objectives provided at the start of each activity in the manual assisted the teachers in recognising the learning outcomes, assessment standards and skills attached to each activity. These plans also show that both teachers accomplished the following tasks well: integrating the lesson content with other learning areas; identifying associated science process skills; the perceived barriers to learning and suggested enrichment opportunities; and specifying the RNCS principles of Social Justice, A Healthy Environment, Human Rights and Inclusivity associated with each activity.

Teacher A

She required a lesson that addressed the problem of littering in the classroom and at school, and the 'Litter Survey' from the manual (Appendix: 10) coincided with this need. She adapted the 'Litter Survey' text material for her learners in order to "make it easier for the Grade 4's to understand." This action is indicative of the fact that teachers' curriculum processes include reading and translating curricular ideals written by others into ideals that teachers intend and enact in the classroom (Remillard, 2000: 335).

Later, during an informal conversation, she admitted that she had adapted the material for her learners, based on her misgivings and concern that the learners would experience difficulty understanding and using the "big words" such as 'biodegradable' and 'non-biodegradable'. During my observation of the lesson, I noticed that the learners appeared quite comfortable and at ease with the use of the terminology.

Her task adaptation was carried through to the worksheet that she had designed as an assessment activity for her learners (Appendix 11). In terms of the learners' responses to these tasks (Appendix 8), it appears that they recognised the essential meanings associated with these terms. The process of adapting the material for Grade 4 level "did not take much effort because all the information is in the manual." She was informed and guided by the material since the manual provided "simple demonstrations of the different kinds of pollution, and it became easier to grasp what pollution is all about."

The lesson plans revealed that she creatively integrated the content provided in the 'Litter Survey' with other learning areas, as follows:

⇒ the learning new words (biodegradable and non-biodegradable, pollution, waste, solid) in Language Literacy and Communication (LLC);

⇒ an exercise on data collection and representation in Mathematics;

⇒ research on the negative impact of pollution in Social Science;

⇒ the use of recycled materials in Technology;

⇒ the importance of a clean environment for healthy living in Life Orientation;

⇒ the economic impact of dealing with human waste in Economics and Management Sciences (EMS); and

⇒ designing anti-littering posters in Arts and Culture.

The skills she identified for the lesson reflect those offered in text material, and include:

⇒ Identifying and analysing litter problems.

⇒ Recording observations.

⇒ Co-operative group work.

In terms of the outcomes, she established that the learners would be able to:

⇒ Identify and clean up litter.

⇒ Demonstrate less wasteful habits.

⇒ Understand that Planet Earth is our most precious resource.

She associated the following with RNCS principles of:

⇒ Social Justice: Caring for the environment and at the same time caring for others.

⇒ A healthy environment: The importance of a healthy environment to ensure healthy living conditions. Protection of the environment by re-using and recycling.

⇒ Human rights: Protecting the rights of others to a healthy environment in which to live.

⇒ Inclusivity: The necessity for others to have access to healthy living conditions, like access to water and basic sanitation.

With respect to learning styles, she indicated that the following would apply: visual, auditory, tactile and kinaesthetic. Regarding the barriers to learning, she mentioned that these pertain mainly to physical and material resources, such as:

⇒ Limited available space and cramped working conditions.

⇒ Limited supply of reference material in the school library.

For enrichment, she suggested:

⇒ Independent research at the library.

⇒ An audio-visual presentation demonstrating the harmful effects of littering on animal life.

⇒ Internet research on pollution.

Teacher B

She decided on the 'The Water Cycle' activity (Appendix 12), because in her opinion it corresponded with the 'Matter and Materials' theme she was busy with then. While this

activity might not have been originally designed for this purpose, it proved well suited to the teacher's intention. Moreover, during an informal discussion, she indicated that the Water Cycle lesson had been a good match for the theme and demonstrated the three states of matter very efficiently. Yet again, this demonstrates that teachers' curriculum processes include reading and translating curricular ideals written by others into ideals that teachers intend and enact in the classroom (Remillard, 2000: 335).

She had not adapted the material for her learners, and followed the Water Cycle lesson plan described in the manual more precisely for Grade 7 level, since "everything is at hand to do the different stages or phases. Everything is clearly explained and clear directions make it easy."

She incorporated an activity associated with the water theme into another learning area, that is the search for definitions of related words like rain, snow, hail, dew, mist, clouds, frost, and ice into LLC (Appendix 12); and extended the integration process into other learning areas. These examples of integrated learning include:

⇒ calculations and problem solving activities involving liquid quantities in Mathematics; city planning and water provisioning;

⇒ as well as the impact of droughts and floods in Social Science;

⇒ the economic value of water in Economics and Management Sciences (EMS);

⇒ the power of water to generate electricity in Technology; as well as

⇒ designing water saving posters in Arts and Culture.

In terms of the learning outcomes, she mentioned the following:

⇒ Identify the three states of matter as illustrated by the Water Cycle.

⇒ Understand the processes involved.

⇒ Link a change in phase (solid, liquid and gas) with the input of a type of energy, example heat energy.

The skills she identified for the lesson mirrored those offered in text material and include:

$\Rightarrow$ Recording observations.

$\Rightarrow$ Interpreting observations.

With respect to the RNCS principles, she linked these as follows:

$\Rightarrow$ Social justice: The need for all people to have access to clean running water.

$\Rightarrow$ A healthy environment: water pollution, causes and effects. The potential harm to human life. Diseases that are spread through water.

$\Rightarrow$ Human rights: The rights of all citizens to access clean water and sanitary living conditions.

$\Rightarrow$ Inclusivity: Conserving water so that everyone can benefit from it.

The learning styles involved include: visual, auditory, and tactile. As to the barriers to learning, she mentioned physical and material resources which include:

$\Rightarrow$ Limited available space and cramped working conditions.

$\Rightarrow$ Limited supply of reference material in the school library.

$\Rightarrow$ Lack of equipment in the Natural Science laboratory.

For enrichment, she suggested:

$\Rightarrow$ Independent research at the library.

$\Rightarrow$ Internet research during the computer period.

According to Remillard (1999: 323), the dissimilar approaches to incorporating materials during the task selection and design phase of curriculum development is representative of appropriation and invention. Teacher A used the text as a resource, and selected and adapted a task in accordance with learners' needs that she had identified. This is respresentative of invention. Teacher B was not motivated by a similar need to adapt the text material for Grade 7 level, and consequently used the material directly from the manual, indicating appropriation, as explained by Remillard. To account for this difference in approach, I can only suggest that Teacher A might have considered the material too complicated for Grade 4 learners and therefore adapted the content to match her perception of their level of learning . At the same time the material might be

considered more appropriate for Grade 7 level and consequently Teacher B was not required to affect any modifications.

4.5.1.2. Construction Arena

According to Remillard (1999: 328-329), the Construction Arena comprises all the interactions in the classroom, either planned or unplanned that impact on the enacted curriculum. During this phase the teacher is concerned with initiating and sustaining learners' interaction with the selected tasks. Two types of teachers' task enactment activities are distinguished, namely reading the manner in which learners' perform in relation to the given tasks, and improvising in response.

Reading learners' performances includes activities such as perceptively observing the learners and listening to their responses to given tasks. The information that the teacher derives from these observing and listening activities is used to ascertain the learners' progress, understanding and difficulties. In this respect, the specific goals associated with the selected tasks serve as indicators to guide the ongoing assessment of the learners (Remillard, 1999: 329).
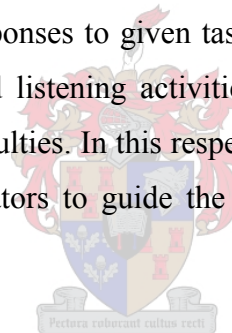
Furthermore, Remillard (1999:331) notes that the process of responding to learners' interaction with the tasks involves a form of improvisation or 'on-the-spot curriculum construction'. Improvised decisions are made based on information gleaned from the ongoing assessments. Other factors impacting on these decisions include the particular objective of the selected task, as well as the teachers' views regarding learning. Improvisation involves considering a number of options, such as deciding whether to introduce a new task to the learners, or allowing the learners to continue or conclude working on a particular task.

The classroom observations (Observation Schedule: Appendix 3, and Indicators for the Narrative: Appendix 4) effectively illustrate the teachers' practices and level of interaction with the learners. During these sessions, I observed that good rapport and

lively interaction characterised the teachers' interaction with the learners. The learners in both classes freely expressed their ideas, and eagerly shared their thoughts with their teachers and peers.

The teachers confidently and efficiently moved through a range of questions, from low-order to high-order questions, alternating between these at different stages during the lessons. Both teachers used effective questioning techniques to channel learning, and the teachers in turn were guided by the responses of the learners. Remillard (1999: 329) refers to this activity as "reading the student's performances", that is, observing, listening to the learners' responses in order to gauge their level of understandings, struggles, and progress. The teacher adapts her responses to these readings as the lesson unfolds.

Teacher A

Her teaching approach made for a very lively lesson, and learners were constantly engaged throughout the lesson. In terms of my observation, the practical nature of the presentation effectively captured the learners' interest, and they responded enthusiastically to the various tasks they were called upon to perform. During the course of the lesson, she responded efficiently and instinctively to an unplanned occasion when a learner requested an explanation for the word "volunteering". She adjusted her response accordingly, and deviated from the initial plan in order to accommodate the learners' questions.

The lesson was concluded with an appropriate summary, and this was reflected on the chalkboard. The learners were then requested to repeat key phrases from the board. A practical activity that was designed to involve the learners, followed. The teacher produced a large bag of waste and directed the learners to identify the items that matched the two categories of waste material, namely "biodegradable and non-biodegradable". The teacher then selected learners randomly from the class group to choose the waste items they wanted to classify. Each time a learner performed this action, he or she was required to explain his/her thinking to the class. I assumed that this activity demonstrated

the learners' level of understanding achieved, allowing the teacher to make inferences regarding the realisation of the learning outcomes.

Thereafter, the teacher produced a worksheet and discussed the requirements for its completion with the learners (Appendix 11). In formulating this worksheet for the learners, she felt that she had to adapt the questions contained in the manual to their level of learning "to make it easier for the Grade 4's to understand". On the whole, the lesson was well-organised, and purposeful and productive in view of the learning demonstrated by the completed tasks (Appendix 8).

Her lesson presentation revealed two aspects, including:
- The incorporation of an element (lesson content) from the manual into the lesson; and
- The inclusion of a personal perspective (The lesson was adapted to Grade 4 level).

The fact that material from the manual informed on ideas and provided the necessary content, allows for the inference that the *We Care* materials had impacted the manner in which the lesson was presented.
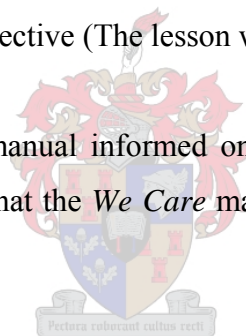
Teacher B

She selected a practical demonstration that she largely performed herself. This she explained was mainly for safety reasons. As to the lesson she presented, I observed that she expertly engaged the learners by using probing and leading questions alternately, and allowed learners to either predict events or explain their observations to the rest of the class. In terms of my observations, she responded spontaneously and tactfully and to the learners' queries throughout the lesson.

An appropriate summary of the lesson concluded the lesson. The learners' responses to insightful questions were summarised on the chalkboard. Then, the teacher requested the learners to make a labelled drawing of the Water Cycle, reflecting what they learnt. On

the whole, the lesson was well-organised, and purposeful and productive as demonstrated by the completed tasks (Appendix 9).

As regards the presentation of the lesson, she followed the directions in the manual more closely than Teacher A. To account for this, I refer to an earlier suggestion that the materials may be considered appropriate for this level of learning, and therefore the teacher did not feel the need to make any adjustments. Here again, the fact that material from the manual informed on ideas and provided relevant information, allows for the inference that the *We Care* materials had impacted the lesson presentation.

4.5.1.3. Mapping Arena

As stated by Remillard (1999:322), the Mapping Arena encompasses the choices teachers make in relation to the organisation and content of the curriculum. Although the mapping arena is not directly connected to the daily, classroom events, it impacts on and is impacted by these events. Decisions taken in this area contribute to the context in which the activities of the other two areas take place.

In addition, Remillard (1999:334) identifies two components of this arena, namely topic determination and content determination. Whereas topic determination demarcates the broad categories or topics into which the curriculum is divided, teachers' decisions regarding content-determination specified the concept or skills forming the focus of a given topic, the sequence in which the topics are to be taught, and the amount of time that should be spent on each of the topics.

Discussion on how to link topics and content in the RNCS for Natural Science with the content in the *We Care* manual, essential mapping activities, was the subject of the first phase of the *We Care* process. The teachers were initially advised as to how the material could be related to the different Natural Science topics, but later they performed these tasks quite adeptly. This aspect was confirmed by means of the lesson plans they completed, as well as during the interviews that were performed. Here the teachers

creatively correlated the topic under investigation with related matter in the other learning areas.

During the interviews they identified several activities appropriate for and complemented the Natural Science Curriculum for their respective grade levels, as well as categorised specific activities that they considered applicable to the achievement of the RNCS Natural Science learning outcomes of Investigation; Constructing Science Knowledge; and Science, Society and the Environment prescribed for the two grades. However, the fact that both teachers' Natural Science learning programmes had been formulated for the year, restricted further mapping activities.

Teacher A

She based the selection of a topic on a need that she had identified within her own classroom and at school, and selected the 'Litter Survey'. In formulating her lesson plans, she integrated the content provided in the 'Litter Survey' with other learning areas, such as the learning new words (biodegradable and non-biodegradable, pollution, waste, solid) in Language Literacy and Communication (LLC).

The *We Care* materials that she considered appropriate for, and complemented Natural Science for Grade 4 level, included: The Water Cycle, Getting to know an animal, What's to eat?, Exploring soil, the Food Pyramid Game, Invent a Species, and Visitors to plants, (Appendix 13).

During the interview, she suggested the following activities with respect to the achievement of RNCS Natural Science Learning Outcomes for Grade 4:

➢ Investigation – I would think "Getting to know an animal would fit in quite nicely with my programme with the Grade 4's right now".
➢ Constructing Science Knowledge – The Water Cycle.
➢ Science, Society and the Environment – The Litter Survey.

She had already engaged the 'Matter and Materials' theme in Natural Science at that time, but had no problem incorporating an activity from the manual into this theme. She had, in fact, already determined the topic and content for Grade 7 for the term, and simply integrated material from the manual into the theme.

She included an activity associated with the water theme into another learning area that is the search for definitions of related words like rain, snow, hail, dew, mist, clouds, frost, ice into LLC (Appendix 12) and designing water saving posters in Arts and Culture.

The *We Care* materials that she considered appropriate for, and complemented Natural Science for Grade 7 level, included:

➢ Life and Living – Plant a tree, poisonous plants, study of the flower, and creating an observation post to observe animal life.

➢ Matter and Materials – Making your own paper.

➢ Our threatened planet Earth – Water pollution

➢ Earth as a living planet – Endangered species.
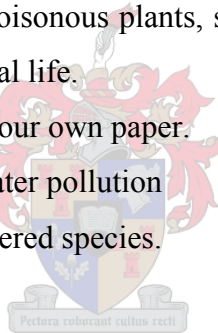
She suggested the following activities with respect to the achievement of RNCS Natural Science Learning Outcomes for Grade 7:

➢ Investigation – Interviewing a tree/an animal.

➢ Constructing Science Knowledge – Information to explain the growth rings of trees.

➢ Science, Society and the Environment – Recipe to make your own paper.

4.5.1.4. Cross-Case Analysis

During the course of establishing sufficient substantiation relative to the contribution of the *We Care* materials to curriculum development processes, Remillard's framework facilitated the process of examining the evidence. Operating within this framework, the two descriptive and interpretive accounts were further subjected to a cross –case analysis, as I searched for analogous patterns occurring in both reports. The findings presented

here developed from the cross-case analyses of the teachers' curriculum processes as they engaged the text in the *We Care* manual. These findings are discussed specifically in terms of procedures and events pertinent to the three arenas distinguished by Remillard (1999: 322-336).

- Design Arena

From the lesson plans and the interviews, I determined that the teachers were guided by the suggestions offered in the text with regard to task selection and adaptation. Teacher A indicated that "the words (terminology) are explained quite clearly, and the language is not too difficult to understand". She found the manual to be well-ordered, and it included useful information pertaining to "integration, knowledge and skills, learning outcomes and assessment standards, as well as assessment strategies". She indicated that the value of the manual manifested in the inclusion of a "variety of fun, practical and learner-orientated activities", and "these activities can be integrated into other learning areas, not only Natural Science". Therefore, she considers the materials very "useful", since in her opinion the various "activities can be adapted to the level of the different grades".

In the interview, Teacher B mentioned that the task of appropriating material from the manual for Grade 7 was not difficult "as everything is clearly explained and clear directions make it easy to follow". She associated two advantages with the use of the materials, namely that "the activities appeal to children", and that the activities "did not prescribe the use of very expensive equipment".

Both cases demonstrated the usefulness and adaptability of the materials to different learner contexts, Grade 4 and Grade 7, as well as accommodating diverse objectives, that were demonstrating a concept (Grade 7), and generating an awareness (Grade 4).

As conveyed through the interviews, both teachers agreed that the *We Care* manual can support the implementation of the RNCS Natural Science prescriptions for the Intermediate and Senior Phases (Grade 7), especially since it provides ideas about learner-centred practical activities. Their appreciation for the usefulness of the manual

with regard to Natural Science teaching extends to include a recommendation of the materials to other Natural Science teachers.

• Construction Arena

Both lessons included a practical element that appeared to interest the learners and generated enthusiasm for learning. Teacher A involved her learners in practical activities, the one activity involved sorting waste into relevant waste material categories (biodegradable and non-biodegradable), and the other activity required the learners to collect waste material from the playground and classify these items too.

Teacher B preferred to conduct the practical demonstration herself since she used a gas stove and was afraid the learners would be hurt. She nonetheless involved the learners by requesting that they either predict or explain different events as the lesson progressed.

In terms of my observations, both teachers endeavoured to involve the learners constantly throughout the lesson presentations through effective questioning, or by requesting that the learners explain and predict events as they unfold. In both cases, the chalkboard was used to reflect a summary of the lesson. It seems that while both teachers drew on essential features of the lessons described in the manual, they still managed to include their own ideas into the presentation.

• Mapping Arena

I introduced the *We Care* project quite late in the year and the Natural Science learning programmes for both teachers had already been designed. Consequently limited mapping activities could be achieved with regard to learning programme design. However, other activities associated with these arenas that were performed well by both teachers included:
- identifying lessons that corresponded with RNCS Natural Science themes and grade
  level learning outcomes; and
- linking the lesson they presented to related matter in the other learning areas.

The fact that the *We Care* materials can be adapted for use by different sets of learners, Grade 4 and 7 levels, and the fact that the teacher had adapted an environmental lesson based on the "Water Cycle" to the 'Matter and Materials' theme, demonstrates the adaptability of the materials to different themes and diverse learner contexts. The adaptability of the *We Care* materials is a significant feature that also promotes the use of the materials for a variety of purposes such as promoting Environmental Education, Primary School Natural Science as well as teaching and learning in other Learning Areas.

In terms of the data processed and analysed, I infer that the *We Care* materials served the function of providing guidance and support to the teachers involved in this study satisfactorily, as well as being assured of its adaptive function to ensure purposive and contextual relevance, thereby contributing to productive curriculum development.

The flexibility of the materials corresponds with the recommendation that 'good' curriculum materials should provide "multiple possible routes" as advocated by Bridgeham (in Remillard, 2000:346), and "multiple options" as suggested by Eisner (1990:66). According to Remillard (2000:346), the flexibility of materials is essential because the paths that teachers and students take through the pedagogic space cannot be predetermined with absolute certainty, but are the result of day-to-day and moment-to-moment decisions. She suggests that, in addition to offering freedom of movement within pedagogic space, curriculum materials must also assist teachers in navigating through that space productively (Remillard, 2000:346).

Apart from the characteristic adaptability of the materials, another equally important attribute of the *We Care* materials is that it offers teachers a framework providing guidance during processes of enacting the RNCS Natural Science curriculum. Well-designed curricular materials, such as the *We Care* materials, that guide and support teachers in the enactment of curriculum implementation are considered valuable resources given that they "serve as significant sources of content and pedagogical content knowledge" (Kesidou & Roseman, 2002:522).

With regard to the contribution of text material to the enacted curriculum, Remillard (2000:344) prefers to emphasise the mediating role of the teacher. This, she adds, is evinced in variations of the teachers' reading of text, and therefore in her opinion it is unlikely that textbooks can shape the curriculum directly. She regards teachers' reading as a central activity in teachers' learning processes, and therefore suggests that texts might contribute more effectively to the enacted curriculum by fostering teachers' reading and subsequent decision making.

Moreover, Remillard (2000: 345) indicates that this aim can be realised if the writers of text offer more than tasks to make a greater contribution to teachers' reading of texts. The requirements she distinguishes as being of particularly importance include providing information that will help teachers assess and interpret specific tasks, a discussion on the underlying (mathematical) goals suggesting ways that the task might be made more or less complex but still focused on the intended goal, suggest alternative tasks or approaches teachers have used to teach an (mathematical) idea, samples of students' work or responses, describing how different components are related to one another as well as the overall goals of a lesson or unit.
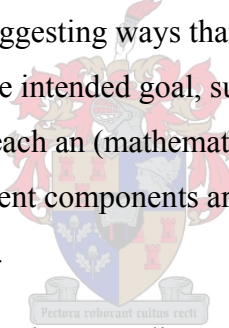
For materials to contribute to the teachers' reading of learners and tasks, Remillard (2000: 345-346) prefers that such text encourages teachers to examine learners' thinking with regard to the goals associated with (mathematical) tasks. She adds that this can be accomplished by the inclusion of descriptions of possible learner responses or work, and how the work can be interpreted, and by providing annotated images of classroom interaction.

With regard to curriculum development, Carl (2002: 3) states that teachers face tremendous challenges, several of which are related to the curriculum. These challenges may manifest at various levels and in various areas, i.e. from national level to within the classroom. Moreover, one of the objectives of school reform efforts is to ensure that schools become places of excellence for all students. As a consequence, this creates certain challenges for teachers, and in turn, demands a certain level of teacher

empowerment in order to achieve this vision of excellence in a diverse society with diverse needs (Carl, 2002: 3).

According to Carl (2002: 4), empowerment is seen as a process that envisions growth and development, and which enables teachers to optimise not only the teaching-learning situation, but also their own potential as educators. He adds that it is therefore seen not as external intervention whereby something is 'done to people' but rather as a process in which they are involved that generates growth and enablement. For this reason, he emphasises that it is essential that each teacher should not be just a receiver of curricula, but in fact a curriculum developer. Teachers must be systematically empowered to be curriculum agents in the true sense of the word (Carl 2002: 3).

The teacher must be a development agent who is able to develop and apply the relevant curriculum dynamically and creatively (Carl, 2002: 16). Therefore, as a curriculum change agent, the teacher must have at his/her disposal specific curriculum skills and knowledge which enable him/her to be effectively involved in the classroom, and outside it (Carl, 2002: 16). For teachers to acquire the knowledge and skills they need, this process necessitates some form of training/education. Carl (2002:269) agrees with Remillard (2000: 347) that teachers are in need of some form of training, "as it is unrealistic and unreasonable to expect that teachers should train themselves". He suggests that they require the help and support of knowledgeable persons (Carl 2002: 269).

Besides training as a factor impacting teacher empowerment, Carl (2002: 270) also suggests that the following factors are equally important in terms of their impact on teacher development and empowerment: support by instructional leaders; opportunities created by facilitators; the teaching environment should be conducive to involvement and empowerment; the leadership styles of educational leaders and their own level of empowerment; structures in schools should stimulate empowerment; the presence of a democratic climate and culture in the school; the presence of channels and opportunities to become involved, might influence empowerment; the presence of sources and the availability of time should be supportive measures; teachers must be committed to self-

empowerment and not be mere receivers of curricula; and decentralisation might influence the process of empowerment.

With regard to decentralisation, Reddy (2000: 3.1.3-3.1.4.) indicates that South Africa has adopted deliberate policies of decentralisation and has encouraged schools to take a greater part in curricular decision making. He states that recent policy documents encouraged individual schools and teachers to develop curricula to meet their classroom needs, in other words, curriculum development should be teacher-driven and school based.

School-based curriculum development is according to Reddy (2000: 3.1.4.) often seen as the reversal of earlier modes of curriculum change where generalised concepts were foisted onto schools. In terms of SBCD, each school developed concepts which were tailored to its specific context. In other words, each school would develop its own version of the core curriculum in relation to or in terms of meaningful interchange with its own environment, in keeping with the requirements of the given communities (Reddy 2000: 3.1.4.).

According to Reddy (2000: 3.1.8), the appeal for teacher participation in curriculum development in South African policy documents finds a largely disempowered teacher corps. It follows that both teachers and schools need to be prepared for a shift from centralised curriculum development to more localised processes. With regard to empowering schools and its teachers to effect this shift adequately, Reddy (2000: 3.1.8) suggests that teachers must be given proper opportunities and support to undertake this task, since "there can be no curriculum development without teacher development" (Kelly in Reddy 2000: 3.1.8.).

Furthermore Reddy (2000: 3.1.8), argues that in view of the innovation introduced teachers will need to be provided with many opportunities for in-service training/education (INSET). In fact, "it is even more important that teachers be given adequate opportunities for continuing in-service education, to enable them to develop

skills that the innovation of school-based curriculum development requires and to develop insights into the wider issues of education".

4.5.2. TEACHER DEVELOPMENT

Concurrent with tracing the teachers' curriculum development processes while they engaged the *We Care* materials, I also explored the potential and limits of the materials to advance teacher learning. While I investigated the way in which materials might support teacher development, the teachers' learning was examined in cross-case analyses, and I noted the way in which the text did or did not contribute to the process. As suggested by Remillard (1999: 317) the analyses of teachers' learning through using text material involved a study of the role the text played in their curriculum processes, and the related changes that could be detected in their thinking and in their classroom practice. Data triangulation, using data acquired from different sources and methodological triangulation, employing a combination of methods such as interviews, questionnaires, and observations, served this procedure.

The evidence of teacher learning was also viewed against the professional development indicators adapted from Janse van Rensburg and Le Roux (1998), as well as with those identified within a framework developed by Bell and Gilbert (1994: 483-497) (Discussed in Chapter 3). Janse van Rensburg and Le Roux emphasise new ways of doing (skills/approaches), new understandings (content/environment), new understanding of context (school) and the establishment of new networks as essential indicators of professional development. Bell and Gilbert (1994: 483-497) prefer the view that teacher learning involves teachers developing their ideas and beliefs, developing their classroom practice, while at the same time acknowledging and addressing their feelings about change.

Overlapping features of both sets of indicators include professional development; the process of transforming concepts and beliefs about science education and effecting

change in respect of classroom activities; and social development, working with and engaging other teachers and learners in new ways. Into this framework Bell and Gilbert (1994: 493-494) insert the dimension of personal development, that is acknowledging and addressing feelings about change processes. They emphasise that the "term" personal is used to refer to an affective, rather than an idiosyncratic development. Moreover, these aspects of teacher development are not attended to sequentially or separately, but are interactive and interdependent, and development in one aspect cannot proceed unless accompanied by development in the other aspects as well (Bell & Gilbert, 1994: 493-494).

4.5.2.1. Overview

- Teacher A

When approached to participate in the *We Care* programme, she eagerly acceded to my request. Her apparent enthusiasm to become involved in this project, coupled with the fact that she was involved in similar programmes, the 'Out of the Box' and the 'SEED' (Schools Environmental Education and Development) programmes, at the school was significant. In addition, most of our sessions took place during her free time and after school. This meant that she was actually sacrificing her time to take part in the programme, which was also notable.

Her apparent willingness to participate and sacrificing her time allowed for the inference that she recognised an aspect of her teaching as problematic. Extending this inference, this would account for her active participation in various development programmes as a means of empowering her teaching practice. The recognition of an aspect of teaching practice as being problematic, and exploring different ways to improve teaching practice relate to Bell and Gilbert's (1994: 493-494) address of personal development.

In selecting and designing her lesson, she seemed to be guided by her knowledge and understanding of the content that fell within the range of the learners' capabilities. From the lesson plan, I determined that she mainly used the *We Care* manual as reference material, and selected information that in her opinion was appropriate in terms of meeting her learners' needs. Initially, she expressed doubt about her selection of the 'Litter

Survey' because she was concerned that the learners might find the "big words" too difficult.

Her concerns soon proved unfounded as we observed that the learners were quite capable of developing a basic understanding of the information presented. Evidence of their level of understanding was supported by the successful completion of the tasks that the learners were given (Appendix 8). Based on what had transpired, she could have been reminded of the tendency exhibited by teachers to underestimate learner capabilities, causing them to disregard material that they consider too complicated. This aspect often results in missed learning opportunities (Webb & Glover, 2004: 105).

Moreover, because of the difficulty she perceived in the material, she proceeded to modify the content to ensure its applicability to Grade 4 learners. Effectively deviating from the recommended pattern, but still retaining the words she believed were too difficult for the learners. Armed with the knowledge that she had acquired from the materials, she proceeded to present the lesson confidently and professionally. The confident and efficient lesson presentation, deviation from the procedure suggested in the material, and modification of learning materials to match the learners' needs, suggest the attainment of a level of professional empowerment.

During the interview she initially indicated that she had not encountered any new strategies in the material provided, in fact, she specified that she was "familiar with most of them". This was, however, contrary to a later admission that she could now "make her Natural Science lessons more fun and involve the learners in the lessons more". To a certain extent this admission indicates that the teacher had acquired new ideas and new understandings with regard to lesson presentations and the dimension of learner-centred pedagogy.

- Teacher B

She similarly appeared very enthusiastic about the *We Care* programme, and sacrificed much of her time to engage in discussion with regard to the implementation of the *We*

Care material in Natural Science teaching. Here again the apparent keen attitude and commitment of free time could be interpreted as an acknowledgment of an aspect of her teaching as problematic.

Her task selection was based on the theme that she had already initiated, namely 'Matter and Materials'. Her selection process was therefore based on meeting a specific curriculum need, that is, developing learner understanding with regard to the three states of matter. She admitted that she had not associated the 'Water Cycle' with this theme before, and was surprised to discover that it worked very well. This was new to her and a definite indication of teacher learning.

In addition, she expressed great interest in a number of other activities that she had not come across before, namely the "interview with a tree", "interview with an animal", the making of a frieze", "miming bird species" "the bird danger box" and the "survival still" (Appendix 13). By way of the interview, she indicated that these novel methods of presentation would certainly be included into her future Natural Science programmes. The learning achieved by Teacher B, is indicative of Janse van Rensburg and Le Roux's (1998) developing new understandings and learning new ways of doing (skills/approaches), coinciding with Bell and Gilbert's (1994: 483-497) developing ideas and classroom practice. Moreover, this indicates that curriculum materials can potentially promote teachers' learning by providing a collection of tasks for teachers to try (Remillard, 2000: 345).

Here follows a discussion of each teachers' development processes and then evidence of teacher development is analysed in terms of the indicators adapted from Janse van Rensburg and Le Roux (1998), and a professional development framework formulated by Bell and Gilbert (1994: 483-497).

4.5.2.2. Indicators adapted from Janse van Rensburg and Le Roux (1998)

The indicators they considered relevant to teacher learning included: new ways of doing, new understandings, new understanding of context, and the formation of new networks. Teachers' learning through using text material was analysed in terms of these indicators.

- New ways of doing (skills/approaches)
- Teacher A

From the interview, I determined that she "can now make my Natural Science more fun and more learner-orientated by involving them more and using the many ideas in the manual". In a sense, this admission can be interpreted as the acquisition of "new ideas" with regard to the teaching approaches she used, and the materials in essence presented new ways of doing.

- Teacher B

Throughout the interview she repeatedly emphasised that she had acquired "new ideas". Based on these admissions, I inferred that the process and the materials fulfilled their essential function of informing and guiding teaching and learning practice. Thus, she was able to benefit from the process and acquired new procedures/processes that she could incorporate into her practice.

- New understandings (content/environment)
- Teacher A

The discussion sessions proved fruitful in terms of helping the teachers to link the material to the Natural Science themes, learning outcomes, assessment standards, and assessment strategies. With regard to linking these aspects of lesson design and planning, she found the manual very helpful, and pointed out that "the manual actually gives you the skills that will be developed, the COs (learning outcomes) that will be achieved, integration with other learning areas, as well as the assessment that can be used, all valuable information". To account for the fact that the teachers found this information

very important, I can only suggest that they might consider the activity of linking the technical aspects; such as content, learning outcomes, assessment criteria and strategies complicated. They therefore seemed to appreciate this aspect of the guidelines provided in the manual.

In addition, during the interview she mentioned that since the manual "used simple demonstrations of the different kinds of pollution, it became easier to grasp what pollution was all about". "Also, the words (terminology) are explained quite clearly and the language is not too difficult to understand. I could manage the content and teach it to my learners." In effect, this demonstrated the achievement of new understandings.

- Teacher B

She too indicated that the discussions we had around the content of the manual, and the manner in which it could relate to the Natural Science themes, learning outcomes, and assessment, proved useful. Her new understanding was based on the realisation that relevant content needed not be compartmentalised and treated as separate categories of learning, but that knowledge/information is interconnected. For this reason, an Environmental lesson, that is the Water Cycle, could be used for the Matter and Materials theme, and function just as effectively in terms of the learning achieved.

- New understanding of context (school)

- Teacher A

The fact that her learners responded quite well to the lesson on the "Litter Survey" despite the inclusion of "big words" such as "biodegradable" and "non-biodegradable", was a lesson to the teacher. It appeared that it allowed for the realisation that far too often learning opportunities have been overlooked because of teachers' inexact perceptions regarding their learners' level of learning. It might also have permitted the realisation that learning material does not have to be disregarded because of perceived difficulties, but that these materials can be adapted for the learners operating at different levels. In this

case, a new understanding of the manner in which materials can be related to the learners' context was achieved.

Teacher B

Linking the "Water Cycle" lesson to the Matter and Materials theme was something she had not done before. This indicated a new understanding of the adaptability of materials to different contexts and to suit different purposes.

- New networks (working with other teachers)

• Teacher A

The *We Care* process promoted collaborative interaction on a professional level. Teacher A concurred, and stated "we have a lot to learn from each other." She expressed disappointment with the fact that "I did not work with the other educators in my grade." This was interpreted as a willingness and readiness to connect with other teachers within a similar environment.

• Teacher B

With regard to collaborative interaction, she indicated another significant advantage of professional interaction, "we share ideas and make recommendations." In effect confirming the essential contribution of collaborative action.

4.5.2.3. Bell and Gilbert's (1994: 483-497) professional development framework

Together with the professional development indicators identified by Janse van Rensburg and Le Roux (1998), a study by Bell and Gilbert (1994) was used to interpret the indications of teacher development that were observed during the course of the *We Care* process, and while the teachers used the *We Care* materials. In the course of conducting a study with science teachers in New Zealand, Bell and Gilbert chronicled teacher development in a three year research project called "The Learning in Science Project". They investigated the development of science teachers, as the teachers learnt new
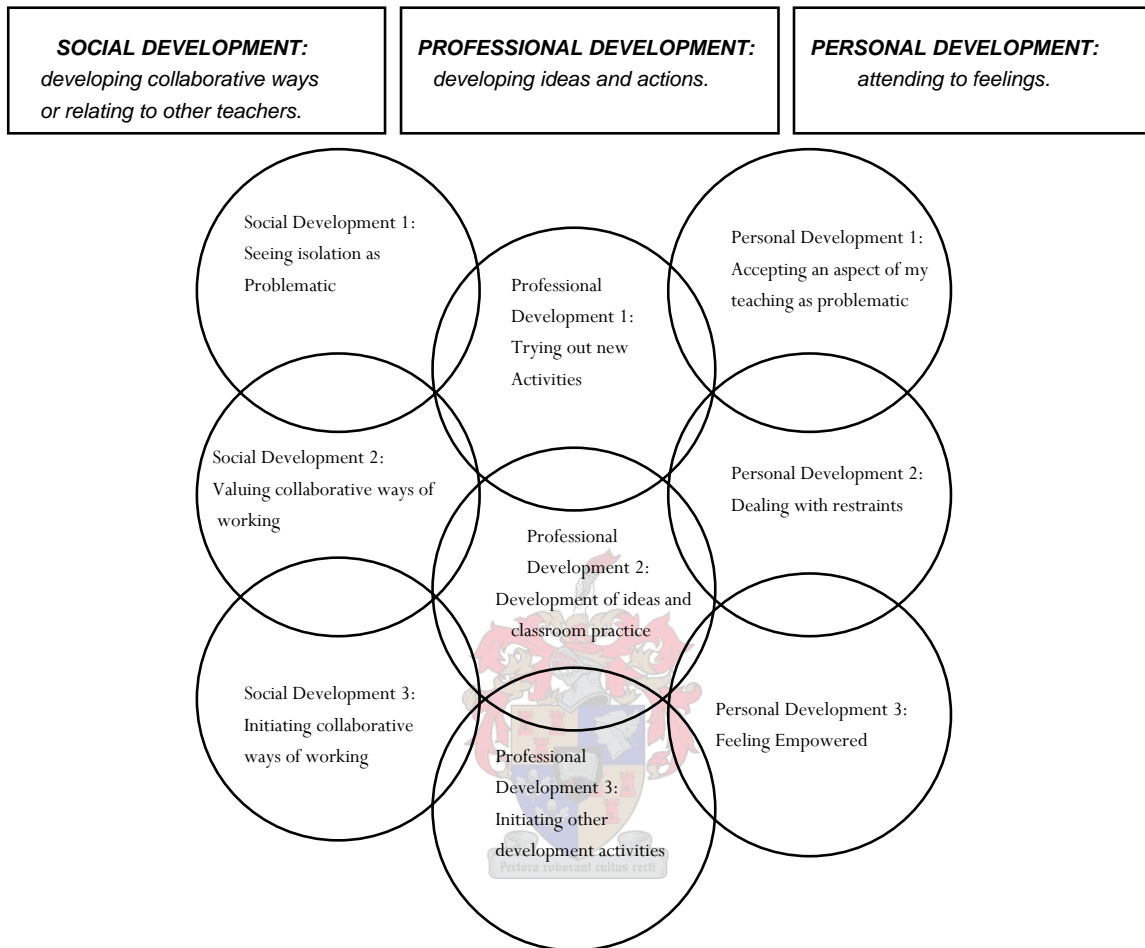
teaching activities that enabled them to take into consideration students' thinking and constructivist views of learning Bell and Gilbert (1994:484).

Bell and Gilbert (1994:483)   state that one of the main implications of the research is the "changed roles and activities of the teacher in the science classroom". In responding to these changed roles, they maintain that "the science teacher is challenged to change his or her teaching from transmitting a body of scientific knowledge to helping the student develop their own (and often alternative) conceptions towards the currently scientific accepted concepts". In so doing, teachers are challenged to consider students' thinking, and ways and means of facilitating students' conceptual development (Bell and Gilbert 1994: 483-484).

Two similarities that I detected between Bell and Gilberts' study and my investigation include: the implementation of new curricula and changing education policies (Bell and Gilbert 1994: 486), and that this change process called for teachers' to modify their classroom practices accordingly. Also, both programmes aimed at assisting teachers in making sense of the changes advocated, and presenting techniques to teachers that could prove beneficial with respect to modifying their classroom interactions with the learners. In contrast to my enquiry, their study was extended over a longer period (Bell and Gilbert 1994: 483) and provided more opportunities to observe the different stages of teacher development in each category. However, their insights proved particularly relevant and useful in terms of tracing the teachers' development, and were utilised where possible.

The diagrammatic representation below provides a concise overview of the three main categories of teacher development as distinguished by the Bell and Gilbert (1994), namely professional (cognitive and action), personal and social development. Three levels of indicators are attached to each of the categories, signifying the progression occurring within each category. As in Bell and Gilbert (1994:485), I analysed teacher development in terms of their categories. The data acquired via the interviews, questionnaires, observation and field notes, as well as selected documents were used to describe different aspects of the teachers' development processes.

FIGURE 3: An Overview of Teacher Development (Adapted from Bell & Gilbert 1994: 485)

SOCIAL DEVELOPMENT: developing collaborative ways or relating to other teachers.	PROFESSIONAL DEVELOPMENT: developing ideas and actions.	PERSONAL DEVELOPMENT: attending to feelings.

Social Development 1: Seeing isolation as Problematic

Professional Development 1: Trying out new Activities

Personal Development 1: Accepting an aspect of my teaching as problematic

Social Development 2: Valuing collaborative ways of working

Professional Development 2: Development of ideas and classroom practice

Personal Development 2: Dealing with restraints

Social Development 3: Initiating collaborative ways of working

Professional Development 3: Initiating other development activities

Personal Development 3: Feeling Empowered

Bell and Gilbert (1994: 493-494) indicate that personal development entails attending to feelings about the change process, being a teacher, and about science education. Social development involves working with and engaging other teachers and learners in new ways. Professional development involves transforming concepts and beliefs about science education, and in consequence effecting change in respect of classroom activities. They contend that these three aspects are interactive and interdependent, and they emphasise that development in one aspect cannot proceed unless accompanied by development in the other aspects as well.

Two critical issues with respect to teacher development cited by Bell and Gilbert (1994:494) included the contribution of new theoretical ideas and new teaching

suggestions; and the experimentation, evaluation and practicing of these new theoretical and teaching ideas over an extended period of time in a collaborative situation where the teachers are able to receive support and feedback, and where they are able to reflect critically.

Teacher development is analysed in terms of Bell and Gilbert's three categories of professional, personal and social development. The analysis focuses on: teachers developing their ideas and beliefs, developing their classroom practice, while at the same time acknowledging and addressing their feelings about change.

- Personal development

• Teacher A

The sacrifice of considerable time and effort, as well as a keen commitment to various development projects, are significant indications of professional dissatisfaction. Bell and Gilbert (1994: 486) suggest that professional dissatisfaction may be with the learning of students in the classroom, not feeling competent or confident to implement the new curriculum, or feeling stagnant with respect to own growth and learning. In an attempt to overcome her apparent dissatisfaction, she actively participates in a number of programmes, essentially as a means of empowering herself. This is interpreted by Bell and Gilbert (1994: 485) as dealing with supposed constraints.

In the interview, she stated "I can now make my Natural Science more fun and more learner-orientated by involving them more and using the many ideas in the manual". I suggest that this admission indicated that she felt empowered, and could now proceed to alter her teaching approach confidently with respect to teaching this learning area.

• Teacher B

Teacher B likewise sacrificed her time and energy to engage in a range of teacher development activities willingly. As suggested for Teacher A, this may be interpreted as a commitment to self-empowerment, and as a means of addressing apparent constraints.

- Professional development

•   Teacher A

From the interview, two noticeable indications of professional development were observed, that is managing content and modifying classroom practice. She mentioned that "I could manage the content and teach it to my learners", and "I can now make my Natural Science lessons more fun, and more learner-orientated by involving them more and using the many ideas in the manual." This was a clear indication that using the materials had impacted classroom practice.

•   Teacher B

I observed considerable professional development, also relating to managing content and effecting change in terms of classroom practice. As opposed to Teacher A, she demonstrated that she was now informed of many more teaching activities that she can incorporate into her repertoire of approaches.

Linking the "Water Cycle" lesson with the Matter and Materials theme was an entirely new experience for her. She encountered various new approaches, such as: "an interview with a tree", and the "survival still". In fact, throughout the interview she repeatedly emphasised the fact that she had acquired "new ideas". Based on these affirmations, I suggest that she had certainly benefited professionally from her participation in the *We Care* programme, having received input regarding innovative teaching strategies, in other words new ways of presenting Natural Science lessons.

- Social development

•   Teacher A

The value of co-operation was concisely expressed as "I feel that we have a lot to learn from each other". In actual fact, this brief statement explicitly illustrated the efficacy of collaborative interaction in a professional community. The actual purpose of bringing people together in this manner was to create opportunities for them to reflect, engage

each other and exchange ideas, and in consequence it promoted professional advancement.

- Teacher B

The benefits that she derived from interaction and interchange was expressed as "we share ideas and make recommendations". She similarly communicated the essential value of collaborative interaction, since making recommendations might suggest reflective action and consideration of alternate approaches to apparent problems experienced.

4.5.2.4. Discussion

Remillard (2000: 347) notes that because of the different ways teachers read textbooks, there is much that revised textbooks cannot accomplish alone. She contends that it is unlikely that curriculum materials can significantly affect teaching if consideration is not given to the nature of support that accompanies them. For this reason, she suggests that teachers need opportunities to learn to use texts in constructing curriculum, and that professional development activities and pre-service and in-service teacher education should help teachers become more active in the curriculum development processes. She adds that this can only be achieved if material and teacher development efforts are more coherent and co-ordinated. Moreover, Remillard (2000:347) suggests that in order to promote the productive use of curriculum materials, professional development opportunities need to foster teachers' reading and decision making, deepen and broaden their (mathematical) knowledge, and develop their knowledge of the curriculum development process.

In fact, both Remillard (1999; 2000) and Bell and Gilbert (1994: 494), have regularly emphasised the need for support, feedback and critical reflection of teaching practices as being relevant to professional growth. This view is echoed by Dennison and Kirk (1990: 23) who maintain that in a busy life of continuous demands and increasing accountability, the only way that a professional person may achieve growth and self-renewal is through some processes of systematic reflection. More significantly, they emphasise that as the demands of professional life continue to change, developing habits which sustain a

constant state of reflectiveness is essential. Such as state of constant reflectiveness supports Reddy's (2000: 3.1.8) earlier recommendation that "teachers must be given adequate opportunities for continuing in-service education, to enable them to develop skills that the innovation of school-based curriculum development requires and to develop insights into the wider issues of education".

Webb and Glover (2004: 103) assert that professional development opportunities need to broaden and deepen teachers' knowledge, since teachers clearly cannot help learners develop understanding if they themselves lack knowledge and understanding. They contend that it is not simply the command of content knowledge that is required, teachers also need to be familiar with different kinds of knowledge. With regard to the different kinds of knowledge relevant to science teachers, as indicated by Shulman (in Webb & Glover, 2004: 103-104) these include:

- Content knowledge, i.e. knowledge about science and of science.

- General pedagogic knowledge, i.e. about classroom management and organisation, over and above subject matter.

- Pedagogic content knowledge, i.e. about how to teach the subject matter.

- Curriculum knowledge, i.e. what is going on as regards national curricula, the materials available, etc.

- Knowledge of learners and their characteristics.

- Knowledge of educational contexts.

- Knowledge of education goals, values, history and philosophy of education, etc.

Webb and Glover (2004: 104) state that invariably content knowledge and pedagogic content knowledge are easily confused when programmes are designed to improve teachers' understanding of science, and it is often assumed that more science content knowledge is needed. They contend that emphasising this form of knowledge is

inappropriate and dangerous, because it sends out the message that teaching science is about 'delivering' content. Furthermore, they suggest that teachers who lack the necessary understanding have resorted to "coping" strategies that essentially impoverish children's learning opportunities, such as (Webb & Glover 2004: 105):

- Sticking to the areas where they are most confident, and neglecting other equally important sections of content.

- Relying heavily on work cards/textbooks which give step-by-step instructions.

- Avoiding anything that might "go wrong".

- Using expository teaching/the narrative.

- Not allowing questioning and discussion.

For this reason they stress that teachers' understanding and pedagogical content knowledge are most important since they promote teachers' confidence, and enable them to (Webb & Glover 2004: 105-106):

- Plan, knowing the 'big picture' understanding they are aiming at;

- Recognise the seed of a scientific idea in what children say or write (and encourage the process);

- Recognise 'blind alleys' and redirect children's activities along more fruitful lines;

- Put forward scientific ideas for children to consider (not as the 'right' answer, but to be tested out against what they are doing and seeing);

- Assess learners' progress and to involve children in assessing their own progress (by communicating the direction in which the learning is going).

Webb and Glover (2004: 108) maintain that the true challenge facing science educators is developing an understanding of the nature of science itself in order to promote a

scientifically literate society, i.e. one that can distinguish between superstition, pseudo-science and science, tell the difference between entertainment and possibility when watching science fiction movies, etc. The development of such an understanding of science poses serious challenges for teacher learning and current teacher development programmes.

While on the one hand we need to acknowledge that tremendous strides have been made with regard to teacher development in South Africa in view of the relevant literature, we, on the other hand, have to concede that much more work needs to be done to ensure that essential elements of the curriculum change process filters to the level of the teachers in a more productive and encouraging manner.

Here, the defect or deficit model as described by Bagwandeen and Louw (1993: 69) should preferably have no place in South African teacher development initiatives. As stated by Bagwandeen and Louw (1993: 69), this model is characterised by the view that teachers need development because they lack the necessary skills to teach successfully. Moreover, this view assumes that something is wrong with the manner in which teachers function, and therefore deems corrective intervention necessary. Reddy (2004: 140) adds that at the heart of the defect model is the contention that education is a rapidly developing field in which old ways of doing things are constantly being replaced by new and better ways. He asserts that this view (the defect model) is infused with the notion that someone knows more about how teachers should behave in classrooms than teachers themselves. His criticism of the deficit/defect approach concerns the design of 'one size fits all' interventions that to all intents and purposes disregard the varying contexts and needs of the teachers, (Reddy 2005: 6).

Sikes (1992: 37) writes that factors motivating all change lie in the assumption that all is not well and that students are not receiving the best education because teachers and their teaching are inappropriate or inadequate. She expands on this and suggests that the common interpretation inherent in this view of teachers is that they lack the necessary knowledge, skills, and competences required. As a consequence, the changes are

introduced in order to remedy the "deficiencies" in the teachers and their teaching, and are ostensibly to help teachers to "develop" and "improve" (Sikes, 1992: 37).

According to Reddy (2004: 141-142) the two main approaches to professional development currently operative with respect to National Curriculum Statement teacher training, include the "cascade advocacy approach" and "cascade plus cluster approach" (discussed in Chapter 2). In fact, the dominant approach appears to be a deficit/defect model approach which proceeds by way of advocacy campaigns based on cascade approaches. He observes that teachers are not consulted in the process of development, and tight control is exercised as to what information is disseminated and what teachers are expected to do once they have attended such INSET processes (Reddy 2004: 142).

In contrast to the defect/deficit model, "the growth model aims to familiarise teachers with developments in the field of education" (Reddy, 2004: 140-141). In terms of this approach to professional development there are more opportunities for growth. Teachers are respected as professionals who hold professional opinions about their work and issues related to their work. INSET processes are regarded as opportunities for continuous professional development rather than as sessions during which skills are either updated or renewed. This approach involves teachers as co-constructors of knowledge, and may even encourage teachers to become involved in planning and presentation. Furthermore, Reddy (2004: 141) adds that an important aspect of this approach is that continuous support is provided and networking is encouraged. In essence, this is consistent with Dennison and Kirk's (1990: 23) constant state of "reflectiveness", mentioned earlier, that is demanded with respect to a changing professional environment.

Reddy (2005: 7) indicates that it is well-documented that professional development or INSET programmes extended over a longer period, and that offers site-based support, are more valuable for ensuring the successful implementation of curriculum reform and transformative initiatives, while at the same time efficiently contributing to the professional development of teachers. Of importance is his observation that these

essential aspects are noticeably absent from current programmes offered by the Western Cape Department of Education.

Fullan and Hargreaves (1992: 6) assert that teacher development must be conceptualised much more thoroughly than it has been. They write that its relationship to educational change is not just a matter of better implementation of selected innovations (although it includes this) but more basically a change in the profession of teaching, and in the institutions in which teachers are trained and in which they work. They regard teacher development as being tantamount to transforming educational institutions.

Both the *We Care* and 'Out of the Box' processes, while they are to a large extent materials-based, offer sufficient opportunities for support, feedback and observation sessions, and can therefore potentially make a greater contribution to more productive professional and curriculum development than the skills-based INSET programmes preferred by the Western Cape Education Department. Consistent with the recommendation made by Marx et al. (1998: 678), the design and delivery of these processes, namely *We Care* and 'Out of the Box', reflect the integration of issues of policy, context and the professionalism of teachers more noticeably.

Within the context of teacher development it is also significant to note that this research study has found that learning support materials, such as the *We Care* materials, do perform a valuable function in teaching and learning "by providing guidance and structure to teachers" (Reys, Reys, Lapan & Holliday, 2003:74) as they implement reformed science curricula . In view of this specific function, the potential for these learning support materials to exert a positive influence on teacher practice, while at the same time promoting science education reform efforts cannot, and should not be ignored.

CHAPTER **5**

CONCLUSION AND RECOMMENDATIONS FOR FURTHER RESEARCH

5.1 Introduction

The research highlights important relations in education / curriculum change processes. One area foregrounded by my research question is the relationship between the use of curriculum materials and its possible value to teacher development in times of change in education. The data and discussion point to an almost mutualistic relationship between the use of materials, curriculum development and teacher development.

The *We Care* materials played various roles in the research process. Initially the materials provided scaffolding for teachers by serving as suggestions for possible activities. It also provided structure for lessons in science with links to other learning areas. Both teachers in the research project referred to the fact that they learnt new pedagogical approaches from the materials and were stimulated to attempt different activities based on the materials.

The process of introduction to and possibilities of the materials also played an important role and was highlighted as a benefit by the teachers involved. Comments included the benefit of interaction with other staff members, discussion of content with colleagues as well as discussion of experiences with me during the interviews and general communications. The process provided for both content knowledge improvement and pedagogical ideas to be tried and discussed in a non-threatening environment with colleagues. Evidence of professional development linked to the use of materials was demonstrated by both teachers in this research process. These included trying out new ideas, accepting the need for change as well as developing and adapting materials based on the original suggestion materials in the *We Care* resource pack.

5.2 Concluding comments

According to Calderhead (1984:86) little help is given to teachers to help them adjust to the demands of new materials or teaching approaches and consequently many curriculum innovations have superficial impact on classroom life. It is my understanding that curriculum change as a matter of course has a direct bearing on key aspects of teaching practice, principally with respect to the subject matter and pedagogy it sets out to modify. The corollary of such developments impacts learning support materials directly, as the content of such materials may well be deemed obsolete or irrelevant in terms of the prescriptions identified by the new curriculum imperatives. Invariably, associated with curriculum change is the identification of new teacher knowledge and skills that may feature as an essential requirement for the successful implementation of the new curriculum. In my opinion, it is therefore axiomatic that the role of teacher development and curriculum materials should feature prominently in any discussion on curriculum change.

Retrospectively the central elements of the research question, curriculum materials and teacher development, appear inextricably interconnected and inexorably bound to curriculum change events. It is my understanding then, that since each component constitutes a vital and indispensable part of the process of curricular implementation, it is fundamentally important that these elements should not be trivialised or treated as separate entities, but that their interconnectedness and interdependence be acknowledged and addressed in discussions on, and in processes of curriculum reform and transformation.

From my research it would seem that the realisation of curriculum and pedagogical change demands that teachers are afforded ample opportunities to re-examine and strengthen their subject knowledge, develop their competencies in respect of the required teaching methodologies, and expand their knowledge of the applicable learning and assessment strategies. Teachers thus sufficiently empowered would tend towards altering their teaching strategies in a more knowledgeable, confident and efficient manner.

Crucial to this empowerment process is a supportive environment in which teachers are permitted to engage in experimentation and a reflection of praxis.

An essential aspect of this supportive environment is the supply of text/learning support materials for teachers, as stated by Carl (2002: 270). Given that teachers are invariably guided and supported by the available materials, it goes without saying that these should be readily available to them especially during periods of reformation and transformation. However, Adler et al. (2002: 54) pointed out earlier that educational resources are not only seriously limited, but are also unequally distributed among South African schools. They write that differential distribution of material and human resources in school education is highly visible across the country. For this reason, they (Adler et al., 2002:58) suggest that any programme which advocates the shifting of classroom practices should interrogate its assumptions about resource availability and use.
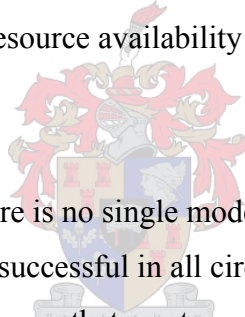
According to Ball et al. (1986), there is no single model for teacher education (in-service processes) that is guaranteed to be successful in all circumstances. Nevertheless, they indicate that there is growing consensus that most successful teacher development projects are likely to involve a substantial element of school-based work, and the sharing of ideas amongst teachers.

Loucks-Horsley et al. (2003: 47) indicate that the current focus of professional development has been extended to incorporate not only the teacher, but also the organisation to which the teacher belongs. Moreover, they recommend that professional development programmes directed at supporting continuous teacher and organisational learning, should entail measures to ensure that such programmes correspond with a school's vision and goals, that it is reasonable for the teachers and students, builds the leadership and infrastructure needed, fits with the school's context, and provides teachers with the variety of experiences they need to learn.

In addition, professional development opportunities ought to consider teachers' prior knowledge and experience and provide for ample opportunities for teachers to apply their knowledge within a supportive environment. Incorporating these suggested actions, as well as reflecting on what is already known about effective professional development programmes in terms of the research that has been produced, can in all likelihood increase the success of future teacher development programmes. Loucks-Horsley et al. (2003: 46-47) suggest guiding principles for professional development processes which could be adapted to various contexts. These include:

- Effective professional development experiences are directed by a clear image of effective classroom learning and teaching.

- Effective professional development experiences provide ample opportunities for teachers to develop their content and pedagogical content knowledge and skills, and to reflect on their own practices critically.

- Effective professional development experiences are research based and engage teachers as adult learners in the learning approaches they will use with their students.

- Effective professional development incorporates opportunities for teachers to work with colleagues and other experts in learning communities.

- Effective professional development experiences support teachers to serve in leadership roles.

- Effective professional development experiences provide links to other parts of the education system.

- Effective professional development experiences are designed based on data that determine their focus and priority as they relate to student learning.

5.3 Recommendations for further research

This research was a process of limited scope done at a single school with two volunteer teachers. I feel research of this kind however reveals ideas that are particular and needs that are immediate to teachers practice. Small scale projects such as this case study also have the advantage of providing more depth and understanding regarding teachers' responses to curriculum changes and its implications for their practice. Given the importance of teachers in times of curriculum change I feel it would be valuable if more long term studies related to the role of materials in curriculum and teacher development could be done in various contexts. I also feel the important issue of teachers' day to day experiences and practical needs in implementing altered and changed curricula need to be studied and reported in order to facilitate change processes driven and implemented by teachers in classrooms in various contexts. These studies would not only highlight experiences but also inform the nature and structure of professional development processes and would contribute to making these processes more responsive to teachers' needs and contexts.

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