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How Natural Sciences teachers plan and enact their lessons in Outcomes-based Education

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

The South African education system has altered radically since 1994, when the new democratic government took over. The content-heavy Apartheid-era curriculum was soon replaced with a post-Apartheid outcomes-based curriculum, that aimed to address key developmental goals, such as values, knowledge and skills acquisition by learners. The South African outcomes-based curriculum, then called C2005, was implemented for the first time in 1998, in the foundation phase (Grades 1,2 and 3), followed subsequently by other grades. The curriculum was then reviewed and revised, in order to make it more understandable in the classroom. The revised version was implemented in the schools in 2004, commencing at the lower grades.

Changes in policy have led to great changes in the expectations of the way in which teachers should teach and the way in which learners should learn in the classroom. These changes impose new planning demands on teachers as designers of learning programmes (Department of Education, 1998): teachers are expected to plan for lesson activities that will ensure that learners, for example, in the Natural Sciences, attain inquiry and investigative skills, observational and experimentation skills, and an understanding of the sustainable use of Earth's resources. The new outcomes-based education (OBE) curriculum has made it imperative for teachers to change their planning directives, and switch from focusing on teacher input, expressed in terms of content, to focusing on the learners' achievement of clearly defined outcomes of the learning process (Department of Education, 1997).

Many researchers investigated classroom practice in the initial stages of curriculum reform and discovered that the shift from content-oriented to outcomes-based learning in South Africa has been slower than anticipated, as learners display very few of the skills they are supposed to acquire through the attainment of learning outcomes (Hattingh, Rogan, Aldous, Howie and Venter, 2005).

This information was further confirmed by Onwu and Stoffels (2005), who found that teaching was still content-based and that many teachers have opted for published Learners' and Teacher's Guides. These researchers concluded that, despite the training that the Department of Education offered, teachers still became confused when faced with radical changes in the curriculum, and that they failed to put theory into practice. The use of new teaching strategies and assessment methods, as well as the inclusion of new content in the curriculum, was still perceived to be a problem (Jacobs, Vakalisa and Gawe, 2006). Jita (2004) argues that the implementation problems that many teachers experience is as a result of the fact that reformers have not paid sufficient attention to the personal aspects of teacher change, especially in developing practicable teaching plans that are effective in the classroom.

This study intends to expand knowledge on the personal aspects of teachers, by investigating how they plan and enact their planned activities in the classroom. Bage (1999) reported that it is necessary and useful that plans are written for the following reasons: they simply reflect mental planning of the teacher; give structure and direction for the lessons taught; align assessment with lesson outcomes; maintain a productive balance in the teaching-learning process; and are useful for future planning.

Clark and Peterson (1986) developed an analytical framework for theorising lesson planning as a basic psychological process which allows the individual teacher to visualise the future and construct a framework to guide his or her prospective actions. It can be argued that teachers' own practical and theoretical knowledge are primary factors determining how they would adapt their curriculum planning processes, as they are expected to start by identifying the required learning outcomes and assessment standards, prior to selecting the content and learning activities that will lead to the achievement of the outcomes. The extent to which teachers adapt their plans is unknown, taking into consideration the fact that policy has prescribed ways of planning and even templates or formats for planning, which could be limiting. Furthermore, this study pursues lesson planning in outcomes-based education (OBE) and its enactment in the classroom.

1.2 TEACHING SCIENCE IN SOUTH AFRICA

The South African National Curriculum Statement (NCS), which employs an OBE teaching approach, is defined by eight learning areas for Grades 1 to 9, one of which is Natural Sciences. The teaching approach aims at learners achieving outcomes through grade level assessment standards that will lead to the acquisition of knowledge and skills. In Natural Sciences, for example, the learners should be able to conduct scientific investigations, construct knowledge, and relate science, society and the environment (Revised National Curriculum Statement, 2003). Teaching should be learner-centred in order to promote active learning in the classrooms and laboratories, where learners should engage in authentic learning processes, such as cooperative learning, group work, practical work, research investigations, reports, etc. Teachers should fulfil various roles that include being mediators of learning, interpreters and designers of learning programmes and materials, researchers, lifelong learners and learning area specialists (RNCS, 2003).

The Revised National Curriculum Statement (RNCS) aims to develop the full potential of each learner as a citizen of a democratic South Africa. It seeks to create a lifelong learner who is confident and independent, literate, numerate and multi-skilled, compassionate, with a respect for the environment and the ability to participate in society as a critical and active citizen (RNCS, 2003).

The Natural Sciences Learning Area Statement envisages a teaching and learning milieu that recognises that the people of South Africa attain a variety of learning styles as well as culturally influenced perspectives. It starts from the premise that all learners should have access to a meaningful science education that is learner-centred, to help them understand not only scientific knowledge and how it is produced, but also environmental and global issues. Furthermore learners are provided with a foundation that they can build on throughout life (RNCS, 2003). The Learning Area promotes scientific literacy by focusing on: the development and use of Science process skills in a variety of settings and application of scientific knowledge and understanding; as well as the appreciation of the relationships and responsibilities between science, society and the environment.

The teaching of Natural Sciences as a learning area is characterised by learning activities that integrate knowledge and skills; hence, certain methods of inquiry are generally used

(Hattingh et al., 2005). The learning outcomes for Natural Sciences prescribe that learners acquire process skills as they formulate hypotheses; design and carry out experiments to test the hypotheses; investigate a phenomenon; gather, analyse and critically evaluate data or information; observe and measure; synthesise and communicate their findings; construct, interpret and apply scientific knowledge; and be able to demonstrate an understanding of the interrelationships between science, technology, society and the environment (RNCS, 2003). Therefore, the type of methods and resources that the teacher decides on, their relevance and appropriateness, determine the level of acquisition of the specified knowledge and skills by the learners. Planning is essential for a clear identification of the purpose of a lesson and also to direct the teaching-learning process towards achieving its aim.

How then, on the basis of their designated roles, are teachers expected to go about their planning decisions? A key planning decision that teachers have to make is to identify the learning outcomes, which describes what knowledge, skills and values learners should know and demonstrate, including what they should be able to do at the end of the lesson. The assessment standards then describe the level at which learners should demonstrate their achievement of the learning outcomes and the ways of demonstrating their achievement. It becomes the responsibility of the teacher to select the content, learning activities, the instructional methods, resources, time allocation, assessment strategies, as well as enrichment activities (RNCS, 2003). According to Hobden, (2005), while textbooks seemed to have a noticeable impact on most of the teachers' content decisions, this is not the case with the planning in NCS. The detailed planning of individual learning experiences or activities that can lead to the attainment of outcomes now has added significance, and the development of skills and attitudes is incorporated in content acquisition. This is where I see the gap in planning for effective lessons by teachers.

The expectation that teachers should interpret and develop the meaning of learning outcomes in relation to content implies that they need to set aside time for planning and designing learning activities, a practice that involves acting and thinking in a reflective manner. All the decisions pertaining to the plan and the implementation thereof remain the competence of the teacher. However, many teachers experience a contradiction between what policy prescribes and what they themselves know the implementation to be, creating

a gap between what is and what should be about teaching and learning. Policy guidelines prescribe how the OBE lesson plans should look, and formats or templates for writing out lesson plans are provided. As they are in the process of adapting both their planning and teaching methods, it is a challenge for teachers to ensure that all learning outcomes and assessment standards are effectively pursued and that each learning area is allocated its prescribed time and emphasis (RNCS, 2003).

The training that teachers underwent on NCS, in 2005/6, across all the learning areas and grades, included planning issues. Teachers were provided with training manuals, policy documents and planning guides that comprised exemplars of learning programmes, content description, teaching and assessment strategies, as well as planning formats. The policy puts emphasis on the three levels of planning: the learning programme for a phase, work schedule for a grade, and lesson plans with specific learning activities. The assumption is that teachers understand what is expected of them in terms of planning, but the necessity thereof which forms the basis of an outcomes-based and learner-centred teaching approach, is perceived differently among individual teachers.

If planning is defined as a fundamental psychological process which allows the teacher to visualise the future (Clark & Peterson, 1986), to what extent are teachers allowed the autonomy, based on their experience and knowledge, to decide on the what and how of teaching in an outcomes-based way? Do policy prescriptions limit teachers' vision? Carlgren (1999) argues that the use of new planning methods is a new experience in which teachers lack competence. It is for this reason that this study intends to investigate how teachers plan, and what influences their decision-making in planning lessons – is it policy prescriptions, or teachers' own experiences and knowledge, or is it the focus on learning outcomes and content?

One might argue that a lot of studies have been done on OBE and have reported a lack of teachers' success, but these studies had little or no specific focus on lesson planning. Based on the assumption that through planning, teachers do visualise what they will do in the classroom, and that planning is an intention to act, if teachers do plan, the question arises: to what extent do they turn these plans into reality in the classroom for learners to attain outcomes, knowledge and skills?

1.3 PROBLEM STATEMENT

This study is based on the fact that, as a curriculum specialist who trains and supports teachers in the learning area of Natural Sciences, the researcher observed that policy puts the emphasis on planning as a way of drawing teachers away from content-driven teaching approaches, so that they will rather plan and teach with the intention of learners' achieving the learning outcomes. However, Hattingh et al. (2005) comment: 'As South Africa continues in a period of unprecedented curriculum change, a great deal of time, money and effort may be wasted, as good ideas are not translated into classroom reality.' They argue that the changeover process has been unsuccessful, but have failed to scrutinise the way in which teachers, particularly in Natural Sciences, actually design learning programmes from which lesson plans are drawn in a practical and realistic manner that will ensure the successful enactment of the planned activities in the classroom, taking into account that the outcomes to be attained by the learners are the primary goals in an OBE approach.

This study undertakes theory-based research on teacher planning as a significant factor, based on the assumption that teachers visualise the future and construct a framework to guide their future actions (Clark & Peterson, 1986). The intention is to investigate the extent to which teachers translate their decisions about outcomes, content, learners' activities, assessment strategies, resources and time allocation into reality in the classroom, taking into consideration learners' interests, prior knowledge, acquisition of skills and learning abilities. The new curriculum makes several demands, particularly in relation to planning, as it depicts intentions, and an endeavour to align lesson activities with policy through the use of policy guidelines. Researchers need to ask themselves as to what extent teachers meet these demands, what influences their decisions, based on the level of curriculum support that they have received, as well as on policy documents that prescribe the expectations of the curriculum.

The focus of this study is to find out how the OBE lesson plan tries to achieve this and the extent to which teachers turn their decision-making, as reflected in their lesson plans, into reality, through a case study of two teachers in two schools with different backgrounds.

A matter to be explored is whether planning is integral to their achieving the specific outcomes in Natural Sciences, and if so how these teachers enact these plans in the classroom. Although the focus of OBE is on what the learners can actually do, lessons naturally consist of inputs and outputs, which necessitates planning and outcomes. There is a need to study the types of approaches that teachers use as they take the initiative to adapt to change.

1.4 RESEARCH QUESTIONS

The study investigates the following two questions:

- Research Question 1: How do Natural Sciences teachers plan for their lessons or learning programmes in an outcomes-based curriculum?

- Research Question 2: To what extent do Natural Sciences teachers translate their lesson plans into classroom practice?

1.5 RATIONALE FOR THIS STUDY

Shavelson and Stern (1981) report that teacher behaviour is guided by individual thoughts, judgements and decisions. In order to understand the behaviour of teachers, then, it is essential to know their goals, the nature of the context in which they function, their information-processing capabilities, and the relationship between these elements. Yinger (2001) asserts that most of the research done internationally has focused on what types of problem-solving and decision-making processes are involved in teacher planning in relation to their practical knowledge. Research done in South Africa has revealed that thus far the decision-making and practice of Science teachers, in contrasting resource contexts, are still dominated by traditional pedagogy, and a dependence on Learner's Guides or texts to structure and facilitate practical activities for learners (Stoffels, 2005). Through a case study that investigates lesson planning, this study aims to find out whether this is true for OBE, and whether, if teachers do plan, what their plans look like, and to what extent these plans lead to the attainment of the ideals of the curriculum as envisaged.

Since the implementation of the outcomes-based curriculum, there has not been much attention to the planning implications. Little attention has to date been devoted to the enactment of these lessons in the classroom, with reference to the South African outcomes-based curriculum. Therefore this study will lead to an understanding of the extent to which teacher planning meets the expectations of the curriculum of bringing about the kind of learner envisaged – one who will be infused with the values and act in the interests of a society based on respect for democracy, equality, human dignity, life and social justice (RNCS, 2004). The curriculum aims to develop the full potential of each learner as a citizen of a democratic South Africa. Taking cognisance of the notion that South Africa's educational outcomes are to be achieved through learners' involvement in solving problems, working in groups, managing themselves, communicating and relating to familiar and actual real-life situations in their classes, this study seeks to achieve more insight into the application of this principle.

1.6 LIMITATIONS

The study focused primarily on teacher planning and on how teachers enact these plans in the classroom. The learning area policies of the new curriculum in South Africa prescribe that teachers develop learning programmes that cover the content, learning outcomes, assessment standards, learners' activities and time frames for teaching specific concepts. The concept of planning in relation to OBE approaches is quite broad, and classroom implementation is also influenced by multiple factors. This study is limited to case studies of two teachers in two different school settings.

1.7 CHAPTER SUMMARY

This chapter provides an introduction and orientation to this study, raising questions about what teachers consider while planning for lessons in an outcomes based context, which factors influence their decision-making processes, and how lesson plans are turned into reality in the classroom. One outcome of the research will hopefully be to find an explanation for what the literature has reported thus far about the implementation of the South African curriculum – if outcomes are not attained in the classroom (Hattingh *et al.*, 2005), then what is really happening in the classroom?

This study intended to determine whether teachers do plan, how their plans are structured in terms of the requirements for lesson planning, and whether these plans are implemented or enacted as planned. The assumption is that if plans do specify learning outcomes, and relevant activities are designed to address them, with a certain degree of both practical and theoretical knowledge of the subject on the teacher's side, it should be possible for these policy ideals to be realised – the question that needs to be answered is whether they are, and if not, why not. The findings are significant in that they may bring about a different perception of planning and how teachers can integrate their planning in their teaching, because if lesson planning means constructing a framework to guide the teacher's future actions, then it is worth the time and effort during both the preparation and the enactment stages.

CHAPTER 2

A LITERATURE REVIEW ON TEACHER PLANNING AND ENACTMENT

2.1 INTRODUCTION

This chapter discusses the literature reviewed, in order to understand the research theories and findings as discussed by other researchers who are interested in the topic of lesson plans. The discussion focuses on the perspective on teacher planning by outlining the main findings and identifying the gaps in the knowledge base. It also sets out a developing country's perspective, for example, in Southern Africa, in terms of what has been done, particularly in South Africa. It clarifies how my research will address what is still not known about teacher planning.

The reasoning behind lesson planning has been studied extensively in educational literature (Leinhardt, 1983); however, McCutcheon and Milner (2002) assert that to date less attention has been paid to the analysis of taught lessons. This study draws on literature on the research on teacher planning in order to get an idea of how teachers plan and enact their plans in the classroom, including the preparation, enactment and lesson-analysis stages.

2.2 TEACHERS AS DESIGNERS OF LEARNING PROGRAMMES

Yinger (1980) affirms that it is necessary to plan in advance as time allocation is crucial. A learning programme is a phase-long plan that provides a framework for planning, organising and managing classroom practice for each phase (for example, Grades 7, 8 and 9). It specifies the scope of a phase, providing the pace and sequencing of activities for a year. It consists of work schedules for each of the three grades in a phase, which is then broken down into lesson plans that are structured, and systematic arrangements of learning and assessment activities that promote the attainment of learning outcomes and assessment standards for the phase, without compromising the integrity of the learning areas (RNCS, 2003).

In a study published in 2007, Hattingh, Aldous and Rogan (2007) reported that a small percentage of teachers were on track, but that many teachers still failed to interpret the learning area policy and plan relevantly, which could make the ideal goals set by the Education Department futile. One of the teacher's roles as described in the NCS is to interpret and design learning programmes and materials (RNCS, 2003). Even though policy prescribes the same planning methods and teaching approaches for all teachers, their experiences, level of experience, expertise and practical knowledge differ.

How do teachers go about their planning in an outcomes based context? The fact that policy prescribes the intended curriculum, whist the attained curriculum is influenced largely by the teachers' practical and theoretical knowledge as well as the learner component, draws attention the importance of what happens in the classroom. It is for this reason that this study not only aims to investigate teachers' perceptions and understanding of planning requirements, but also takes into account what is actually happening in the classroom. This is very significant, as the research questions are concerned both with how the intended curriculum is planned for and how lesson plans are enacted in the classroom.

Coleman, Graham-Jolly M and Middlewood D (2003) argue out that the success of the learners remains solely the responsibility of the teacher, because all learners can learn and everyone can meet a high level of competency. In South Africa, the outcomes-based curriculum is centred around learners' achieving a set of desired learning outcomes which integrates the development of process skills. The responsibility for interpreting and achieving the outcomes correctly and for developing learning activities is assigned to the teachers. They are obliged to use a variety of teaching methods and to allow each learner sufficient time and multiple opportunities to master knowledge and skills. OBE emphasises standardisation and accountability, and keeps teachers responsible for the results. It presumes that reform results from policy prescriptions and monitoring. Policy prescribes content and planning formats, thus teacher experience and teacher theorising are clearly devalued. However, teaching cannot be standardised, because teachers as professionals need to create knowledge in use as they practice.

Sardo-Brown (1988) asserts that a reflection on lesson experiences is necessary in order to improve planning strategies. The concept of constructing a framework relates to what is required by the South African National Curriculum Statement, which prescribes that teachers design learning programmes which describe what should happen in the classroom for learners to achieve the set learning outcomes (RNCS, 2003). Teachers are expected to develop a work schedule that describes an outline of the lesson activities for a year, from which weekly or daily lesson plans are drawn. Collaborative planning at school level involves teachers in a department or a particular phase (for example, Grades 7, 8 and 9) offering the same learning area, because the knowledge areas or content, skills, learning outcomes and assessment standards show progression from one grade to another. In this study, teachers' frameworks or work schedules were investigated in line with their intentions in the classroom.

2.3 THE SIGNIFICANCE OF PLANNING

According to Clark & Dunn (1991), planning is a psychological process of envisioning the future, and considering goals and ways of achieving them. Lesson planning can be defined as a systematic development of instructional requirements, arrangement, conditions, and materials and activities, as well as testing and evaluation of teaching and learning. It involves analysis of the learning needs and the development of a delivery structure to meet those needs. Schon (1983) described lesson planning as pre-active decision-making that takes place before instruction. Clark and Dunn (1991) stated that, consciously and unconsciously, teachers make decisions that affect their behavior and that of their learners. Planning a lesson involves teachers' purposeful efforts in developing a coherent system of activities that facilitates the evolution of learners' cognitive structures. The quality of those decisions and efforts depends on the creativity of teachers and on their ability to apply learning and instructional theories.

Yildirim (2003) argued that lesson plans includes writing of, and a guide to future actions. Lesson preparation is worth the time, because written plans forces teachers to carefully think on how to reach the outcome to ensure learner achievement. Research on teacher

planning revealed contrasting views on whether plans should be mental or written. Matimolane and Sanders (2004) contend that doing written lesson plans results in a number of benefits for teachers, yet a range of South African studies raise doubts about whether South African teachers are preparing adequately, especially in a manner that would be able to achieve the ideals of the curriculum. There are concerns that the planning of many teachers may be inadequate, which could be a factor inhibiting some teachers from meeting planning requirements such as designing lessons around outcomes; using learner-centred and activity-based approaches that involve the development of skills; and including continuous assessment which contributes to the learning process.

Bage (1999) reported that it is necessary and useful that plans are written as they simply reflect mental planning of the teacher, give structure and direction for the lessons taught, align assessment with lesson outcomes, maintain a productive balance in the teaching-learning process and are useful for future planning. Ornstein, (1997) reasons that there is no one ideal format to follow for a lesson plan. Teachers who plan are more effective regardless of outcome measure, than teachers who do not plan, because an activity plan does at least demonstrate a positive intention to act. Written lesson plans also provide a trail of evidence that can be used to gain insight into teachers' pedagogical content knowledge.

Furthermore, Lederman and Niess (2000), argue that as to whether a written plan increases the teacher's effectiveness anymore than a plan committed to memory does not compromise the value of planning. While teachers' written plans consist only of an outline of topics or a sketchy list of important points, it is teachers' mental plans or images that are most important in providing a picture of what is intended and should take place in the classroom. However, only few teachers seem to be doing adequate planning to achieve these benefits. According to Shavelson & Stern (1981), the key elements that necessitates planning include: using effective methods of teaching to maintain learner attention, an orderly transition between activities in positive teaching and learning environments, and dealing with the growing instructional diversity within the classroom in order to achieve goals. In their lesson planning teachers could include most of these factors, even if it means writing them down or not.

In their research findings, Lovat & Smith (2003) revealed that teachers do make plans to be enacted in the classroom for the following reasons: to obtain a sense of purpose and direction, confidence and security, and feelings of increased control. There is a lot of time and effort invested in the plan, because decisions are made relating to the sequence, organization and structuring of tasks, and the amount of time spent on each task. What occurs in the classrooms is the result of a dynamic and complex set of interactions and relationships between planning outside the classroom, action within the classroom, and reflection; both during the action and after the action is over. It also demonstrates the impossibility of separating the planning phase from the enacting phase.

2.4 THE PLANNING DEMANDS OF OBE

Borich (2000) explains that the planning demands of the outcomes-based education are that more emphasis is placed on the identification of learning outcomes, which is influenced by the teacher's knowledge of outcomes, learners characteristics, subject matter, teaching methods and personal knowledge, which develops through everyday experiences, such as observations, experiences in lesson planning and teaching-learning processes. Every lesson outcome must specify what the learners need to be able to do afterwards, be measurable and sets a standard (criterion) for its achievement (RNCS, 2003).

Dick and Carey (1996) argued that, "perhaps the best-known component of the instructional design models is the writing of performance objectives, or, as they are more commonly called, behavioral objectives" . The purpose of the specific cognitive instructional objectives is to guide the lesson-planning process. They provide the basis for designing the instructional package and developing evaluation and assessment strategies. Formulating cognitive objectives, teachers convert a set of learning needs to a set of learning objectives that indicate performance. The major goal of objectives is to explicitly describe the skills to be learned, and Mager (1984) argued that cognitive objectives in lesson plans must describe the intended outcomes of learning. Current standards-based instruction calls for observable, measurable curriculum objectives couched in outcome language such as what students will know and be able to do.

The choice of outcomes is a defining moment in educational planning. For example a lesson outcome in Natural Sciences may require learners to be able to do scientific investigations (Jacobs, Vakalisa & Gawe , 2004). The Assessment Standards for this outcome include: planning investigations, conducting investigations, collecting and evaluating data, and communicating findings. The assessment standard sets a criterion for the attainment of a specific learning outcome indicating how that achievement could be recognised or measured . Lessons, particularly in an outcomes-based context, do not all follow the same pattern. Some lessons are directed at learning of facts or rules, or the mastering of a practical skill; others promote conceptual understanding, or the acquisition of mental skills (such as problem solving). There are indeed different kinds of lessons to bring about different kinds of learning.

Lovat & Smith (2003), maintains that planning for a lesson demands much more than merely the preparation of textbook content. Instead, planning lessons involve a complex and interrelated chain of events and decisions about learning activities. In the planning process the teacher simultaneously identifies the following: learning outcomes and assessment standards or mastery level; the theme and purpose of the lesson; learners' prior knowledge; sources of information; methods of instruction or teaching strategies; appropriate materials and resources needed; key concepts; learners activities; actual assessment tasks and techniques; expectations and criteria for judging the effectiveness of planning. Spady (1994), concurs that one of the challenges of outcomes-based education is not only to integrate content-knowledge and development of conceptual understanding into the outcomes, but to find ways of choosing content knowledge. This indicates how multifaceted planning is, and therefore requires knowledge of all the interrelated components.

2.5 FACTORS INFLUENCING TEACHER DECISION-MAKING PROCESSES

Schmidt et al. (1987) identifies factors that influence teachers' content decision-making as the following; textbooks, a set of objectives outlined as policy, variation in student characteristics and performance, and their own resulting fulfillment. They further points out that even where policy specified content, teachers may still choose content different from that specification, with the textbooks having a noticeable impact on most of the teachers' content decisions. These factors are outlined as follows:

Pedagogical knowledge

McCutcheon and Milner (2002), asserts that other influencing factors include: the teacher's personal beliefs, attitudes, perceptions, teaching style, content interpretation, pedagogical and practical knowledge on classroom instruction from which interpretative skills and high quality teaching originates. Increased pedagogical knowledge of the subject matter and instruction, leading to improved quality of existing lesson plans and teaching approaches in terms of what worked or what did not, result from the teachers' self-reflection on how their plan for instruction served the aims of the lesson. Milner (2003) further argues that teacher planning depended significantly on their personal and professional experiences, which influenced how they thought about their work, negotiated curriculum issues, and enacted planned lessons. Teachers use classroom instructional methods that correlate with their personal teaching style, experiences and capabilities, than with what policy prescribes.

An essential part of teachers' knowledge that goes beyond specific topics within a curriculum is the subject matter that is to be taught. The subject matter of any area of study, in very broad terms, includes the topics, facts, definitions, procedures or algorithms, concepts, organizing structures, representations, influences, reasons, truths and connections within the area of study and the connections outside the area of study to other areas. This definition suggests that subject matter knowledge has several influences that shape the learning and teaching of prospective teachers. Ma (1999) found several parallels between elementary teachers' subject matter knowledge and the ability to function as an effective teacher within the classroom.

Teachers' subject matter knowledge influences both their actions in the classroom and their interactions with students. In many cases content knowledge is referred to as the knowledge of the subject. It is the factual information, organizing principles, and central concepts of a discipline. Teachers who lack a distinct understanding of content knowledge have troubles in other areas of teaching. Content knowledge is seen as an integral part of teaching and is needed to make effective instruction possible. Teachers' beliefs about subject matter are the ways they think about the nature of the subject in relation to how it is learned and how to facilitate learning of content by the learners.

Similar to the syntactic structures of teachers' knowledge, teachers' discipline, beliefs and experiences play an important role in their teaching (Ma, 1999). Subject matter knowledge (SMK) plays several important roles in teaching. For example, a limited knowledge of a topic can cause a teacher to be unable to define a learner's mistake and therefore fail to resolve this problem. Limited knowledge in the subject matter can cause teachers to be uncomfortable when using alternative materials, or to use these tools in a way that can cause learners to have incorrect ideas about the topic. Ma (1999), also stated that pedagogical knowledge does not make up for limited SMK. For example, teachers with limited SMK may be unable to address students' non-routine questions, or plan exploratory tasks that connect substantive structures in the subject.

Subject matter knowledge, pedagogical knowledge, and curricular knowledge are seen as domains central to teachers' knowledge base. Shulman (1987) lists the components of SMK as part of the knowledge base that underlies teachers' understanding, needed to promote comprehension among students. Again, teachers' SMK is shown to be essential in helping learners to understand. (Mullis et al., 2000) reported that, "average subject achievement of learners is related to how well teachers felt they were prepared to teach the subject, with higher achievement related to higher levels of teaching confidence in their preparation to teach".

Content decisions

In a study, Zahorik's (1975), revealed that most teachers begin their planning process with a consideration of content, which tends to be problematic if content is then emphasised over the objectives. However, Schmidt and Porter (1987) argue that content, which serves as the basis for instruction, can be decided prior to actual teaching. How teachers decide on the content to teach and from where they draw this content is another consideration for planning. A prerequisite for effective lesson planning is that teachers should understand the subject matter.

During lesson planning, content must first be analysed and then organised in such a way that learners can make sense of it in a meaningful way. Learners are also expected to link content to their prior knowledge and experience. According to OBE policy, planning should start with the objectives, where the teachers first decide on the learning outcomes intended for the lesson, as well as the assessment standards that describe the achievement of the learning outcomes. The teacher can then refer to content when selecting the relevant learning activities (RNCS, 2003).

Lewis (1994), revealed that teachers depended on the published materials in significant ways and most of the activities were adapted in some way. What teachers actually do is adapt curriculum materials, lesson plans, unit plans, and assessments to be appropriate for their own learners, contexts, objectives, and styles, both while planning and during enactment. This new emphasis on teacher planning has important implications for educational reform because, as McCutcheon and Milner (2002) put it, it is ultimately only through teachers' plans that reforms and policies are put into action. This is connected to a gap between theory and practice, and also between teachers' thinking and teachers' acting, as a result of failure to recognize teachers' work and professional knowledge. What is needed is a shift in focus from seeing planning as a preparation for practice, and not as a practice. Carlgren (1999) concurs that the practice of planning is as important as the practice of teaching, and it can be done within teacher education.

Yildirim (2003) found that some teachers complained that the curriculum does not guide them enough, hence switching from a content-based teaching approach to an outcomes-based one is still a struggle for many. Training on the curriculum was also reported to be inadequate, meaning that to a certain extent teachers had to apply their practical knowledge. Although the responsibility to design learning programmes offered in a school lies with the teachers of that school, the Provinces have to provide teachers with guidelines that they have to observe to compile these learning programmes. The Provinces also need to guide the implementation of learning programmes in accordance with the National Curriculum Statement and the Learning Area Statements.

It is clear that the changes which are required to conceptualise teaching as an interactive activity in which both the teacher and the learner participate in the teaching and learning process are not adequately described in curriculum documents (Nakabugo and Siebörger, 2001). Setting old and new practices in opposition to each other also obscures the reality that there is a gradual movement from one towards the other, which might be facilitated at times by new insights and perceptions. If planning methods are to make the desired impact in classrooms across the country, much closer attention will have to be paid to what happens in the classrooms at present and to the ways in which to facilitate meaningful changes successfully.

An OBE approach accords well with planning for lessons to ensure content coverage, as well as acquisition of knowledge and skills by the learners through the achievement of the set outcomes. The main focus of this study is to explore how teachers respond to the OBE planning demands, and the impact they have on their classroom practices in relation to enacting the planned lessons. The literature review therefore had to consider teachers' decision-making processes as they visualise the future and construct a framework to guide their future actions, which is eloquently defined in the conceptual framework. This relates to what the curriculum envisages, by specifying the development of learning programmes as a teacher's primary role. The study aims to facilitate an understanding of the participants' experiences as they are articulated in the findings.

Teacher planning was considered from different perspectives, considering the fact that teachers may choose the objectives-first or rational model (Tyler (1950), or Yinger's (1980) process model, where content, goals, knowledge and experience are combined to yield an initial conception of an activity worthy of consideration. The relationship between the curriculum's emphasis on outcomes, teachers' decision-making relative to their selection of content, learning activities, the available resources, and allocating time in a changing classroom environment is influenced to a large extent by learner behaviour. These relationships were explored in order to clarify the factors that would possibly have an impact on the conception and experience of the participants in relation to the planning demands of an outcomes based curriculum. The enactment of the planned lessons in the classroom were further observed to establish the extent to which lesson plans are turned into reality.

Policy

A number of factors influence teacher planning, both internally and externally (Lovat & Smith, 2003). The education system is one of the important factors in defining a teacher's curriculum decision-making ability. The teacher perceives that the system has already made decisions concerning the syllabi, curriculum documents and policies of the education system in which they work. Smith (1983) believes that teachers perceive these documents and policies as restricting to decision options about what information and knowledge have to be taught; what learning outcomes must be achieved; the sequence of topics; time spent on each topic; how assessment and evaluation will take place; selection; and the use of resources for teaching. Bage (1999) made a strong argument that policy-makers should build from teachers' natural diversities and avoid attempting to standardise their planning.

Hiebert and Stigler (2000) made it clear that teacher planning is to a lesser extent integrated within most education systems, as planning requires significant time on the part of the teachers as curricula are developed and implemented. They further indicated that, "many teachers do not even prepare lesson plans, at least not around learning goals". Kennedy (1994) suggested that experienced teachers do not use instructional design features in a written form of lesson planning. Teachers' records of their lesson plans are sketchy, quite brief or cryptic shorthand (Reiser, 1994).

According to McCutcheon (1980), a number of practical realities hinder effective teacher planning, such as; the gap between the national curriculum and the classroom needs; tension between instruction and planning; difficulties in using the standard format for preparing plans; level of detail required; developmental level of the teacher, shortage of time and resource; classroom management; and lack of guidance and collaboration among colleagues. All these problems have the potential to decrease the effectiveness of teachers' planning practices, and as a result, plans may not fulfill their intended functions.

Yildirim (2003) observes that teachers make their own reasoned decisions about whether to implement recommendations on policy or texts or use both in an interrelated manner. During the planning process teachers alter and modify the curriculum. This allows the teacher opportunities to formulate decisions about the curriculum's pace, sequence, and emphasis. Teacher planning, therefore, is a major determining factor of what is taught in schools. Teachers' own decision-making skills and content knowledge enable them to examine existing textbooks and interconnect concepts that their learners need to learn. In the South African curriculum, content is specified in Departmental Learning Programme Guidelines, which to a large extent prescribes what teachers must teach. This to a certain extent limits the teacher's capability of adapting available resources to achieve the outcomes planned for, whilst employing a learner-centred teaching approach.

The research of Bage (1999), done on the English National Curriculum revealed that teacher planning remains a complex and individualized activity. Teachers' views of planning contrast with policy specifications on planning procedures and formats, particularly in an instance where, behavioral objectives; students prior knowledge and skills; learning activities; assessment opportunities and learners' needs must be specified. Outcomes should be evaluated in an attempt to standardize their planning.

2.6 THE CONCEPTUAL FRAMEWORK

The conceptual framework for this study is drawn from the framework developed by Clark and Peterson (1986), who defined planning as a basic psychological process which allows the teacher to visualise the future and construct a framework to guide his or her future actions. In this study, this framework is used to analyse and explain the decision-making process teachers engage in during planning, with the intention of enacting this plan in the classroom.

This theory was essential for this study because the switch from a curriculum where subject syllabi were more teacher-centred and prescriptive to an outcomes-based curriculum has placed increased planning demands on teachers. The focus of the study is on how planning with the outcomes in mind will turn out in the classroom situation during enactment. This framework is aimed at constructing a new understanding of the correlation between planning and enacting lessons in the classroom within the context of an outcomes based instructional approach. This study aims at analysing teacher's decision-making processes relating to an outcomes based curriculum.

Clark & Peterson (1986) note that teacher planning has been documented as a significant area in which teachers make a wide variety of decisions about lesson activities that will lead to the attainment of the desired learning outcomes. Looking at it as a psychological process that depends on the teacher's decision-making skills, Piaget addressed the issue of planning in terms of means-end behavior, which eventually becomes consciously anticipatory. Lesson planning and teaching itself involves cognitive thinking where teachers make pedagogical decisions on how to act and reason in a rapidly changing classroom context, in order to promote learning. Teachers' plans serve as a mental script or image which guides their interactive teaching. They envision themselves enacting the plan, what they will say, ask, use as materials and how to deal with potential difficulties (McCutcheon, 1980).

Planning can be conceived as a hierarchically organized sequence of actions, both cognitive and behavioral, directed towards a goal. The concept of planning has as a central feature the constructs of thinking ahead, goal setting, and using systematic

strategies to achieve goals. There is a general agreement that plans are goal-directed and that purposeful actions usually continue until the desired goal is attained. Objectives means something aimed at, goal or aim. Outcomes mean results or visible effects of an action or event (Cohen, Bronson & Casey, 1995).

The South African outcomes-based education policy prescribes that lesson planning should begin with identifying the outcomes first, followed by identifying activities that are content-based and that will address the selected outcomes and ensure their achievement (RNCS, 2003). In other words, outcomes can be defined as objectives or goals. The literature explains the concept of teacher planning as a cognitive process in which teachers make decisions on how they will act to attain specific outcomes. The literature also indicates two ways in which teachers can approach instructional planning: teachers can either select outcomes or objectives first, or they may consider content, goals and knowledge concurrently in the process.

Shavelson & Stern (1981) reason that, because teaching takes place in a complex, uncertain and rapidly changing social environment, teachers tend to construct simplified models of reality as a basis for decision-making. In terms of instructional planning, teachers do not appear to follow widely advocated objectives-first models. First proposed by Tyler (1950), the objectives-first, or rational, model consists of a sequence of four steps: specify objectives; select learning activities; organize learning activities; and specify evaluation procedures. Another model of teacher planning that has recently been proposed is Yinger's (1980) process model, where teachers approach planning as a three-stage problem-solving task: content, goals, knowledge and experience combine to yield an initial conception of an activity to be implemented, with emphasis on evaluation of the routine to the teacher's acquired knowledge and experience.

Research has shown that instead of following the objectives-first model, most teachers plan activities that will fill available instructional time (Zahorik, 1975). McLeod (1981) found that teachers attached importance to behavioral objectives, though not as the starting point for planning. Sardo-Brown (1988) confirmed this finding in a study that many teachers did take objectives into account at some point in the planning process. Desforges (1995), remarks that research on the development of teacher knowledge has persistently drawn

attention to the extensive knowledge base of teachers in respect of cognition-laden activities such as planning and evaluation. Based on this understanding, this research will investigate teachers plans and their enactment in the classroom, in an outcomes-based context. Even though policy prescribes the selection of learning outcomes prior to content, lesson planning itself is a decision-making process which is largely influenced by teachers' own cognitive, behavioural, attitudinal and conceptual frame.

In another proposed model of planning, Leinhardt (1983) postulates that teacher planning is governed by an implicit set of activity outline or mental scripts for executing interactive teaching. Because these mental scripts are so well rehearsed, teachers have little need to elaborate on them during planning. Consequently, teachers concentrate on forming schedule during planning, focusing on the sequencing of goals, content and activities.

McCutcheon (1980), points out that teachers rehearse plans mentally to anticipate problems or to elaborate on initial ideas. They may consider the steps of the rational model at some point during planning, but do not use an objectives-first approach. They select from conveniently available sources, such as teachers' editions of textbooks or curriculum guides, those activities that they believe will engage student attention. Written plans are nested within more comprehensive mental plans or lesson images, and the fact that certain planning elements are not part of written plans should not lead to the conclusion that they are not important components of planning. For example, objectives may not be part of the teacher's written plan, but becomes part of their lesson images. Another point is that mental planning is not recognized by theoreticians or teacher educators as an important or legitimate part of planning. Yet, mental planning is probably the part of teaching that has the potential for being the most professional activity of teaching, for it gives teachers the opportunity to relate theoretical knowledge to particular cases.

Teaching as a practice involves making decisions about the what and how of learning. What factors do teachers consider when planning and during the actual enactment of learning activities, which is to some extent influenced by learner behaviour? The assumption is that the ultimate outcome of the lesson is important, without disregarding the

hierarchical organisation of decisions in teaching. The intention of the policy recommendation that learning outcomes be identified first is to ensure that the content and learning activities that are consequently selected will then address the outcomes and ensure their attainment (RNCS, 2003).

This undertaking anticipates the transition from content-based teaching (which is teacher-centred and textbook-oriented) to a more learner-centred approach. So, for example, in Natural Sciences, if the learning outcome states that learners must plan, conduct an investigation, discuss and record their findings, then the teacher will select the relevant content knowledge and activities that will lead to learners' acquisition of related skills. The learning outcomes and their assessment standards have the knowledge and skills embedded in them, and will therefore guide the teachers in terms of employing an outcomes based teaching and learning approach.

As Brumfit and Rossner (1992) point out, teaching is a process, which, like most human activities, depends on making choices of various kinds: choices of materials, activities, approaches, and so on. Decisions are constantly to be made, sometimes to eliminate alternatives, sometimes to arrange different activities. They claim that the number and the nature of options available to the individual teachers will depend in part on the amount of practical experience teachers bring into their tasks. They refer to a hierarchical organization of decisions in teaching, where decisions about approaches come first, decisions about syllabus design next, and materials construction and classroom management last. Teachers, particularly experienced ones, know a lot about pupils, class management, academic subjects, representation of concepts and the promotion of classroom work. Experience does make an enormous difference on making right decisions at the right times.

According to Nunan and Lamb, (1996) planning for teaching includes at least three elements: a knowledge of the students and their needs, a set of goals and objectives, and a personal view of the nature of learning. More specifically, the decision-making points in teaching can be listed as: objectives, content, tasks for the day, evaluation, classroom talk, instruction methods, error correction and feedback, questions, assignments, dealing with

behavior problems, teacher and learner roles, small group and pair work, large classes, one-to-one instruction, self-directed learning, mixed-level groups, motivation, anxiety, and attitude. Teaching is viewed as a decision-making process based on the various categories of knowledge, skills, attitude and awareness. Teachers are therefore decision-makers who process information and act upon those decisions within complex environments. They need to know the tricks of their trade, but they also need to know why they do what they do. This implies that the outcome of the lesson will depend largely on the interaction between the teacher and the learners, striving towards achieving a common goal, or solving a problem during the teaching-learning process.

The central core of a model teacher's decision-making process needs to include what is observed in the actions and events that occur in the classroom. When it comes to immediate decision-making in the classroom, the goals in teachers' minds may be affected by how the present situation is perceived by them (Woods, 1996). This constant monitoring of the current state, which affects subsequent choices in behavior, links the goal and current circumstances. Moreover, these comparisons of goal states and current states can be embedded. The ultimate goal state can be broken down into components, creating sub-goals and producing a hierarchical organization of goals. That is to say, a teacher sometimes decides to make a decision on the actual time and place of teaching according to the present circumstances. One action leads to another through the processes of planning and understanding or interpreting. An individual's action is a part of a larger event which results, and which also includes others' actions and unforeseen consequences.

From the study on the extent to which teachers used their lesson plans, Richards (1999), found that teachers tend to divert from it at the time of teaching and make instant changes in their lesson plans. Departing from the lesson plan at the points where interactive decisions had to be made during teaching, happen such that time can be used more efficiently, modifying activities to raise interest level and elaborating activities due to pedagogical reasons. Any interactive decision made during teaching would mean a change in the lesson plan. The changes are usually not major ones; they are probably best characterized as fine-tuning of the original plans.

Flood (2003) noted that learner behaviour tends to play a major role in teachers' interactive decision making. The research suggest that often, this behaviour is intended to reduce the complexity of classroom work, and to make classroom life less demanding. Doyle and Cater (1984), from their observational study noted significant changes from the time the task was introduced by the teacher to the time it was accomplished by the learners. The teacher did an increasing amount of work for the learners by specifying the features of the acceptable product, hence the task became less ambiguous and more explicit. These changes were brought about largely by the learners as they influenced task demands by asking questions about content and procedures in order to elicit clarifying instructions from the teacher.

Clark and Peterson (1986) define interactive decision as a deliberate choice to implement a specific action. An interactive decision is a continuous choice between continuing to behave as before and behaving in a different way. As has been noted above, teachers' plans are not always implemented as the teachers intended. Teachers need to decide on what works best for them in terms of the achievement of the intended outcomes.

The literature differentiates between planning that is objectives-directed and the one that is learner-focused. The challenge remains that the attainment of outcomes is as important as the learners' conception of the knowledge and skills. Another essential feature that teachers have to consider is the content knowledge that must be covered within specified time frames, as outlined in the work schedule. For example, in Natural Sciences, there are four knowledge areas which integrate physical, life and geographic sciences; and these must be completed as scheduled within the school terms in a year. Therefore it becomes imperative for the teacher to make decisions that will integrate all these elements.

It has been reported by Peterson et al. (1978), that planning directed primarily to content and objectives was associated with "subject-matter focused teacher behaviour and with a somewhat rigid pattern of instruction. In contrast, planning that dealt with the learner was positively related to teacher behaviour classified as "group-focused". Zahorik's (1975) study of teacher planning supports the relationship between planning directed to content and objectives and rigid patterns of instruction. The study compared the effects of structured planning with the absence of structured planning on teachers' classroom

behaviour. Teachers who were given structured lesson plans did not encourage or develop learners' ideas as much as the teachers who did not have the opportunity to plan. They also did not foster discussion as well. One possible explanation for this finding is that teachers without the chance to plan had no choice but to explore learners' ideas and experiences whereas those who knew the topic in advance were able to focus on content rather than on the learners. This study also suggests that when planning becomes too structured or too task-oriented, it can lead to instruction that is rigid and unresponsive to learners. This method could make the teacher focus more on the plan, to be purely task-oriented, rather than on learners' behaviour. This implies that less interactive teaching would be allowed. Conversely, focusing on the learners could lead to allowing a lot of questions and discussions, which could take more time, and as a result the planned activities may not be completed (Zahorik, 1975). Looking at the importance of both content coverage and learners' needs suggests that a balance be maintained between the two.

The South African National Curriculum Statement and its revision puts an emphasis on planning, as a way of ensuring that each teacher develops a framework that includes objectives or outcomes, content, assessment tasks and strategies, resources and time allocation. Thus the teacher becomes knowledgeable about the content which must be completed within a specified time. This can be regarded as a structured way of planning which compels the teacher to cover all the content, use the available resources, assess learners, and use different approaches to cater for learners' various abilities.

Clark & Elmore (1981) reported that teachers develop a framework of plans for the structural and social features of the classroom, within which particular units and activities are planned for the school year. Daily planning is conducted within the context of weekly, unit, term and yearly plans. Sardo (1982), asserted that teachers have different planning styles that cannot be completely captured in a general portrait. Teachers consider unit planning as the most important type of planning: they view daily lesson planning as much less important. Unit planning is defined as a cyclical and an incremental process that begins with a general idea and moves through phases of successive elaboration. In making those plans, teachers seem to respond differently to several pressures. For most teachers, standardized and curriculum-based tests exercise a powerful influence. For others the textbook is the primary determiner of what is taught. For most secondary

teachers, their own knowledge and experience is dominant, with the district's curriculum guide exerting only a modest influence on their decisions. How then does the teacher integrate all these essential elements, and achieve the desired goals in OBE?

Although these plans for work are usually not implemented with a high degree of commitment (Zahorik, 1975), the evidence suggests that long-term and short-term plans are important. Sardo (1982) explains that teachers' yearly, quarterly, and unit plans are the main means by which teachers make decisions about content selection and time allocation. Research on teacher effectiveness suggests that learner achievement is higher when teachers deal with the prescribed content and allocate time consistent with district priorities (Sardo, 1982). Well-organised instruction pays off. While there is no proven direct relationship between the quality of the written lesson plans and the organisation of the taught lesson, it seems safe to conclude, as Clark and Peterson (1986) do, that teacher planning does influence opportunity to learn, content coverage, grouping for instruction, and the general focus of classroom processes – all important elements of effective teaching.

Policy prescribes three levels of planning in a school year, meaning that teachers must develop a long-term learning programme for a phase (for example, for Grades 7, 8 and 9), a work schedule per grade and lesson plans on a short-term basis. A learning programme is a combination of the work schedules for the three grades in a phase. It provides a framework from which detailed lesson plans are drawn, specifying learning outcomes, content, learning activities, resources, assessment tasks and time allocation. It is a policy recommendation that plans should be written, and that collaborative planning for the following year should be done at a phase level, in order to reflect on planning as a practice and to also make improvements (RNCS, 2003).

One of the challenges teachers face is to develop learning programmes, and enact them in an OBE classroom context. This means that teachers have to adapt their planning, as well as their teaching methods. The processes that occur in the classroom are influenced to a large degree by a number of factors that the teacher may not be able to control fully, which makes it essential to plan.

In order to meet policy demands, it is necessary that teachers develop lesson plans to guide their future actions. Policy also provides a full layout of the core knowledge areas or content, and also puts an emphasis on planning. To what extent do teachers manage to meet the ideals of the curriculum in a learner-centred classroom environment, taking into consideration the decision-making processes that they engage in during planning? This study investigates the decision-making processes of teachers in an outcomes based context which advocates the selection of learning outcomes prior to content, and carrying out activities or tasks that will ensure the achievement of the intended outcomes. The conceptual framework is used in this study to attempt to explain two teachers' planning experiences and the extent to which they can translate their lesson plans into classroom practice.

2.7 CHAPTER SUMMARY

The study aimed to provide deeper insight into the planning demands of OBE by taking a cognitive approach to study how teachers attempt to realise the ideals of curriculum policies. In this regard, the broader literature on teacher decision-making was reviewed, particularly in terms of the factors that influence the lesson preparation and its implementation, as well as interactive decisions made during the lesson. Most of the studies drew attention to the following points: decisions about lesson activities; planning elements: objectives, content, assessment activities, or tasks; teachers' dependence on the published materials; teachers' personal and professional experiences; written plans versus plans committed to memory; and learner involvement.

This literature review suggests that very little is known about how teachers make their decisions when faced with a different teaching approach as well as planning methods. There is not a full understanding of how teachers deal with the challenges that the OBE curriculum brings, taking away the dependence on texts and having to plan with outcomes in mind. Teachers are expected to refer to a variety of resources to design their own learning programmes, which must in turn outline learning activities meant to address the prescribed content in a given time frame. Acquisition of the desired knowledge and skills by the learners in a learner-centred teaching environment is of utmost importance. The

review has highlighted the need for this study to examine to what extent teachers turn the ideals of policy into reality, right from the planning phase to the enactment stage, noting that a number of factors influence their decision-making processes.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter describes the research process that structured this study. It presents the research design, strategies for sampling the participants, and the data collection methods used in the study. A qualitative inquiry was done to capture the lesson planning decision-making processes, understandings, experiences and practices of two teachers in relation to the new planning demands of an OBE teaching approach in the South African curriculum.

Qualitative research aims to gather an in-depth understanding of human behaviour. It relies on reasons behind various aspects of behaviour. Simply put, it investigates the why and how of decision-making, not just what, where, and when. Hence, the need is for smaller but focused samples rather than large random samples. Qualitative research categorizes data into patterns as the primary basis for organizing and reporting results (Woods, 1996).

The reason for choosing a qualitative methodology was that the research process occurred in a school as an educational institution, and that the teachers as individuals who have a core duty and a responsibility to teach are a diverse group of professionals with different personalities, ideologies, values, abilities, perspectives, needs and experiences. According to Bogdan and Bicklen (1982), a qualitative methodology enables researchers to view experiences from the participant's perspectives. Therefore, the method was chosen to enable the researcher to capture each teacher's perspective.

This research involved a comparative case study of two teachers' decision-making processes during planning and how they enacted these lessons in the classroom, within an outcomes-based, learner-centred environment. Therefore, the methods for gathering information relied on multiple sources of evidence. These included direct observation,

in-depth interviews, and analysis of documents and materials. As a result it was possible to gain a sharpened understanding of why the investigated processes followed the paths they did, and what might become important to look at more extensively in future research. The research process involved investigating each instance within its real-life context.

3.2 RESEARCH PURPOSE

As was indicated in Section 1.4, this research was conducted to find answers to the following questions:

- Research Question 1: How do Natural Sciences teachers plan for their lessons or learning programmes in an outcomes-based curriculum?
- Research Question 2: To what extent do Natural Sciences teachers translate their lesson plans into classroom practice?

3.3 RESEARCH DESIGN

This case study followed a qualitative approach as the best way to investigate the subjective experiences and thinking of teachers is an in-depth, interpretative design, as advocated by Woods (1996). The study investigated only two teachers, in order to obtain an in-depth analysis. A case study design was employed in order to gain insight and deeper understanding of the factors that influence teacher planning and the enactment of these plans in the classroom. Case studies have been increasingly used in education. It is a valuable method of research, with distinctive characteristics that make it ideal for many types of investigations. According to MacMillan and Schumacher (2001), a case is a tool with which a researcher selects to gain an in-depth understanding of participants or documents for study. This method examines a case over time in detail, employing multiple sources of data found in the setting.

The aim was to obtain a detailed description of the context in which teachers function. Qualitative research describes and analyses people's individual and collective social actions, beliefs, thoughts and perceptions - data is collected by interacting with selected persons in their settings and by obtaining relevant documents. According to MacMillan and Schumacher (1997), qualitative research is concerned with understanding the social phenomenon from the participants' perspective. Understanding is acquired by analysing the context within which the participants operate and by narrating the meanings participants' attach to these situations or events.

Qualitative studies tend to be field-focused. As in most research done in education, it was required of the researcher to go out to schools, visit classrooms, and observe teachers. The researcher was physically present to observe and interpret behaviour, gain more insight, and obtain meaning from events as perceived by the participants.

Data was collected through ethnographic interviews, non-participant observations, as well as document analysis, as proposed by White (2005). This research produced descriptive data (Erickson, 1986) of two teachers' lesson plans and their expression in spoken words of their experiences relating to enacting the planned activities. Both teacher and learner behaviour were observed in the classroom, in order to gain a better understanding of the teachers' decision-making during planning in the learning area, Natural Sciences.

3.4 SAMPLE

The data gathering took place in 2006. Two Grade 7 teachers were selected from two schools in the Rustenburg Project Area, Bojanala West Region, North West Province. The two teachers were in their first year of implementing the Revised National Curriculum Statement with Grade 7 learners in 2006, which was the first year of the implementation of the new curriculum after its revision. Convenience sampling was used because the respondents could be accessed easily and conveniently in their natural settings, being the schools in which they teach.

For the reason that primary school teachers (Grade 1 to 7) had been engaging with C2005, since its introduction in 1998, Grade 7 teachers were the most optimally suited for my inquiry into teacher planning and decision-making in a curriculum that is outcomes-based. Both teachers had received the same training for NCS as conducted by the Subject Advisors in the District.

In order to gain a better understanding of the planning decision-making of my participant teachers, I confined this study to the learning area with which I am academically experienced in, namely *Natural Sciences*. My experiences in the teaching profession both as a teacher and a subject advisor for Natural Sciences, led to the assumption that I could understand the participants' views and perceptions in terms of how they plan and enact their lesson plans in the classroom.

The participant teachers differed with regard to their teaching experiences in Natural Sciences. The two schools have been in existence for more than 20 years, and differ in terms of the grades offered, the demographics and the availability of resources. The purpose of working with two teachers from varied backgrounds was to enrich data, as their school backgrounds differ. A thorough analytical study of each case was done, in order to gather rich information in a small sample size, as recommended by McMillan and Schumacher (1997).

Tirelo[*], a black female teacher, had already been teaching for 13 years (first, Mathematics and then Natural Sciences for three years). Tirelo holds a Diploma with specialization in Maths and Science. *Thuto** Middle School is situated in the township, which is a previously disadvantaged black community, with 100% African, Setswana-speaking staff and learners. The school is moderately resourced, offering only the senior phase, Grades 7, 8 and 9. *Thuto* Middle School has enrolled 810 learners, and does not have a Science laboratory. The middle school structure was established in the former Bophuthatswana homeland system.

It was *Brian*'s* third year as a Natural Sciences teacher, after he had worked as a Science teacher for five years after completing his BSc degree. *Platinum** Primary is a former

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Model C, English-medium, well-resourced, multiracial school situated in town. Its staff is 97% non-African, and it admits learners from Grades R to 12. The school has enrolled approximately 1 100 learners.

Ethical considerations regarding the personal nature of the qualitative research required that the researcher ensure that the rights, confidentiality and dignity of the respondents be protected. Hence, names were changed as indicated by an asterisk.

3.5 DATA COLLECTION

The purpose of this study was to understand the extent to which teachers plan and enact their planned activities in the classroom. Data was collected for two school terms, by means of audiotape-recorded interviews, classroom observations and an analysis of documents. Semi-structured biographical interview sessions were conducted that lasted for about two hours, to obtain information on the participants' teaching qualifications, experiences, perceptions of the teaching of Science, interpretation and implementation of curriculum policies relating to the RNCS, as well as formats and factors that influence their planning.

3.5.1 Lesson observations

Twenty-five lessons were observed that each teacher presented with one class of Grade 7 learners, as the new curriculum was being implemented in this grade for the first time after its revision. The purpose of the lesson observations was to get an understanding of how learners engage in activities, and how the teacher guides and drives them towards the enactment of his or her own plan, taking into consideration the time allocated and the outcomes to be achieved. The observations were not video-recorded, but an observational schedule was used and notes were taken of both the teachers' behaviour and the decisions made as the lesson progressed.

3.5.2 Pre- and post-lesson interviews

Prior to each lesson an interview was conducted in order to understand what the teacher actually planned to do in that specific lesson, how activities would proceed, what interaction the teacher anticipated with the learners, as well as factors influencing such decisions. The researcher gathered information on the envisaged lesson outcomes, the content to be taught, worksheets or textbook activities, apparatus for experiments, and the time allocated for the lesson.

Post-lesson interviews were intended to follow up on the teachers' thinking during the lessons, factors that influenced the lesson activities, dealing with learners' behaviour in relation to their level of comprehension, the type of questions they asked, and the extent to which spontaneous changes had to be made in relation to that.

Another reason for the post-lesson interviews was to obtain a reflection of time management in relation to OBE approaches that are learner-centred and activity-based. The teacher could immediately reflect on the lesson and make inputs as to the extent to which the initial intention was realised, as well as express a personal view on the teaching-learning process. The researcher could also ask questions to establish the extent to which the teacher valued the completion of specified content as part of the weekly planning, in order to determine whether the term's teaching schedule was adhered to or not.

The data was enriched by the pre- and post-lesson interviews, because they provided insight into the teacher's planning regarding the instructional decisions that teachers make in relation to various levels of planning (decisions about the learning programme, work schedule and lesson plans), the intended outcomes, the choice of content, the learner activities, teaching strategies, assessment, time allocation and the use of learning materials. Lesson preparation represented the smallest unit to reflect a first-hand experience with all the cognitive dimensions and practical stages that accompany the learning process in Natural Sciences. Interviews were the best method of collecting data for this question because they provided the most direct evidence of the teachers' intentions about the teaching-learning process.

3.5.3 Document analysis

An analysis of the teachers' work schedules and lesson plans during the data collection process was conducted, in order to establish the type of decision-making processes that are reflected in their planning. A work schedule is a year plan that indicates the core knowledge (content), learning outcomes, assessment standards, teacher's activities, learners activities, resources, assessment tasks and the time allocated. The work schedule subdivides the content to be taught on a term basis - a year has four terms. It serves as a pace setter to ensure that all the content is taught in a year. In the 40 teaching weeks that are allocated in a year, time is used for teaching and examinations.

A lesson plan includes what is in the work schedule, but describes the learners' activities in detail, explaining exactly what the learners will be doing for the time allocated. A lesson plan is a smaller planning unit and is a short-term tool. It can be for a day or a week, focusing on a specified topic. An analysis of a lesson plan, whether it is written or not, gives an understanding of what the teacher envisages achieving with a lesson.

3.6 DATA ANALYSIS

McMillan and Schumaker (1997) claim that qualitative data analysis is primarily an inductive process of organising the data into categories and identifying patterns or relationships among the categories. In this study, data was analysed by listening to the audio-taped interviews, with written notes categorised into units according to common themes. Field notes prepared from observations were also used as important tools to identify factors influencing teachers' decision-making processes during planning, as well as during the enactment of the lesson.

Data collection and analysis were done concurrently throughout the entire research process, so that emerging themes from the analysis of various incidents influenced subsequently the data collection approach and created an opportunity to expand on issues or obtain more clarity. Smit (2001) refers to such data analysis as an ongoing and emerging process.

The researcher initially analysed the data from each of the two cases separately, noting similarities and differences between how each teacher understood the concept of planning, how each one prepared for lessons, the considerations taken into account and the enactment of each lesson in the classroom. Based on the intensive content analysis of each case study, a cross-case comparison was made to answer the research questions listed in Section 1.4 above.

The findings from the comparisons and contrasts in the data obtained are used to highlight the individual and interrelated planning methods and approaches, in relation to lesson presentation. The findings are discussed in detail to show the extent to which teachers reflect on enacted plans, their subject-matter knowledge as well as their experiences with learners, balances out in their attempt to achieve the outcomes set during the planning stage and the coverage of the content.

3.7 VALIDITY

The issues of validity in terms of a true reflection of teachers perceptions and behaviour should be taken into consideration in relation to capturing the true meanings of the responses from the participants' perspectives (Cresswell & Miller, 2000). The main threat to validity is that the observer may be biased and tries to dominate the participants' perspectives. The observer can also have an influence on the participants that may result in data that is distorted. It is difficult in qualitative research to eliminate completely the human element and influences emanating from the side of the observer that can alter the data.

In this study, the following mechanisms were used to recognise and reduce the threats to validity. Firstly through prolonged engagement and persistent observation in the setting I was able to build resonance with the participants'. Secondly I made extensive descriptions of the circumstances under which teachers function. Thirdly I obtained instant clarification or verification of responses, in order to capture the participants' understandings and the meanings of their decision-making processes. The participants' were made aware that they

had to behave as they normally did in their natural settings, because the observations were being made from a research point of view and not for curriculum-monitoring purposes. Multiple research strategies were employed, including pre- and post-lesson interviews, extensive classroom observations, recall sessions, field notes and a thorough analysis of teachers' lesson preparation files. To a large extent, this approach assisted in obtaining a full picture of the participating teachers' decision-making processes with regard to planning for their lessons and how they enacted these plans in the classroom.

3.8 CHAPTER SUMMARY

This chapter explained the research design of the present study, approaches, procedures, strategies and the validity of the data collected. The qualitative research design that was adopted enabled the study to focus on the concept relating to the decision-making processes of teachers as they visualise the future and design frameworks or plans that will guide their future actions. The analysed data are reported in the next chapter.

CHAPTER 4

FINDINGS

4.1 INTRODUCTION

This chapter presents the case studies of two teachers with the intention of revealing teacher understanding and decision-making when planning for lessons in accordance with an OBE approach. The case study report commences with descriptions of both teachers, followed by the institutional context in which the teaching and learning processes occur, under the following main topics:

- How does the teacher plan for lessons in an outcomes-based curriculum?
- To what extent does the teacher enact the lesson plan in the classroom?

An interpretation of the evidence generated from the data unpacks the teachers' understanding of what the expectations of the curriculum are in terms of planning, and the decision-making processes that they engage in as they visualise the future and develop a framework that will guide their future actions. In conclusion, the main factors that influence the teachers' planning decisions and the enactment of these lesson plans in the classroom are reflected upon.

4.2 TIRELO'S CASE

4.2.1 Personal information

Tirelo* is a 36-year old, Tswana-speaking, Christian, South African black female. She holds a three-year Diploma in Education from a College of Education, with Mathematics and Science as her major subjects. She furthered her studies on a part-time basis and acquired a Higher Education Diploma from a university. She started her teaching career in 1993, and had been teaching for 13 years by the time the data for this study was gathered. Her reason for deciding to study education was that she was inspired by being a Mathematics and Science student herself, thus she felt she could study and teach the subjects. It was affordable at that time to study at a College of Education that was near her home town, so that she could cut down on accommodation costs.

She had been teaching at Thuto* Middle school for three years when the study was done, and that is where she started teaching Natural Sciences in Grade 7. She had previously taught Mathematics at another middle school for ten years. In the next year, she would proceed with her learners to Grade 8. There are five Grade 7 Natural Sciences classes in the school, with 50 to 57 learners per class, all of whom she was responsible for. She participated in the learners' extramural activities as a netball coach, and also assisted in athletics.

With regard to her teaching career, Tirelo said she was content. She indicated that she found Natural Sciences challenging, as it was then her third year of teaching it, after many years of being a Mathematics teacher. To take up the challenge, she prepares thoroughly, refers to various sources and adheres to the scientific approach of imparting practical skills to learners. Since she was in her third year of teaching Natural Sciences in Grade 7, she said she felt she was familiar with the subject and was ready to proceed with her learners to Grade 8, and up to Grade 9. Tirelo also commented that she liked teaching Science and enjoyed it. What made it challenging was that learners indicated that they had some prior knowledge of Science from their daily experiences, which they then constructed into scientific concepts and schemata.

Thuto Middle school has been in existence since 1980, offering Grades 7, 8 and 9. The school started with only ten classrooms and three management offices. One of the classrooms that was intended to be a Science laboratory was used as a staff room and for the storage of books. In 2003, five more classrooms were built, plus a staff room and a library. At the time of the study, 22 black teachers were permanently employed at the school, including the Principal, one Deputy Principal, and four Heads of Department. One clerk was employed for administration and finances. Sporting grounds around the school premises were not well-developed, except for a netball and a soccer field on bare soil. The school did not have a laboratory, and a few very old items of apparatus were kept in a small room. There was one duplicating machine in the Deputy Principal's office, and a computer in the Principal's office. The duplicating machine did not always work, therefore the teacher often had to write on the chalkboard, or use the activities in the learner's guide. No computers were accessible to the teachers at school, therefore most assessment tasks were handwritten. Most of the learners had learner guides, as the Department of Education supplied new textbooks to schools for Grade 7 in 2006, when the revised National Curriculum Statement was implemented.

The school enrols about 800 black learners from the township and neighbouring squatter areas. It starts at 8h00 and classes continue until 14h00. Periods run for 30 minutes, with some double periods. Break runs from 11h00 to 11h40. An assembly for the learners is held on Mondays and Fridays for 30 minutes in the morning, prior to lessons. On Fridays, lessons end at 13h00, so that learners can do the general cleaning. The impact of unemployment and HIV AIDS is evident, as most of the children are orphaned and depend on Government grants, as well as their grandparents' pension money.

When experiments must be done, the teacher has to improvise and ask learners to bring resources. In the absence of laboratory apparatus, the teacher is limited to carrying out experiments using household apparatus and chemicals, as well as natural resources. Learners often work in groups so that they can share resources.

4.2.2 The Research Findings

4.2.2.1 How does Tirelo plan for lessons in an outcomes-based curriculum?

A detailed description of how Tirelo plans for her lessons is provided below. As it has already been indicated, a learning programme is a phase plan for a year (for example, for Grades 7, 8 and 9). A work schedule is a plan for a specific grade (for example, Grade 7) for a year. In other words, work schedules for Grades 7, 8 and 9 put together make up a learning programme or a phase plan. Tirelo meets with other teachers in the Science Department at the end of each year to develop a new work schedule for the following year or to amend an existing schedule. Then, on a weekly basis as the teacher prepares to teach, a lesson plan is written out, which is a breakdown of the work schedule. As agreed upon in the Science Department at the school, these plans are submitted to the Head of Department for monitoring and control. The purpose is to ensure that the teacher adheres to the schedule in terms of the content that is taught, and that the correct pace is maintained.

The Education Department in the region has trained teachers on the curriculum. At the training sessions, the teachers received Policy Guideline documents that deal with planning, learning area content and assessment. The teacher keeps these documents in her file and uses them for reference when planning. The Grade 7 work schedule that Tirelo uses is an exemplar that was provided in the Policy Guideline, and the Science department at the school has adopted it. The work schedule provides a summary of activities, which are then described in detail in the lesson plan. An exemplar work schedule is shown in Appendix II.

Lesson plans are written out on a weekly basis, describing the topic, learners' activities, resources, references and assessment tasks. The plans are written on a standard template that teachers obtain from the Policy Guideline document. Templates may differ but the details remain basically the same. A lesson plan can be written out for a day, a week or two, or to cover a specific topic, and they are kept in the teacher’s file.

The teacher starts her planning by referring to the core knowledge, the learning outcomes and assessment standards which are indicated on both the work schedule and the lesson

plan. This information is obtained from the Learning Area Policy of the National Curriculum Statement. To derive relevant content and activities that address the assessment standards, the teacher then refers to the learner's guide. During training, teachers are guided on how to use the learning area policy in determining the content to be taught, in order to refrain from following the learner's guide from one chapter to another. The teachers have realised that learner guides vary in the content they cover, as well as the amount of detail. Some topics that are prescribed for Grade 7 may be absent from a particular Grade 7 published textbook. Teachers then have to teach according to policy, and refer to a variety of textbooks. Another realisation that is important to teachers is that publishers have demarcated the Senior phase (Grades 7, 8 and 9) learning programme differently: some Grade 7 content may appear in the Grade 8 or Grade 9 textbook or vice versa. An illustration of a lesson plan template is shown as Appendix III.

A lesson plan describes what the teacher intends to do in a specified period. It includes the topic, learning outcomes and assessment standards, teacher's and learners' activities, resources, assessment and time allocation.

Tirelo described her planning as follows:

> *We sit down as NS teachers and look at the formats that we can use, and we agree on one method of planning. I look at my work schedule, then it informs me on how to do the lesson plan. Then, I look at my learner's guide, get information from different learner guides, and use the one that is simplified and clear. I prepare my lesson plans before I go to class. I planned for a week for phases of matter. Next week I'll plan for phase changes. So I write out my lesson plans on weekly basis. Sometimes I prepare them for two weeks.*

Tirelo had written out a lesson plan for two weeks on the core knowledge: 'Energy and Change' – forms of energy and changing stored energy into another type of energy. Time allocated for a lesson is thirty minutes, and seven periods are allocated for a week, meaning that two of them are double periods. The lesson plan was written out as indicated in Appendix I.

Tirelo's understanding the scientific nature of Natural Sciences

Tirelo has experienced the full curriculum change in South Africa, as she was teaching Mathematics in the senior phase (Grades 7 to 9) when Curriculum 2005 was introduced to schools. She indicated that the challenge was bigger at that time, as teachers had to implement learner-centred teaching approaches and assessment strategies, whilst focusing on the outcomes. She commented as follows:

> *Sometimes we become so nervous when we start to implement the new curriculum. We ask ourselves how we are going to cope, how learners are really going to react, how they have been doing things from their lower grades. So you have to know what they have been doing so that you can link the prior knowledge when you are preparing.*

Teachers use various teaching methods and they also approach the learning areas differently. Introducing a new topic requires that the teacher firstly establishes what the learners already know in order to link it to the new knowledge that learners will acquire during the lesson. This is one of the strategies emphasised in the new curriculum. As an illustration, Tirelo explained:

> *I first check to find out what they know, then try to explain what they know in scientific concepts, and introduce new concepts. Most of the time they discuss in groups to gain a better understanding of Science knowledge. I try to think about the learners, and ask myself that if I am going to present this lesson in the classroom, what is it that they can come up with? The resources that I am going to use during the lesson must be handy and easy to get.*

The learners' intellectual abilities and behaviour largely influence the teacher's interactive decision-making during classroom instruction.

Collaborative planning in the Natural Sciences Department

A year plan is referred to as a work schedule for a particular grade and it divides the four knowledge areas in the Natural Sciences learning area into the number of teaching weeks allocated. The four knowledge areas or themes in Natural Sciences are 'Life and Living' (Biology), 'Energy and Change' (Physics), 'Matter and Materials' (Chemistry) and 'Planet Earth and Beyond' (Geography).

Tirelo gave an account of the features that typically characterise her planning. By the end the year, teachers offering Natural Sciences learning area in a phase (Grades 7, 8 and 9 in this case) sit together as a department and strategise for the following year. The structure of a learning programme depicts how the four knowledge areas for Natural Sciences will be treated in the 28 to 30 allocated teaching weeks per year (the remaining 10 to 12 weeks are used mainly for assessment and exams).

Teachers keep learning programmes, work schedules, lesson plans, a pace setter, activity worksheets for learners, assessment tasks and records of marks in their portfolios or files. The lesson plans clearly indicate teacher's and learners' activities, content knowledge, learning outcomes, resources and assessment forms. The teachers regularly refer to the plans as they teach the various knowledge areas and move from one term (for example, the teaching period from January to March) to another, in order to monitor their pace, complete content for each knowledge area, and work within time frames. The teachers use the work schedule to strategise and cover each theme within the allocated time, because some themes have a lot of core knowledge and concepts that need to be taught broadly.

Tirelo found that she only had two weeks left to present the whole theme on 'Planet Earth and Beyond'. A lot of time was spent on the first theme that she presented in the first term, which even ran over to the second term. Tirelo explained her plan for a term as follows:

> *During the first term I did 'Matter and Materials' – conductivity, insulation, electricity, magnets, particle model of matter, melting and evaporating, volume, mass and density. In the second term we did acids and bases, elements and compounds, indicators at home and in the lab. This is where we did a lot of experiments in the second term.*

At the end of implementing a year's work schedule, teachers reflect on the challenges they met and how to improve on their performance in the following year. The teacher does acknowledge that the enacted plans need to be improved in future.

4.2.2.2 To what extent does Tirelo enact the lesson plan in the classroom?

At the beginning of the week, Tirelo introduced the different forms of energy – heat, light, sound, potential, kinetic, chemical and stored energy. Classroom activities included, explaining, writing summary notes on the chalkboard, completing worksheets, translating pictures and illustrations, and investigations, where learners conducted experiments on how stored energy changes to used energy. She divided the learners into nine groups of five when doing experiments. Learning outcomes and assessment standards that were addressed during this lesson were written on the chalkboard, so that learners may know what should be achieved during the lesson. Tirelo did not manage to complete all the activities as planned, and they overlapped to the third week. At the end of that week, learners wrote a formal assessment test on energy forms and energy changes.

The written out lesson plan gives a summary of the activities that Tirelo intended for the learners. The time allocated is written as it appears on the work schedule. To teach this content and address the assessment standards, she had to find activities in the learner's guide in the form of notes, illustrations, procedures for experiments, and questions for assessment. She carried on from one activity to another to cover all the sub-topics indicated in the lesson plan. More time was spent on the activities than planned for. The lesson plan only gives an indication of the learning activities, henceforth in the classroom the learners will use a guide/textbook to carry out activities. The specific pages are not indicated in the lesson plan, and evidence of such activities is in the learners' workbook. Evidence of additional handouts, worksheets and assessment questions are kept in the teacher's file. To obtain a clear picture of the extent to which the planned lesson has been enacted, I had to refer to the plan itself (in cases where it was written), to the teachers file as well as the learners written work. Tirelo did work through her plan to achieve the outcomes, the challenge being, needing more time than was available.

To analyse Tirelo's case in terms of how her lessons relate to her plans, I reflect on the way she utilised the lesson period and the decisions made about learners' activities. She spent the first and the second term teaching 'Life and living', which compromised time for the other themes. She does write out her lesson plans in a short summary as indicated in the exemplar, even though in some instances she does not. Learners activities are not described in full detail, therefore she will refer to various learner's guides, and gather activities in the form of notes, handouts or worksheets. In most cases activities from the learner's guide are used, as well as explanatory notes.

Writing out a lesson plan is part of the initial decision-making, which involves identification of learning outcomes, assessment standards, content, resources and time. The actual teaching then tends to differ from the actual planning because of the following reasons: the activities may be long, learners may find them difficult or interesting, experiments are conducted and the results analysed, and some textbooks give a lot of information on a topic. Even though Tirelo had planned to use two weeks, she found she needed to use more time. It was a challenge for her to manage all the activities during the stipulated time, which then contradicted the planning in the work schedule. Time is limited and if a predetermined schedule is not adhered to, there is no recovery time at the end.

In response to the question of whether teaching according to a lesson plan helps children to learn, Tirelo remarked:

> *I can say that the way I have prepared for the lesson and the activities that I brought into class for learners to do did help them to learn, because most of them are hands-on. If I do get a positive response, it shows that the learners did learn something from what I prepared. If I don't, I do try to direct the lesson the other way so that they can have the knowledge and understanding of what is happening. Planning is important. I felt confident because I was well prepared.*

Teachers plan with an expectation in mind of achieving what they have planned for, in terms of managing time allocated for the period, covering the activities that learners engage in, assessing them, and interacting with the learners in such a way that they acquire new knowledge, skills, and a clear understanding of scientific concepts.

Learner participation and being actively involved is one of the characteristics of a learner-centred teaching approach, as learners bring some prior knowledge to the lesson, upon which they construct a new understanding. A number of factors influence how activities will run in the classroom, as Tirelo described:

> *In most cases I just go to class. If the learners come with the resources, the learning and the facilitation becomes much more easier, than when they didn't bring them. If they do not all bring resources, we have to use the ones that are there, and sometimes they are not enough for all the learners. The learners do have an idea, because they listen to the news in the outside world, and come with all these ideas to the classroom. Learner participation is at times good, and sometimes not good. Because they are not the same, some are still struggling.*

On the question of how the teacher manages with experiments and obtaining the necessary resources, Tirelo responded as follows:

> *When we work in the class that's where I get cooperation from them, but when you ask them to do some of the things on their own at home, they don't. Some of them do not bring the resources. I ask them in advance to bring them. Then I collect the resources class by class, then I use them in all the classes.*

An experiment-oriented approach made Tirelo attend to individual learners as they asked questions. The learners discussed and completed worksheets. At the end of the lesson, she explained to the learners what they had achieved during the lesson in relation to the learning outcomes.

Learners' activities

The Natural Sciences policy prescribes three Learning Outcomes (LOs) that address different competencies. "The learning outcomes stress the learner's ability to use science knowledge, not just acquire it. Learning outcomes 1, 2 and 3 are used to assess progress in the learner's ability to plan and carry out investigations involving knowledge, to interpret and apply that knowledge in classroom situations, as well as in situations affecting the learner as a member of a changing society" (RNCS, 2002). Teachers have to plan and

design learners' activities that will address these learning outcomes.

Tirelo illustrated how she facilitated the learning activities in the following way:

> *To help the learners understand the concepts on the transfer of heat energy as conduction, convection and radiation, I allowed them to explore different materials in relation to the concept of insulation – retaining heat and preventing loss of heat. The learners investigated by filling up boiled water into two different mugs: a tin-plate mug and a polystyrene mug. The learners realized that the tin-plate mug was hotter on the outside, and therefore had to make predictions. Learners also conducted their investigations using two pots, one covered with an aluminium foil, and the other one with a black plastic bag. They poured the same amount of water in the pots and put them in the sun. Observations were made and readings on the temperature changes were recorded at thirty-minutes intervals, for a period of three hours. In another investigation I asked them to take two cloths, a white and a black cloth, and use it to cover their legs - a black cloth on one leg and a white cloth on the other leg. They then had to sit in the sun for ten minutes and thereafter compare how it feels. Which one is getting hotter than the other.*

Tirelo introduced the theme 'Matter and materials'. She would start by exploring the learners' prior knowledge:

> *Today they had to answer questions in their class work book. I asked the learners to define what matter is and explain what it is made up of. They also had to write down the three phases of matter and their properties.*

The curriculum in a specific learning area is structured in such a way that the knowledge and skills set out in the learning programmes, builds up from the construction of basic concepts to more differentiated experiences, as they progress from one grade to another.

Tirelo indicated that learner performance varies all the time. It is sometimes good, and sometimes bad, even when the teacher thinks that the content taught was not difficult. There are also problems when learners are given homework, where they have to do practical investigations at home or gather information for research projects. In relation to classroom management, discipline is sometimes also a major problem. Tirelo said:

> *The classroom management is not so good if you look at the number of learners (50 learners made up of 9 groups of 5 or 6). Sometimes they do cooperate very well, sometimes there's too much noise. The learners did participate anyhow. I think learners do understand the content because they were confident to answer most of the questions in the worksheet.*

To achieve the outcomes becomes the main objective during the enactment of the planned lesson, which is then influenced by a number of factors, such as learners' prior knowledge, the teacher's ability to vary teaching methods, varied learners' abilities, teaching resources, learner discipline and time management.

Teachers view the teaching of science from different perspectives. Tirelo expressed her view as follows:

> *It is challenging because I only started teaching science when I came here. It is my third year now. I started my teaching career in 1993. I enjoy it. I really enjoy it. I like teaching NS, because when I look at some of the activities, they are challenging. I believe that the teaching of scientific concepts does benefit the learners. With regard to learners, it does not mean that they do not know anything. They do know some of the things, it is just that we expect them to reason at a certain level that they cannot manage. Whenever I allowed them to explore scientific nature and phenomena, I discovered that they are quite knowledgeable.*

Tirelo's interest in the learning area as well as pedagogical knowledge acquired from having specialised in Science, enable her to assert herself in the teaching of NS.

How Tirelo enacts the lessons planned for a week

Tirelo indicated that her focus during the week is to use the allocated time effectively, keeping in mind, the learning outcomes that should be covered. Then on weekly basis, lesson plans as well as assessment plans are drawn up. Tirelo's main concern for that week then becomes, facilitating all the learners activities, as planned. Tirelo described how she implemented her plan as follows:

> *At the beginning of the first week I started with 'Energy and change'. I taught the different forms of energy: heat energy, potential energy, kinetic energy or movement energy, electrical energy, and all the other forms of energy. The second week, the learners investigated the different forms of energy using resources, such as candles, batteries, matches and methylated spirit. A battery and a candle were used as sources of chemical energy, and elastic potential energy was illustrated with a catapult. The learners worked in groups. The concepts on energy transfer were treated during the third week – transfer of heat energy by conduction, convection and radiation. Learners' activities in the fourth week, involved making observations and references in order to come up with conclusions. They were comparing heat conduction of different objects: a tin-plate mug and a polystyrene mug; a white cloth and a black cloth. I spent four weeks of the third term and started with 'Matter and materials'.*

In another instance, Tirelo had a plan written out for a week on 'Transfer of heat energy' – conduction, convection and radiation. Learners carried out a number of activities, including, investigations, completing tasks in the learner's guide, worksheets on experiments, homework, assessment tests, discussions and corrections. At the end of the third term, there was only a week left to introduce a new knowledge area, 'Matter and materials'. A lesson plan was written out for a week on the particle model of matter. End of term exams had to start in the following week for two weeks.

Tirelo described the situation as follows:

> *On the theme 'Matter and Materials' I did the particle model of matter. This is what I did in one week. I went to the three phases of matter, solids, liquids and gases. I only introduced phase changes, which I then taught in detail at the beginning of the fourth term. I taught these concepts in one week, then exams started for two weeks in September, after which the schools closed.*

Tirelo indicated that exams normally run for two weeks, where the learners write one paper in the morning, and another paper in the afternoon. During the last week of the term, when exams are complete, little or no teaching takes place, as the teachers have to mark, compile mark schedules and write learners' reports for the end of the term.

Utilization of Learner's guide, Teacher's guide and classroom resources

Tirelo indicated that, in instances where learners are asked to bring resources or household materials that are required for conducting experiments, some of them do not bring them. She then collected what was available from all the learners, and arranged the learners in groups, in such a way that the resources could be shared. Learners' activities included studying notes, diagrams and illustrations in the learner's guide, followed by answering questions. The completed task was marked using peer or self assessment. Tirelo moved from one group to another, monitoring the learners work. In an instance where a longer lesson period was allocated, she managed to sign the learners' work.

It was evident that most of Tirelo's learners in the various Grade 7 classrooms had learner guides, as a readily available resource. It made life easier for Tirelo where the learner's guide had relevant activities for a particular topic that she wanted to teach. However, in instances where the learner's guide did not, she then had to make copies from other texts for learners, whilst copying facilities at her school were a serious challenge. A teacher's guide is used jointly with the learner's guide, providing answers to all the questions. Tirelo indicated that she in many instances had to provide learners with additional information in the form of study notes and worksheets, in order to cover concepts that are not included in the learner's guide.

To depict how Tirelo used sources for reference:

> *Within a week I managed to complete the various forms of energy – gravitational potential energy. I gave them some worksheets from various sources, some were from the books that I used when I was studying for my Higher Education Diploma in Science. The learners wrote these in their class work books.*

Tirelo's classroom instruction varied from explaining concepts in the learner's guide, to learners copying notes from the chalkboard, doing written assessment tasks, and conducting experiments. Tirelo indicated that:

> *I am planning to teach the following concepts in the coming week: melting, freezing, condensation, and phase changes from solid to liquid and from liquid to gas. For phase changes I have decided to get a water kettle to illustrate water evaporation and condensation. To demonstrate the phase change from solid to liquid I will use ice cubes.*

The Education Department did provide textbooks for learners, during the first year of implementation of the revised curriculum in a particular grade. Tirelo, like other teachers had to select from a series of learner's guides and choose one that the school would then order for all the learners. The Learning Area Statement for NS provided the content details for a phase (grades 7, 8 and 9) collectively, without a clear demarcation of the core knowledge, that specifies as to what content must be taught in each grade. A lot of uncertainties with regard to the core knowledge affected even the way published texts have been structured, with some content being placed in the wrong grade. As a result, the grade 7 teacher, has to refer to learner's guides of Grades 8 and 9 as some of the relevant content could be published there, whilst some of the topics in the Grade 7 book are actually Grade 8 or 9 content. Apart from using learner guides in an interrelated manner, the teacher should further refer to other textbooks and library books.

A guiding document on the content demarcation for each grade in the senior phase (grades 7,8 and 9), was received by the teachers as part of the Participants' Training

Manual for grade 7 during the 2006 training on the revised curriculum. Unfortunately, this content demarcation was not included in the Grade 8/9 training manual, which was issued for training in 2007. However the original content guide could be availed to grade 8 and 9 teachers in the NS department at school level. On the contrary a lot of published teacher guides also contained exemplar learning programmes and year plans that specified content for each grade in the senior phase (grades 7,8 and 9). The fact that these learning programmes vary from one teacher guide to another, leads to lack of uniformity in the implementation of the NS curriculum. This makes it imperative that teachers be guided appropriately on the curriculum.

Teachers find that they cannot use one textbook that the school prescribed for the learners, which was a practice in the old curriculum. They cannot depend on the learner's guide and follow it from one chapter to another, but they must first check with the work schedule as prescribed in the Learning Area Statement, and use relevant texts that will address the specified core knowledge areas, concepts and learning outcomes.

What the teacher sees as the role of assessment

Tirelo did not specify assessment tasks on the lesson plan. It is only the assessment strategy that is indicated, whether it will be self or group assessment. She used questions at the end of each concept, from the learner's guide. Learners refer to their guide when answering these questions. Worksheets are pasted in the learners' workbooks. For a formal test she refers to different learner guides and copy it for the learners. Copies of short weekly tests and long term tests are kept in the teacher's file. This is an indication that the teacher does not rely on the learner's guide only, for assessment. Assessment tasks from the learner's guide forms part of the classroom activities, and evidence of such work is evident in the learners' workbooks.

The new curriculum policy emphasizes daily learner assessment, which differs from the old tradition of giving learners class-work once a week, or at the end of a topic. An assessment task gives an indication of the extent to which outcomes have been achieved in that particular lesson. Using an activity-based approach and assessing learners on smaller pieces of work, has been a practice since the implementation of Curriculum 2005.

Most of the assessment tasks are done as open-book and either individually or as a group, they are discussed and corrected by one-self or peer, as in the case of informal assessment. Formal assessment is comprised of projects and tests.

Tirelo assessed learners on what they have learned from the written notes, and the textbook summary. Learners work on an activity as individuals and at times in pairs or groups of five, ask questions and receive guidance from the teacher. She moves around the class and mark their work as they are writing and invites questions from learners. Time was adequate for interaction to cover all the activities that were planned for the lesson because the period lasted for an hour. The environment allowed learners to work at their own pace, asked questions and received feedback. In most of the lessons, learners' responses were positive, and they participated.

Teachers try to use different teaching and assessment methods in order to afford learners better opportunities to learn. Tirelo said:

> *I try to give learners simple activities. If I give them an activity and they fail it, I try to simplify it or give them a much simpler one.*

Quarterly examinations form part of the school assessment plan, so that learners can be assessed on the whole term's work. A work schedule for the year allocates time for these exams. Tirelo explained the exam schedule at the end of the term, as follows:

> *I was able to teach until the end of the term, when the exams started. Exams ran for two weeks in September. Learners write the exams and we get a chance to mark. In the morning they write one paper for one learning area, and in the afternoon they write another learning area paper. The tests were written from 4th to 8th September. Tests were planned for a week but they overlapped to another week. The NS test was mainly on energy and change, but I also asked a question on solids, liquids and gases since I had already started with matter and materials before the exams start.*

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On the question of how the learners' performed, Tirelo explained as follows:

> *These learners are not committed. If you look at the test, some of the answers are there but they failed the test. They had to look at the pictures, read the questions to see if they understand the questions before they start answering. We do an analysis of the results for all the learning areas – 107 learners passed and 46 did not achieve. Then I tried to give them a re-assessment task, but still they didn't perform that good.*

Learners are afforded an opportunity to be re-assessed when their performance is not good. Assessment forms are varied, to afford learners better opportunities. As in science, learners are assessed both formally and informally through investigations, assignments, projects, performances, presentations and tests.

How Tirelo enacted her plan during a school term

A school term is a period of eight to ten weeks. A year plan consists of four term plans. In Natural sciences there are four core knowledge areas that are taught in a year. Teachers plan in such a way that they complete one core knowledge area in a term, or even advance and start the second knowledge area within the same term, because there are other extra-mural activities such as sports, that sometimes disturb the daily running of the school. The fourth term, is the last, and it is always short because time is allocated for end of the year exams. Teachers then have to use the best of the first three terms of the year to cover the four core knowledge areas in Natural Sciences. In Tirelo's plan, the time allocation for each knowledge area was indicated as follows: Life and Living (8 weeks); Energy and change (8 weeks); Matter and Materials (8 weeks); Planet Earth and Beyond (6 weeks). The time allocation added up to 30 weeks. Policy prescribes that teachers plan for 28 to 32 weeks of actual teaching out of the 40 school weeks per year. The 40 weeks include time allocated for revision, tests and exams.

From when the schools reopened in October there were only four weeks available for

teaching before the learners wrote the final exams from 6 to 18 November. At the beginning of the fourth term, Tirelo continued with different phases of matter to treat other concepts in detail, including making models to show the states of matter – solid, liquid and gas. There was a written lesson plan for one week on acids and bases. For other topics that were taught, there were no written lesson plans. Another knowledge area/theme – 'Planet Earth and Beyond' was still left out, but it was allocated six weeks on the work schedule, meaning that Tirelo had to rush through all the content in only two weeks. Tirelo described how she had to change her plan as follows:

> *I will be starting with 'Planet Earth and Beyond' before the exams start from 6th to 18th November. Because I have not done anything under 'Planet Earth', I think I am going to need more time. I'll manage to complete 'Matter and Materials' in two weeks of the remaining four weeks. Then I will be able to teach a something on 'Planet Earth and Beyond'.*

Tirelo found that she only had two weeks left to present the whole theme on 'Planet earth and beyond'. A lot of time was spent on the first theme that she presented during the first term, which even overlapped to the second term. Failure to complete all the knowledge prescribed for a grade 7 learner impacts negatively on the knowledge progression and acquisition of basic skills from simple to complex concepts as they advance from one grade to another.

Tirelo's reflection on how she implemented her work-schedule in a year

Tirelo's reflection on how she taught the four knowledge areas in Natural Sciences from the beginning of the year was as follows:

> *I treated the theme 'Life and Living' during the first and second term. I think there is too much work that I did in the third term because I treated two themes, 'Energy and Change' and 'Matter and Materials'. I did not manage to complete 'Matter and Materials' in the third term, and had to use two weeks of the fourth term to do it. Then I only had two weeks left to teach 'Planet Earth and Beyond'. I mean if I have to teach Grade 7 next year, then I will start with 'Energy and Change', because I spent too much time treating 'Life and Living'.*

Tirelo described how she intended to improve on her plan for the following year, from term to term, as follows:

> *If I look at the way I treated 'Energy and Change' and 'Matter and Materials', I think next year I will start with 'Energy and Change', and do a little of 'Matter and Materials' in the first term. In the second term I'll be continuing with 'Matter and Materials' and then start 'Life and Living'. Complete it in the third term. Then 'Planet Earth', I'll do it in the fourth term.*

These changes are a way of improving on future actions. It still remains a challenge because according to Tirelo's work schedule 'Planet Earth and beyond' is allocated six week of instructional time, but if it is left until the last term, there are only four weeks available to teach. Another crucial aspect is revision, which should be allocated time to assist the learners in exam preparation. Revision is not even given a thought in Tirelo's case because of time constraints. Proper planning would require a clear description of the concepts to be taught, the detail as well as the required standards, the number of assessment tasks and their complexity, such that time can be utilized efficiently. An interpretation of the curriculum that will lead to appropriate planning and teaching would lead to realising the ideals envisaged by curriculum planners.

4.3 BRIAN'S CASE

4.3.1 Personal information

Brian* is a 32-year old, English-speaking, Muslim, black South African male, teaching Natural Sciences in Grades 6 and 7 at Platinum* College. He holds a BSc degree, and studied for a Higher Diploma in Teaching Methodology when he joined the teaching profession. He has been teaching for three years at Platinum College, which is a multiracial, former Model C, English-medium school in town, offering Grades R to 12. Platinum College has a well-equipped science laboratory. The school building was extended in 2004, on a rand for rand financing, between the Education Department and the Anglo-Platinum Mine – a new, expensively built high school section is now in operation. The school started as a primary school 30 years ago, then extended its curriculum to FET

in 2005, and presented its first matric learners in 2007.

African learners from town, the suburbs, the adjacent township and villages, constitute close to 50% of the learner population at Platinum College, with a total enrolment of about 1 200 learners. Of the 40 teachers employed at the school by the Education Department, only three are Black Africans. The school is charging parents a school fee amounting to R350 per month, with a teacher-leaner ratio of about 1:30 or less (the school where Tirelo teaches, by contrast, charges R300 per year, with an over-crowding problem in the classrooms, and a teacher-learner ratio of 1:50 or more). This is indicative of the healthy financial state of Platinum College.

4.3.2 The Research Findings

4.3.2.1 How does Brian plan for lessons in an outcomes-based curriculum?

Brian uses the Grade 7 work schedule from the Policy Guideline as a reference, then he writes out lesson plans on a weekly basis, using the format given in the Guideline. Copies of learners' activities and assessment tasks are kept in the teacher's file. One of the observations made in class was when Brian presented the topic of the classification of vertebrates. Brian's class had thirty learners. The lesson presentations were characterised by learners' having to classify, identify structural features, the teacher's explanations, notes presented on transparencies, handouts and assessment worksheets. Learners had to use their own guides as a reference.

With regard to what he considers while planning, Brian mentioned that he includes time (how long to spend on the lesson), the type of learner activities, learning outcomes and assessment standards to be achieved by the learners, what the learners already know (pre-knowledge), and what the learners will need to know. As an illustration, Brian said:

> *I planned in advance, researched what I needed, looked at the prior knowledge of the learners, their interests and their level of understanding. I teach according to the lesson plan and reflect on my successes and failures.*

Brian indicated that he does write down lesson plans. As an illustration, Brian said:

> *All Grade 7 teachers use the same printed format for lesson planning. I use a formal typed lesson plan.*

Time allocated for a period may vary from 30 to 70 minutes, depending on whether the school uses a five or six-day cycle. A period is used for discussion and explanations, including a short assessment task that is immediately marked by the learners, and corrections are done. At the end of a weekly cycle, learners write a formal assessment task that is marked by the teacher. Most of the activities are completed during the lesson, and homework is given, for learners to find additional information for projects.

Brian's understanding the scientific nature of Natural Sciences

Brian sees Science as a living subject, and the learners must understand where the topic fits in everyday life, expand knowledge in this particular learning area and link it to other learning areas. Brian indicated that he enjoyed teaching Science, but that sometimes learners do not participate in the topic, or do not do their assignments and re-assessment projects, which makes teaching difficult.

As an illustration Brian said:

> *It's a lot of fun, Science in general is so wide, you can do anything –you can go from putting activities on paper to taking the learners outside and getting learners to do the experiment themselves or making questions themselves. I think it's a wide area, it's very basic to follow in the Natural Sciences learning area. I want the learners to feel very enthusiastic about learning Natural Sciences.*

Brian varied his teaching approaches. Learners worked either as individuals or in groups. Illustrations on posters and videos formed part of classroom instruction. Learners planned and conducted experiments, recorded their findings and drew conclusions.

As to why it was necessary to try different teaching methods, Brian remarked:

> *Making the learning experience more visual and practical, promote the nature of science and inculcates scientific skills and knowledge in the learners. The learners are then able to achieve the learning outcomes, academic knowledge and skills. The question and answer method is used, learners refer to their guide and discuss, which ultimately makes them attain the specific outcomes.*

Based on the findings from classroom observations, it was evident that conducting experiments in class, is interesting for learners as they become engaged and are eager to see and understand what is happening. It breaks the routine of listening to the teacher's explanations or working on an activity in the learner's guide. In relation to classroom management Brian pointed out as follows:

> *It is a challenge to involve all the learners, get their full participation during the lesson and keep them focused. I have to work on the classroom management all the time. I view classroom interaction as a two way stream, meaning that as I impart knowledge to the learners and guide their cognitive learning processes, the learners themselves must engage in constructing knowledge through discussions and responses to questions.*

It was evident from the teaching-learning process, that for learners in grade 7, scientific concepts must be thoroughly taught and explained by the teacher, to enable learners to reach a certain level of comprehension according to their intellectual abilities.

Brian illustrated in the following way:

> *Each and everyone of the learners have their own understanding of what they observe, and have to apply their critical thinking to make sense of the concepts. I regard experiments as minds-on and hands-on activities. The learners learn easier when they see, unlike if they only read from their guide. Being able to explain concepts in their own words means that they understand.*

Brian indicated that his understanding of what the Learning Area policy says is that, teachers must involve learners as much as possible and use a learner-centered approach. The expected result in terms of the learning outcomes is that learners must be able to plan and conduct scientific investigations, analyse findings, construct science knowledge, and apply it to the relationship between science, technology, society and the environment.

Collaborative planning in the Natural Sciences department

In accordance with the learning area policy, the core knowledge areas in Natural Sciences are namely, 'Life and Living', 'Energy and Change', 'Matter and Materials', and 'Planet Earth and Beyond'. There are four teaching terms in a school calendar, ranging from 10 to 12 weeks each. Some of the weeks in a term are used for writing tests and exams. During the first term, in January, Brian taught two themes, 'Energy and Change' and 'Matter and Materials'. He indicated that he really went through them quickly, because normally he would teach just one of these themes in a term.

During the second term, from April, Brian taught 'Planet Earth and Beyond', but he remarked that he felt that he had spent too much time on this theme. At the beginning of the third term he introduced 'Life and Living' which he completed at the end of the term. He then had to revisit concepts that he did not teach thoroughly on the theme 'Energy and Change', using the two weeks that were available for teaching in the fourth term. This was then followed by one week of revision and the writing of the final exams. The coverage of the content is a key policy requirement, which requires making tactful decisions during planning.

Planning for a learning area in a school is done at departmental level where teachers sit together and refer to policy documents. It involves refining the learning programme, determining the level at which the learning outcomes and assessment standards were achieved, and evaluating learner attainment, in order to improve the plan.

Brian explained:

> *In our department we always work together and talk about how to go about with the themes. As the new curriculum will be implemented in Grades 8 and 9 starting from next year, we are going to sit down and talk about it. The different themes and time frames are also indicated in the lesson preparation. We will look at this year's work schedule and improve on it. Write down exactly all the things that we will be doing next year, the different themes and the time allocation.*

In relation to the implementation of the new curriculum in Grade 8 in 2007, teachers' reflection on how they worked on the Grade 7 curriculum could assist them in developing better plans for both Grades 7 and 8. Brian's input was the following:

> *I had a meeting with one of the grade eight teachers, I asked if she could assist me, what are the areas she's focusing on next year, so that when I start planning, I can just give an idea to the Grade 7 learners, so that when they go to high school, they don't find that in the classroom they don't understand anything, just to give them the next stepping stone so that they know what they are looking forward to in the examination and what do they expect there. You see a learning programme is appropriate. You see, what's happening is that, every term, every year, every lesson, you see how you're building on each all the time as you plan.*

The knowledge and skills that learners acquire leads to a better understanding of concepts at higher grades.

The implementation of the Natural Sciences curriculum in grade 7, in 2006, was a new experience for teachers. They encountered a number of challenges regarding the amount of detail to cover on specific topics, limited information in the textbooks, adhering to their plans and managing time effectively. Reflecting on their challenges could help them

improve on their planning for the following year. The teacher's both theoretical and practical knowledge in science are instrumental in assisting learners with regard to acquisition of scientific knowledge and the application thereof, as well as developing, scientific skills, thinking abilities, and a high level of reasoning.

4.3.2.2 To what extent does Brian enact the lesson plan in the classroom?

Brian integrated a variety of methods, such as cooperative teaching, group work, posters, word flash cards, and experimental equipment, making the learning experience more visual and practical. The objective is to promote the nature of Science by inculcating scientific skills and knowledge in the learners, in order to ensure that they achieve the learning outcomes, as well as academic knowledge. The question and answer method was used, learners referred to the learner's guide and discussed questions in order to reach the specific outcomes. With regard to factors that influence enacting the planned activities in the classroom, Brian indicated that planning does help him prepare for the lesson. Being prepared and knowing the subject matter makes everything flow. Brian responded in this way:

> *I stick to the lesson plan as much as possible. Learners might ask a question and then we have to discuss it in the class. You see, it sometimes happens, but there are a few naughty learners in the class who would just waste your time, they just want to sit there in their comfort zone, understand what I mean! To me when I am in class, discussions and demonstrations work out very well.*

Brian indicated that it is a challenge to involve all the learners, to get their full participation during the lesson and keep them focused. He regards classroom interaction as a two-way stream, learning from learners and helping them learn from him. It was evident from the teaching-learning process that for learners in Grade 7, scientific concepts must be thoroughly taught and explained by the teacher, for the learners to reach a certain level of comprehension in relation to their intellectual abilities.

Brian illustrated this point in this way:

> *If each and everyone of them have their own view of what they see, because this is 'what do I see' and 'what do I think' activity, and what am I going to produce after seeing that. It is a minds-on, hands-on experiment. Learners learn easier when they see, they do not only read from the textbook. Putting it in their own words means they understand.*

The three learning outcomes in Natural Sciences address different competencies, where learners should carry out investigations and acquire knowledge and skills; and interpret and apply that knowledge to the natural environment they live in (Department of Education, 2002). Teachers are expected, as one of their roles, to plan and design learner activities that will address these learning outcomes.

Learners' activities

Teaching scientific concepts requires that learners do experiments in order to handle apparatus themselves, observe and make conclusions. The first learning outcome states that learners must plan investigations, conduct them, record data and communicate their findings. Brian's experiences of doing experiments with learners are the following:

> *I do experiments. I found that when I did some experiments with acids, bases and pH measurements, the learners enjoyed them. With plants I had to give them a specimen, for example, with mosses they saw how they look like and how they feel. Luckily most of them know how to swim so we managed to get an algae. When we discussed the role of the algae some of the learners really participated and from home they brought a lot of information, from the internet, about what is the role of algae in the ecosystem and how they use it in everyday life.*

Brian used different resources for lesson presentations. He described another lesson presentation as follows:

> *Luckily we have videos in the library. I borrowed them and showed them to the learners. I asked them to look for six characteristics of the animals – the habitat, respiration, reproduction and excretion. After that I gave them a worksheet to do. I marked it. I assess them formally, and sometimes informally as a discussion in the classroom and they also work in groups. We were doing invertebrates, the kids enjoyed it also. When we studied fish, I brought a fish. I bought it from the market. I just gave it to them. Some of the learners said they want to dissect it, and they wanted to see what's inside.*

Learners' activities are supposed to be integrated as individual or group work, and assessment forms part of daily lesson activities.

In relation to how Brian experiences the teaching of Science, in terms of methods, and making it interesting for the learners, Brian's response was:

> *Sometimes it happens. To be honest not all the learners are brilliant, not all the learners are responsible. Sometimes, discipline-wise you don't finish the topic today, it takes you two days; it's not nice because I want to see a thing done the same day because it's still fresh in their minds and it stays in their minds for a longer period. Some of the kids do not participate at all.*

Some of the factors that determine the extent to which the teacher will achieve and complete what is planned for the lesson include learner participation, learner responses and discipline.

How Brian enacts the lessons planned for a week

A work schedule is a year plan for a particular grade and it divides the four knowledge areas in Natural Sciences learning area, into the number of teaching weeks allocated. Brian explained that weekly and daily lesson plans breaks up the work schedule into smaller, attainable classroom activities. The lesson plan depicts teacher and learner

activities, content knowledge, learning outcomes, resources, assessment forms and time allocation. The manner in which the planned activities will unfold in the classroom will be largely determined by the teacher's level of commitment towards executing the plan, that is by being in control of all the factors and variables that will influence the teaching and learning process - being it internal factors such as learning resources, learner discipline and cooperative learning behaviour; or external factors such as disruptions of the allocated teaching time.

Brian revealed that setting out a plan for a period of a week gives the desired goals a better focus. It breaks up the work schedule into smaller manageable activities that covers a particular topic. A topic may be taught for more than a week, but on weekly basis, Brian reflects on how much he has covered, in relation to the content, LOs, ASs and assessment tasks. Brian gave an account of how the planned activities unfolded in a week, in the following way:

> I started by introducing the classification of the living system to the learners, the plant kingdom and the animal kingdom. Under the animal kingdom they will study vertebrates and invertebrates in detail. Vertebrates are classified into five classes – fish, amphibians, reptiles, birds and mammals. In this grade the learners will only discuss two phyla, Arthropods and Mollusca. We are actually going to divide Arthropods into classes – Insects, Arachnids, Crustateans, and Myopods. Under Molluscs we will study slugs and snails. The learners will watch a documentary on amphibians. Tomorrow we will have a classroom discussion and also summarise the topic. A handout with information on amphibians will be given to the learners, from which I expect them to write a brief report on amphibians. In addition, they must draw the diagram of a frog in preparation to a detailed study on its structure and function. According to my plan, the next organism for the learners to study, is a fish as they relate more to amphibians. I'm just trying to link up LO 1 (scientific investigations), LO 2 (construction of knowledge) and LO 3 (relationship between science, technology, environment and society), just to built up all the information.

Brian does feel in control and content about the manner in which he planned for and managed learning activities in a period of a week. He indicated that he always needs to be fully prepared, so as to be in control of the situation. Trying to maintain discipline consistently improves the learners' focus towards achieving the intended outcomes. It is essential for Brian that at the beginning of each week, he for sees a clear picture of what he intends to do and accomplish with the learners on daily basis.

Utilization of Learner's guide, Teacher's guide and classroom resources

Brian indicated that he does not have a problem conducting experiments in class, whether the school has a laboratory or not. He indicated that he has enough knowledge of the subject matter. He consults many textbooks when preparing. In respect of resources, Brian commented as follows:

> *The school and learners are able to provide, whatever resources we've got, I plan the lesson according to that. Using the resources goes hand in hand with planning. If you plan your resources on time you know that they are going to use these resources for this particular activity. You plan in time and you organise the resources. I am extremely enthusiastic about sharing scientific knowledge with the learners. I use all possible resources at my disposal in order to do this.*

Planning for resources becomes a necessity in Natural Sciences because of its practical nature.

Brian indicated that the resources assisted the learners as intended. Brian concurred that accessing the relevant resource materials is not such a challenge, and that he could ask for assistance from senior teachers in the High school. He further hinted that, heads of departments (HODs) in the learning areas are experienced and offer support. They also monitor both his work and the learners'.

As an illustration, Brian said:

> *I feel in full control of the new curriculum and the teacher support team at the school is always available to address any queries or challenges regarding the learning area. Apart from reference to the learner's guide, I also use a lot of handouts from other texts and library books, because certain concepts are not covered fully in the learners' guide. It is convenient to refer to the learner's guide because every learner is in possession of one, but I cannot rely on it alone because it is limiting in terms of other knowledge areas that are specified in the learning programme. I have to first identify the content, the learning outcomes, and the assessment standards thereof, after which I need to find learning materials that contain the relevant information. I use various sources in an interrelated manner. Something that I started practicing at the inception of the new curriculum and trying to apply an outcomes-based teaching approach.*

Brian revealed that he conveniently uses assessment questions in the learner's guide because the answers are not provided, hence it makes it imperative for the learners to use a bit of logic, critical analysis and thinking when answering the questions. The answers to all the assessment tasks are provided in the teacher's guide, of which only the teacher keeps a copy. Learners' exposure to the review questions in their guide elicit their comprehension and also serves as a measure of their achievement level. Brian explained how he uses the learner's guide as follows:

> *I get bits and pieces from any book that could help me. This learner's guide is like the major one, but I do have others that I use, especially for interesting investigations.*

Learner's guide selection at the inception of the National Curriculum Statement became the teacher's prerogative. Publishers interpreted the learning area content differently hence it became a challenge for the teacher to select a more relevant one. As it turned out it was difficult to find one learner's guide with all the prescribed core knowledge and concepts, nor with a clear guideline of the level of detail required. Having no clear

guidelines at the time, on the core knowledge specified for the various grades in the senior phase (grade7,8 & 9), also posed another challenge for teachers. Nonetheless, in terms of the complexity and variation of knowledge, and the fact that a teacher is designated the role of a researcher and a life-long learner, multiple referencing becomes the nature of teaching and learning.

What the teacher sees as the role of assessment

Assessment is done informally and formally on regular basis to determine the level of understanding and evaluate learner performance. Different forms of assessment are used, for example, assignments, tests, investigations, experiments translation tasks, projects and presentations. Assessment tools include checklists, memos and rubrics. Assessment strategies used can be self, peer or teacher-assessment, and performance is recorded for feedback and reporting. A number of factors influence what goes on in the classroom. As an illustration, Brian indicated:

> *For the third term, everything is done, it is planned for. I am going to assess them nine times. I've already set the first assessment task, so they have a few lined up already.*

Learners were given homework to research about amphibians and write up a scientific report, with pictures and diagrams. Brian encouraged the learners to use the library. Brian would first go to the library and arrange books that will be necessary for the theme that he is teaching. After completing the class amphibians, he introduced the class fish and followed the same plan – notes on transparencies, handouts with additional information, a video on fish, assessment tasks and homework to do research at the library or use the internet. On this topic he brought some fish to the class and learners investigated and observed the external structure. They had to draw and label the structure, referring to their guides.

How Brian enacted his plan during a school term

A school term is a period of ten to eleven weeks. A year plan consists of four term plans. Brian adapted a work schedule from the policy documents and the time allocated for the four knowledge areas in Natural Sciences was as follows: Life and Living (8 weeks); Energy and change (8 weeks); Matter and Materials (8 weeks); Planet Earth and Beyond (6 weeks). It added up to 30 weeks of actual teaching out of the 40 school weeks per year. The remaining ten weeks are used for quarterly and end of the year exams.

During the third term, from July, Brian taught the knowledge area 'Life and living', covering the animal kingdom and the plant kingdom. Brian indicated that he did not have sufficient time to work on the animal kingdom. At the beginning of the fourth term, in October, it took him two weeks to complete the topic on plants. He did revision with the learners for two weeks, giving learners sets of exam-type questions to work on. At the same time, the learners had to organise assessment portfolios and submit them for compilation of CASS (continuous assessment) marks. At the beginning of November, the final examinations began. There are only four weeks of teaching time available in the fourth term, which Brian should have taken into consideration when executing the work schedule throughout the year. It is practical that not much can be covered in the fourth term; therefore most of the knowledge must be presented during the first three terms of the year. It becomes crucial that planning for the four knowledge areas in NS should be aligned with the number of teaching weeks available in a year, and not necessarily the number of terms.

Planning becomes necessary for teachers, so that they can cover all the prescribed core knowledge areas and assess the learners. It emerges from the findings that Brian needed clear guidelines of the detail to which the different topics must be taught, which is provided by the learning outcomes and assessment standards. The extent of elaboration on a topic is also influenced by the learner's guide, as it happens that more detailed information is given in some topics, more than in others, which can actually compromise time for other essential concepts, if the teacher follows the guide as it is.

Teachers are expected to refer to the policy guidelines as it prescribes content for each grade. Developing a learning programme is the teacher's competence, with reference to

curriculum guidelines. References are made to texts to select content and learners' activities that will lead to the attainment of learning outcomes and assessment standards. Teachers as expected, have to refer to different sources and not rely on the one learner guide that has been provided. In some cases the learner's guide may not have a specific topic, as publishers interpreted policy differently. If one takes a series of grade 7, 8 and 9 textbooks from one publisher, you will find that some topics prescribed for grade 7 are in the grade 8 or 9 book, or vise versa. Teachers then have to plan as they cannot follow one textbook as it is.

Brian gave an indication of how his plan for the third term unfolded by saying:

> *In the third term I finished all the classes of invertebrates. What I did in the second term is the classification of all the animal kingdom. They got a bit of an idea of what I wanted to do. Start of the third term we first did five classes of vertebrates, and then invertebrates and after that we did some plant kingdom – angiosperm, gymnosperm and all this information. And in the test, they will write about plant and animal kingdom; in fact, it's a hundred marks, in order to get feedback.*

It is evident that from Brian's perspective, coverage of the content should immediately be followed by assessment tasks to determine the level at which the learners have acquired the knowledge and skills, which actually signify the achievement of the outcomes.

Brian's reflection on how he implemented the work-schedule for a year

The work schedule, which is actually a year plan for a particular grade, comprises of an outline of learning activities covering the four knowledge areas in Natural Sciences. The four knowledge areas or themes in Natural Sciences are: Life and Living (Biology); Energy and change (Physics); Matter and Materials (Chemistry); Planet earth and beyond (Geography). With regard to features that typically characterize his planning, Brian revealed that at the end the year, teachers offering Natural Sciences (NS) in a phase (grades 7,8,9) sit together as a department and strategise for the following year. The learning programme is reviewed and restructured in order to come up with a more practical

plan that will ensure the completion of the four knowledge areas in NS, within the 28-30 weeks that are allocated for teaching per year.

Brian's portfolio file contains learning programmes, work schedules, lesson plans, a pace setter activity worksheets for learners, assessment tasks and records of learners' marks. He refers to the lesson plans, in order to measure his pace against the set time frames. He further elucidated that the work schedule provides a planning framework that illustrates how the knowledge areas will be taught and assessed on weekly basis. It poses a challenge for teachers to complete each knowledge area within the allocated time, at the same time ensuring that all the content, learning outcomes (LOs) and assessment standards (ASs) are addressed. To give an illustration of how Brian went about enacting the four NS knowledge areas from one term to another, Brian said:

> *I work on terms. First term we worked on physics, mechanics, acids and bases and other concepts on matter and materials.. Second term we worked on 'Planet Earth and beyond'. Now for the third term we are doing the animal kingdom. Fourth term we will do the plant kingdom. I am not very up-to-date with the studies, they have not finished a lot of things but they have done quite a lot. Like I would rather go more into the physics part the last term, to teach this chapter that was left out in the previous term – the chapter on forces. I think it is one important topic. Learners must know why certain things are happening. Unfortunately because of the time frame we couldn't finish it. I would like to go back and finish that chapter.*

Brian indicated that he spent a lot of time teaching the knowledge area 'Planet Earth and Beyond', the whole term. In our discussion he clearly indicated that he does not regard this theme to be relevant to NS, hence in the following year, he will commit more time to teaching physics and chemistry. There are certain concepts that he would select, such as 'global warming' and 'the greenhouse effect', that he considers significant. He further explained that most of the concepts on the planets, force of gravity, phenomena such as day, night and eclipses, he covered in Grade 6, as he moved with his learners from Grade 6 to 7. His argument is that geographical concepts will be covered by the Social Sciences

teacher. This presents a case where teachers make their own interpretation of the curriculum and do away with concepts that they lack interest or competence in.

The drafting of the work schedule is a joint effort by teachers in the same learning area, but as to how to organize and teach all the themes as planned, depends entirely with the individual teacher. At the end of the year, teachers reflect on how they presented the prescribed knowledge areas, as well as how the time allocated was managed. It happens in some cases that more time is spent on some knowledge areas, such that towards the end of the year, time for the completion of other concepts is insufficient. As in Brian's case, the chapter on forces was revisited at a later stage.

Teachers refer to the work schedule as a guide on the content to be covered, and how to manage both teacher and learner activities within a given time frame, so that at the end of the year all the core knowledge has been taught. Brian indicated how he would improve on his future planning, as follows:

> *Next year I will start with the animal and plant kingdom in the first term. For me it's 11 weeks, and I think this has a lot of work to be done. Second term I'll do 'Energy'. These are the themes I must focus more on. The chemistry I'll do during the third term and 'Planet Earth and Beyond'.*

Brian would vary his plan for the following year in such a way that all the themes are equally taught, as allocated in the work schedule. He even managed to do some revision with the learners before they wrote the final examination. He gave the following description:

> *I did angiosperms and gymnosperms, and the last weeks I worked out 45 revision questions. They had to do ten questions a day. I wanted to train them on how to answer questions in a certain amount of time, as revision. It's a practice for them, they have to look for information. We did all the revision and started compiling all the portfolios. I gave them a deadline that I need the portfolios by a certain date, and started compiling the marks.*

Teacher development at school level, for the purposes of professional growth is a positive initiative that benefits teachers. Brian asserted that he would welcome an opportunity to teach higher grades, that is, moving with the learners from grade 7 up to grade 12, based on the fact that he is a qualified Life and Physical Sciences teacher. He views this as an opportunity to broaden his skills and experience in science. Having taught NS in grade 7 for three years now, does not challenge him anymore. His discussion with the principal on this issue was in vain, as the principal believes that the learners completing their primary schooling, also need a strong foundation of scientific knowledge and skills. It is frustrating for Brian because he taught science in grades 10 to 12 before he came to the school. Brian described his plans for the following year as follows:

> *You know, I want to teach grade 7 for the last time next year, from there I want to go to high school. I want to work with grade tens to grade 12. It's more familiar, it's much less work. The reason is they already have basic information on some of the things, and for grade 7 learners, you have to come down to their level. In high school I would choose Biology. I studied Biology and Chemistry. I have a lot of experience in these subjects. I also think that Physics is brilliant as a learning subject, but the only thing I am not good at is Maths, because there's a lot of calculations. In Biology there's a lot of experiments. Science is all about experiments.*

Teachers preferences of subjects or grades is largely influenced by their qualifications and subject specialization. Teaching lower grades for a long time, ultimately minimizes the ability to deal with more abstract scientific concepts. An opportunity to become exposed to both conceptual and practical knowledge of higher complexity, would enhance the teacher's pedagogical knowledge. In some instances teachers do enjoy less challenging situations, whilst others envisage to grow in scientific knowledge.

4.3.3 CHAPTER SUMMARY

As the National Curriculum Statement was implemented for the first time in Grade 7 in 2006, it was the first experience for teachers. They encountered a number of challenges regarding the amount of detail to cover on specific topics, limited information in the textbooks, adhering to their plans and managing time effectively. Reflecting on their challenges would help them improve on their planning for 2007, when the NCS would be implemented in Grades 8 and 9. The teachers' theoretical and practical knowledge in Science is of utmost importance in ensuring that learners acquire scientific knowledge and apply it. Learners further develop scientific skills, thinking abilities and a high level of reasoning.

4.4 AN ANALYSIS OF THE TEACHERS' PLANNING STRATEGIES AND THE ENACTMENT OF THEIR LESSON PLANS

The findings provided comprehensive case study reports of the planning and teaching decisions, as well as the understandings of the two teachers in the study. The objective of an analysis of the two cases was to identify the main similarities and differences between Tirelo's and Brian's decision-making towards lesson planning as a way of developing a framework that will guide their classroom practice in an outcomes-based curriculum context.

On the basis of the research evidence, the main points that emerged regarding the decision-making processes that these teachers engaged in as they developed a framework or a plan to guide their future actions, as recommended by Clark and Peterson (1986), whilst employing an approach that is based on achieving outcomes, were the following:

- The participant teachers in the study do not view planning as a basic psychological process which allows them to visualise the future, neither do they consider the framework that they construct, in the form of a work schedule or lesson plans, as a tool that will guide their future actions. Hence what emanated from the findings was that parts of the knowledge areas are not completed or were only taught partially, and time

allocated was not managed as planned.

- The decision-making processes of teachers, with regard to planning are influenced by factors such as exemplar planning frameworks that are provided in curriculum training guides and teacher's guides, because, instead of adapting them to suit the context in which they teach, teachers try to use them as they are. Therefore, the expectation that a lesson plan will be developed from a work schedule is not met, because of the lack of interpretation of the work schedule which represent a broader framework. The work schedule only gives an outline, meaning that time and effort should be committed to writing out a lesson plan which will reflect detailed learners' activities, how they will be carried out in the classroom, and what the learners will do to achieve the set outcomes.
- The fact that lesson plans are just written on a standard format, and only when time allows, meaning that in some instances they are not written, impacts negatively on the intention to enact the plan in the classroom.
- Whilst learning programmes only give an outline and are developed once for the whole year, drawing up detailed lesson plans requires more time and thought. Not developing plans means not having given what you want to do in a classroom any thought.
- Lesson plans specify the outcomes, content knowledge, learning activities, resources, assessment strategies and time allocation. The decisions made about these details depend entirely on the teacher's planning skills and learning area knowledge. The teachers do not give much thought about planning, as classroom practice is dominated by selecting learning activities from learner's guides, which is also a limiting factor because it depends on the number of references at the teacher's disposal. Most of these texts do not have all the prescribed knowledge, and gives more elaboration in certain concepts that in others. Failure to plan implies lack of reference to prescribed knowledge areas as presented in the work schedule, which could assist the teacher not only in selecting activities, but relevant ones as well.
- Lesson plans may be written or committed to memory. Their presentation is influenced by the teacher's practical knowledge of managing learners' learning abilities, acquisition of knowledge and skills; the attainment of outcomes within a specified time frame and learner discipline. Written lesson plans allow for monitoring teachers' work and pace. The teachers' pace and time management in terms of enacting lesson plans as

intended on weekly or term basis remained a challenge as a result of poor visualisation of future actions.

- The decisions about learning outcomes and the relevant content that will address them requires the teacher to refer to various sources and texts, as there is no single prescribed text. It was evident that the learner's guide prescribed by the school, dominates learning activities because it is readily accessible for the learners. Materials from other text require duplicating, which is a challenge in some schools.
- The teaching of Natural Sciences involves doing experiments, which the teachers in this study were to a certain extent enthusiastic about, even though resources were limited. The amount of time available to do investigations was also a limiting factor. The fact that experiments are done only when circumstances allow, compromise the acquisition of knowledge and skills that learners should acquire as the curriculum envisages.
- Enacting the lesson in the classroom, taking into consideration learners' characteristics, the complexity of the knowledge, the requirements for practical work, group discussions, and the inclusion of assessment tasks, remains a challenge for teachers, as lessons may run over, leading to failure to keep up with the work schedule. This compromises certain concepts that may not be taught thoroughly or may not be taught at all.
- The teachers' attitude towards the teaching of certain knowledge areas such as 'Planet earth and beyond,' represent a negative impact on the teaching of Natural Sciences, as the critical nature of these concepts in establishing the learners' basic scientific skills cannot be overemphasised.

This research adds to the limited knowledge on factors influencing teacher decision-making processes, as they deal with the demands of the South African outcomes-based curriculum – previous studies suggested that meeting these demands was out of the reach of most teachers (Hattingh *et al*., 2004). The aim was to seek an understanding of the teachers' classroom practices, with specific reference to lesson planning, as the curriculum expects them to have a significant intellectual, behavioural and perceptual impact.

4.4.1 Teaching and learning approaches

It became evident from the classroom observations that the teaching and learning approaches did involve a certain level of learner engagement, which relates to learners' being active participants as they constructed knowledge and acquired skills, as required by the National Curriculum Statement (RNCS, 2002). This depicts the ideals of the curriculum, which focuses on the achievement of the learning outcomes and learner-centeredness. The picture that emerged regarding Tirelo and Brian's teaching approaches varied from a presentation of facts to group work.

Panasuk and Todd (2005) found that activities of different types are more effective when they are coordinated with the most appropriate class arrangement. To create effective classroom setting and to provide learners with different learning experiences, the teachers needed to make decisions whether to set up a pair or group work, or to address the whole class. The presentation of facts required learners' full attention on the chalkboard or transparencies whilst listening to the teacher's explanations and taking notes, followed by a written assessment task. Group work involved conducting an investigation, with the teacher's guidance, and learners had to complete a worksheet. Brian preferred a sitting arrangement of two learners per table facing the front, while Tirelo preferred a group setting.

The question is what characterises an outcomes-based teaching and learning approach. How does a teacher strike a balance between the various teaching methods in a classroom situation? It becomes evident that the old teacher-centred methods cannot be done away with, but it is possible to integrate the new and the old. The one factor that influences teachers' attitudes is failing to detach from what they used to do, thus not integrating new approaches, and not developing new strategies to using the resources available. Platinum Primary has a library and a Science laboratory, but Brian could not take the learners to the laboratory to do experiments, as the laboratory was used by the high school learners. However, Brian indicated that he does not have a problem conducting experiments in the classroom. However, he does use the library efficiently, as for every theme that is taught in a particular week, he arranges with the librarian to display relevant books that learners can refer to during their library period.

The question is to what extent does the learning area Natural Sciences requires that learners become involved in investigations or discussions of concepts which they have to study and analyse. Investigations can be done through research by reading articles or scientific concepts, discussing them and answering questions; learners can perform an experiment, discuss findings and write down conclusions; or learners can do projects where learners develop a hypothesis and test it through data collection and investigations.

In one lesson that I observed, learners conducted an experiment on household acids and bases, using some of the laboratory apparatus. Brian actually asked the learners to design their own procedure, conduct the experiment, then present their findings and conclusion. However, not all the lessons are characterised by learners' active involvement.

4.4.2 How teachers use their decision-making abilities in designing learning programmes as a requisite for an outcomes-based curriculum

The outcomes based curriculum implies new planning demands on teachers as designers of learning programmes (Department of Education, 1998), thus in fact affording them considerable autonomy in planning and designing activities that will be instrumental in imparting knowledge to learners and addressing the learning outcomes. As Brumfit and Rossner (1992) point out, teaching is a process, which, like most human activities, depends on making choices of various kinds: choices of materials, activities, approaches, and so on. Natural Sciences, as a purely scientific learning area, consists of four knowledge areas or themes that integrate the physical sciences, chemistry, life sciences and geographical sciences. The four knowledge areas as set out in the Policy Guideline can be scheduled within the four school terms in a year, implying that a theme must be covered per term. Teaching one theme in such a way that it runs over into the next term means that time for the remaining themes is compromised.

There is no single prescribed textbook for Natural Sciences, and when ordering books, teachers are allowed to select learner guides according to their own judgement. Unfortunately, in some instances, the selection of texts was done before the teachers underwent training on the National Curriculum Statement, therefore the textbooks selected

lacked some detail, or contained poorly designed scientific activities. It is a challenge for teachers to use multiple references after years of being textbook-dependent, so the degree to which teachers refer to different sources is still limited. Based on the research observations, Tirelo and Brian both still mainly used the Learner's Guide, and only in a few instances did they refer to one or two other texts. Brian also had video cassettes on the various classes of animals which he used to explain their characteristics, such as their habitat, body parts, movement, nutrition, reproduction, etc. The video cassettes provided information that was absent in the textbook.

Outcomes based learning focuses on achievement in terms of clearly defined outcomes, rather than on teacher input in terms of syllabus content (Department of Education, 1997). It is expected of teachers to first specify the learning outcomes, for example, Learning Outcome 2 (LO 2) states that learners must construct Science knowledge, through the following assessment standards (ASs):

- recalling meaningful information when needed;
- categorising information to reduce complexity and look for patterns;
- interpreting information; and
- applying knowledge to problems that are not taught explicitly.

The teacher then has to find learning activities on particular content or a particular topic in which learners will acquire an understanding of the knowledge as well as skills such as 'categorise', 'identify patterns', 'interpret' and 'apply information'. Brian's lesson on the classification of animals into vertebrates and invertebrates, and a further detailed study of each one of the vertebrate classes, including mammals, amphibians, reptiles, birds and fish, serves as a good example of addressing the assessment standards in LO 2.

Learning Outcome 1 (LO 1) involves scientific investigations, and the assessment standards state that learners must plan, conduct an investigation, discuss and report their findings, which can be in the form of diagrams, mind-maps, tables, graphs, etc. Tirelo's experiment on energy sources can serve as an example, where learners burnt a candle, then observed the light and felt heat given off. This information was then applied to the

energy given off by the sun for plants to photosynthesise, or the heat from burning coal for cooking. Learners answered questions on the different energy sources and what the energy is used for. In another experiment that Brian conducted with his learners on acids and bases, after testing the different substances with an indicator, learners classified different substances as acids or bases.

Learning Outcome 3 (LO 3) involves science, society and the environment, and one of the assessment standards indicates that learners must acquire an understanding of the sustainable use of the Earth's resources. In another lesson that Brian presented under the knowledge area 'Energy and Change', learners had to differentiate between non-renewable and renewable energy sources, and identify them. They also had to apply their knowledge of the technologies involved in electricity generation, as well as the environmental impacts such as the greenhouse effect and global warming.

The nature of Science itself and the design of the Natural Sciences curriculum makes it imperative for Science teachers to teach and instil scientific knowledge and skills in learners. It is assumed that the teacher has the relevant Science qualifications, and an understanding of the nature of Science, which has as its foundation hypothesis testing of scientific theories. The new curriculum does not change the very basic requirement of teaching Science through investigations and experiments. It has actually illuminated what was a recommended practice before by describing the LOs and ASs as a means of presenting the content in a way that will ensure the acquisition of skills by learners. For a teacher to identify the LOs and ASs, and the content to address them, in a sense drives teachers towards teaching Science as envisaged. LO 1 compels the teacher to do experiments, LO 2 requires learners to construct knowledge, and LO 3 involves an application of scientific knowledge to technology, society and the environment.

It is a challenge for teachers to interrelate these concepts and realise that for every concept taught, the three interrelated Natural Sciences learning outcomes can be addressed. For example, the lesson on acids and bases can be presented by testing different substances to address LO 1; knowledge is recalled and interpreted on the characteristics of acids and bases, including examples, to address LO2; and learners can do an assignment or project on acid rain or cures for heartburn as a common health

problem, which is then an application of scientific knowledge to society and the environment.

Some teachers are able to use both their experience and initiative to interpret the curriculum correctly, but many may still require further training, guidance and support to teach the scientific way. If Science teachers still want to do experiments as observations, where the teacher holds a test-tube in front of the classroom for all the learners to observe, then there is a need to change perceptions. The teaching of Science as an investigative learning area demands inquiry and requires that learners do hands-on activities. As an example from this study, in a classroom of 50 learners, divided into nine groups of five, Tirelo managed to conduct a hands-on practical investigation on energy sources using a candle, methylated spirits, wood, coal and matches. Not every learner brought a candle as Tirelo had requested, but the few that she gathered she used in all five of her Natural Sciences classes. For the teaching of different forms of energy, she brought an electric kettle, she found a catapult to illustrate electric energy, a ball to illustrate gravity, a heater, and an apple to illustrate potential energy. Even though textbooks do have pictures and illustrations, seeing, feeling, touching and observing are skills and make lessons much more memorable.

4.4.3 Similarities in decision-making processes

The research findings reveal that the teachers were aware of the necessity to plan, in the sense that they did have a work schedule that sets out a learning programme for the year, giving an outline of learning outcomes, content, learners' activities, resources, assessment tasks and time allocations. Lesson planning and teaching itself involves cognitive thinking, where teachers make pedagogical decisions on how to act and reason in a complex, uncertain and rapidly changing classroom context in order to promote learning (Clark & Peterson, 1986). In the cases that were observed, it was easy for the teachers to use work schedules that were provided in the Policy Guideline, which were then adapted during the National Curriculum Statement training of teachers. However, it remains the individual teacher's responsibility to draw up short-term lesson plans that describe in detail the learning activities and resources needed to address both the learning outcomes learners need to achieve and the knowledge they need to acquire.

The types of decision that the teacher makes, the effort and time committed to developing a framework that will guide his or her future actions, largely depends on how the teacher visualises the future, as well as what the teacher wants to achieve. Lesson planning is also influenced by the teacher's personal beliefs, teaching style, content interpretation, and pedagogical and practical knowledge on classroom instruction from which interpretative skills and high quality teaching originates (McCutcheon & Milner, 2002). The practical nature of Science requires that teachers obtain the necessary reference texts and practical work apparatus they intend to use, as provision is made in the lesson plan templates that they use for listing all the resources. The two participating teachers revealed that they cannot rely on one textbook, therefore multiple referencing to find notes, activities, assessment tasks and experiments procedures is inevitable.

The two teachers' understanding and perceptions of planning revealed that they do regard a plan as a useful point of reference, because all the knowledge and content that learners must acquire must be taught within specified time allocations that must be adhered to. The work schedule provides a framework for the whole year, and detailed lesson plans must be drawn up from it. Bage (1999) argues that it is necessary and useful that plans are written out as they simply reflect mental planning of the teacher, and maintain a productive balance between responsive and child-focused teaching informed by predictive curriculum planning. In instances where lesson plans were not written out, the teacher just referred to the work schedule and found learning activities from available sources. In this way planning was unstructured, and the attainment of the outcomes depended on the teacher's selection of appropriate activities.

Planning also means integrating the learning outcomes and assessment standards in planning to ensure that the learning outcomes are addressed during the lessons. In each theme, all the learning outcomes must be addressed at least twice, whilst the coverage of all the content is also ensured (NCS, 2003). Planning for a year, that is developing a work schedule for a particular grade, entails looking at knowledge areas or content, learning outcomes, teacher's and learners' activities, resources and assessment tasks. The learning outcomes and assessment standards which specify the skills that learners must acquire, and the different assessment forms that are prescribed in Science (for example, investigations, and projects), do compel teachers to teach Science as an investigative

inquiry-oriented learning area, and thus needs to be planned for accordingly.

The pedagogical and practical knowledge of teachers, as well as the level of training that they received on the implementation of the new outcomes-based curriculum did assist them, as both the participating teachers indicated that proper planning and preparation of learning resources increases their efficiency and competence. The teaching and learning is therefore not entirely based on the textbook. Even though learners have one guide, the teachers have multiple guides that are made available to schools by publishers. It only requires the teacher to take the initiative.

Both teachers do make an effort to adhere to policy prescriptions in relation to planning based on the achievement of learning outcomes and assessment standards. The execution of the plan does pose a number of challenges for these teachers, though. According to policy, the time allocated for teaching in a year is approximately 28 to 30 weeks, meaning that all the prescribed knowledge must be covered during this time. Time management still remains a challenge for these teachers.

Another challenge is lack of resources, where teachers have to improvise. The teachers found it difficult to implement their plans as envisaged at all times, because learners learn at their own pace and classroom discipline and the submission of projects and assignments by learners is at times a problem. As Woods (1996) suggests, when it comes to immediate decision-making in the classroom, the goals in teachers' minds may be affected by how the present situation is perceived by them.

4.4.4 Differences in decision-making processes

Sardo (1982) noted that teachers have different planning styles that cannot be completely captured in a general portrait. Policy prescribes that lesson plans be written out daily or weekly. In some instances, one teacher had no time to write out a lesson plan, because of pressure to teach some topics within a limited time. Preparation in such a crisis seems insignificant and the teacher grabbed a few texts to find any relevant information and assessment activities that can be done in class. This led to a particular concept not being taught thoroughly. In such a scenario, it only seems important to give learners some idea of the topic, which implies that learners' knowledge and skills acquisition is compromised.

The question is whether there are ways in place for the teacher to account for content that was taught thoroughly, or partially taught or not taught at all? The moderation of the teacher's work is done at the level of the school, by the Head of Department, and at the level of the Education District office by the curriculum specialist. In one of the two cases observed in this study, the Head of Department at the school is a mathematics specialist and knows little about Science, which means that the teacher's work cannot be thoroughly scrutinised. Moderation at the level of the District office mainly focuses on Grades 9 and 12 learners' portfolios, and if any moderation for other grades, such as Grade 7, is done, it is done in a set-up where all the teachers in a cluster do peer-moderation for only two hours in the afternoon. There is no adequate time to allow the curriculum specialist or subject advisor to evaluate every individual teacher's work.

Tirelo faced a challenge when she only had limited time to present the theme 'Planet Earth and Beyond' in the fourth term. She remarked that she needed more time. Brian managed to complete all the themes timeously and even managed to do revision for two weeks before the beginning of the final exams. However, both teachers intended to plan differently in the following year. Time guides help to treat the time allowed for each phase as a valuable resource. Panasuk and Todd (2005) argue that the idea of time allocation does not contradict the belief that plans should be considered tentative and be flexible. Estimating time for a certain phase of the lesson is important to prevent a common shortcoming of many lesson plans, where the learners become overwhelmed with the concepts to be learned and problems to be solved, and such a lesson can be described as a journey that ran out of time and was not completed.

A term is 10 to 12 weeks long, which suggests that if a theme is completed in seven or eight weeks, the teacher can start another theme. The observations indicated that if the theme on 'Planet Earth and Beyond' is left for the fourth term, there are only be two or three weeks to teach it before final examinations start, which is not enough, since the theme is scheduled for five to six weeks, according to the Policy Guideline. The teaching of this theme is just as important as the teaching of the other themes, as it provides a geographical sciences background for learners.

Teachers can choose to start with any theme, and determine their own sequence of how they want to move from one theme to another. Sometimes the textbook gives a lot of information on a topic, and the teacher finds him- or herself teaching all the concepts. The work schedule should clearly identify the content for a particular grade, as prescribed in the Policy Guideline. The NCS training workshops assisted teachers on the interpretation of policy, and the demarcation of the core knowledge for each grade, so that teachers would know the content to teach, as the core knowledge progresses from one grade to another.

From the observations of how the two teachers enacted their plans in the classroom, it was clear that teachers use different approaches in the teaching of Science depending on the content that is presented, the learning outcomes and assessment standards that the teachers planned to address in the lesson plan. Classroom interaction with the learners included a variety of activities, such as the following:

- the teacher starts by introducing the topic;
- question-and-answer methods to link to learners' prior knowledge;
- writing summary notes on the chalkboard or putting up a transparency;
- explaining and giving examples;
- doing an experiment as a demonstration or learners doing it hands-on;
- learners writing notes and summaries;
- learners' watching a video and answering questions;
- learners referring to a textbook and completing an activity;
- group discussions and individual write-ups; and
- self or peer assessment.

The teachers constantly moved among the learners to guide them, ensuring that they were working and maintained discipline. Learners did an activity for each little section on a daily basis, and after completing a topic, they wrote an assessment test. Learners were given assignments and projects to do at home and gather more information. The teachers started to build on the easiest concepts and progressed to new and difficult concepts.

The teachers emphasised the development of autonomy and independent work, and they took care in giving their explanations and directions so that learners knew what to do, and how to do it. They used verbal interaction to monitor learner understanding of a concept. This was done through posing questions that stimulated thought, probing learner responses for elaboration and clarification, and clear and concise explanations to expand upon ideas. While encouraging learners to think at higher cognitive levels is a goal in science teaching, Tobin and Fraser (1988) concluded that learners tend to resist extensive cognitive challenges. In these observations, learners showed signs of task avoidance behaviours when cognitive demands were too high. This leads to classroom management problems. Thus interspersing high and low cognitive demands in the lesson could reduce the risks associated with high demand tasks.

The amount of time allocated for a lesson differs from one school to another. According to policy, the time allocated for Natural Sciences is three hours and thirty minutes per week (RNCS, 2003). In Tirelo's case, 30-minute lesson periods were allocated for three days, and for two days she had one hour periods, which she used for investigations. Brian had four periods taking 35 minutes and one period taking one hour in a week, which adds up to three hours and 20 minutes. Even though there is time allocated for a library period for Science one day per week, it is still crucial that the teaching time is afforded its maximum allocation or even more.

Teachers' workloads differ from one school to another. Tirelo taught five classes of Grade 7 Natural Sciences, but the learners were crowded, ranging from 50 to 55 in a class. Brian taught Natural Sciences in two different grades, two Grade 6 classes and three Grade 7 classes, with the number of learners ranging from 30 to 35. Both teachers had a registered class, and they also did extra-mural activities after teaching hours. It is very common in the senior phase (Grades 7, 8 and 9) that teachers have to offer more than one learning area

in different grades, as in the previous year, Brian had Technology to teach, and Tirelo taught Mathematics as well.

4.5 CHAPTER SUMMARY

Teaching is viewed as a decision-making process based on the categories of knowledge, skills, attitude, and awareness. To gain insight, two South African teachers were interviewed and observed extensively to understand how they respond to the planning demands of an outcomes-based teaching approach, and how they enact their plans in the classroom. The intention was to show that planning involves a decision-making process in which teachers visualise the future and develop a framework or learning programme that guide their future actions, meaning that the framework serves as a long-term year plan from which short-term lesson plans are drawn. The teachers are then bound to design the lesson plan activities in a way that will lead to learners' achieving the set learning outcomes and assessment standards. Teachers' decision-making processes, both during planning and teaching, are influenced by curriculum policy, teaching resources, their own theoretical and practical knowledge, the context in which they teach, and learner behaviour.

CHAPTER 5

IMPLICATIONS FOR CURRICULUM INNOVATION

5.1 INTRODUCTION

The dissimilarities between the decision-making frameworks of the respondents in this study reveal that teachers need to have a common understanding of the curriculum, what is expected of them and the best strategies that they can use to infuse an outcomes-based approach into their classroom practices. The lack of success of many innovative projects is attributed to the failure of teachers to implement the curriculum in a way corresponding to the intentions of the developers (Van Driel and Verloop 2001). It has already been mentioned that the reformers have not paid sufficient attention to the personal aspects of teacher change, especially in developing effective teaching plans that are effective in the classroom (Jita, 2004). It then becomes imperative that teachers be afforded the necessary guidance and support to enhance their decision-making space.

In almost everything that the teacher has to deal with from planning to teaching and controlling learners' written work, the most crucial element is time. Teachers who plan are more effective, regardless of the outcome measure, than teachers who do not plan, because an activity plan does at least demonstrate a positive intention to act (Taylor, 1970). It is therefore imperative that teachers be allowed adequate time to perform their primary function, without being burdened by too many extracurricular activities. A balance should be struck between the two with classroom practice as the priority.

The argument is that all the elements of classroom practice are interrelated, from planning in terms of designing the learning activities which will address the outcomes using appropriate assessment standards and content, to teaching and marking or controlling learners' work. At this stage of curriculum change, it is premature to assume that teachers are already experienced with mental scripts substituting for written plans, with a clear understanding of learning outcomes and assessment standards that lead to mastery of specific skills, and also certain as to which teaching strategies will be suitable for learners, because the teachers themselves are still in a learning curve. Experience comes with a

gradual discovery of what works best, which might also not be done in isolation. The sharing of experiences within departments at school level as well as within clusters at district level will offer more support for the teachers.

What then are the demands of the outcomes based curriculum? It is simply for the teacher to think, visualise, decide and act. Talk and chalk alone will not develop young scientists. In essence, a typical Science lesson can have some form of apparatus, or chemical or equipment or specimen that learners can investigate hands-on as a way to explain concepts. Learners can be encouraged to bring as many resources as possible so that everyone participates. One of the factors that teachers can consider is to engage learners on a set of authentic problem-solving activities (Snyder, 2005), so that they can construct scientific inquiry knowledge, develop an understanding of their own and become independent learners.

5.2 OUTCOMES BASED LESSON PLANNING

The need for careful lesson planning is best understood in relation to two related concepts: efficiency and effectiveness. The time allocation for the Natural Sciences learning area is generally limited and hence the time allowed for each of its components (scientific investigations and research projects) is even more so. Time must be used with maximum efficiency to ensure the highest possible level of outcome achievement. The most efficient learning activity is that which is effective in achieving more than one outcome.

All decisions regarding how the allocated time is to be used should flow from a clear idea of which outcomes are to be achieved. It may be that one or more outcomes have been prescribed by a curriculum, but these are usually formulated quite broadly, for example, the learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts. The outcomes for a single lesson must be accountable in relation to these but obviously must be much more specific, for example, planning an investigation. Planning an investigation implies several yet more specific outcomes related to specific performance elements such as hypothesising, designing an experiment, listing apparatus, outlining a

procedure and precautions. Again, remember that the means to the achievement of one outcome may simultaneously be the means to the achievement of others (RNCS,2003)

From the above, it should be clear that even when teaching in accordance with a set curriculum, the teacher will need to make decisions as to the specific outcomes for each lesson. Making the best possible decisions requires a thorough understanding of who the learners are and what they are already able to do. The logical way to proceed is to start with the longer-term outcomes, for example, those for the year, semester or term, which are often prescribed by a curriculum. If it is up to the teacher to determine which longer-term outcomes are to be achieved, the decisions will be made on the basis of what the teacher regards as most important. Ideally, these decisions should take account of and accommodate learners' interests and goals. Given that the time allocated for teaching is restricted, the question of which outcomes should be prioritised is crucial. When it has been established what the longer-term outcomes are, the learners need to be assessed in terms of their present levels of achievement in relation to these outcomes.

Outcomes are necessarily hierarchical and one of the crucial skills a teacher needs is how to logically sequence outcomes. This entails the same ability as it is demonstrated in mind-mapping (www.ukzn.ac.za/musiced/lesson planning.htm). Having determined the outcomes for a lesson, it might seem logical that the teacher should then decide on the learning activities and teaching methods he or she is going to apply. The kinds of learning activities selected should effectively and efficiently lead to the successful achievement of outcomes by the learners. In keeping with OBE philosophy, the activities should be those in which each learner is an active agent, not a passive receiver of knowledge. Indeed, the words ‘know’ or ‘knowledge’ should probably never be used in formulating outcomes. Even though all cognition relies on knowledge, there is no real cognition unless the knowledge is processed in some way. There needs to be some level of application for anything meaningful to be achieved.

Activities must be considered in relation to general principles of education. These principles provide useful criteria for assessing the educational potential of the proposed activities, as well as the subject content, materials and media that the activities will make use of. It must also be determined how multidimensional the proposed activity is in terms

of outcome achievement. Obviously, the best activities are those designed to achieve a range of outcomes, even though just one outcome may be the primary focus of the activity. It also makes sense to consider possible activities in relation to the different kinds of development that education should be facilitating.

5.2.1 Six Common Mistakes in Writing Lesson Plans

Without question, the very best teachers are good planners and thinkers. The success of professional teachers requires commitment and practice, especially of those skills involved in planning lessons and learning activities, and in managing classroom behavior. Planning lessons is a fundamental skill all teachers must develop and practice, although implementation of this skill in actual teaching can, and usually does, take some time. Being able to develop an effective lesson plan format is a core skill for all who teach.

Kizlik (2008), from the study that evaluated lesson plans, identified the mistakes that distort or weaken what the plans are supposed to communicate. Improving lesson planning skill should begin by first thinking carefully about what the lesson is supposed to accomplish. In developing lesson plans, the following are mistakes that teachers make most often:

1. **The objective** (outcomes) of the lesson does not specify what the student will actually do that can be observed. Remember, an objective is a description of what a student does that forms the basis for making an inference about learning. Poorly written objectives lead to faulty inferences.

2. **The lesson assessment** is disconnected from the behavior indicated in the objective. An assessment in a lesson plan is simply a description of how the teacher will determine whether the objective has been accomplished. It must be based on the same behavior that is incorporated in the objective. Anything else is flawed.

3. **The prerequisites** (assessment standards) are not specified or are inconsistent with what is actually required to succeed with the lesson. Prerequisites mean just that -- a statement of what a student *needs to know or be able to do* to succeed and accomplish the lesson objective. It is not easy to determine what is required, but it is necessary.

4. **The materials** specified in the lesson are extraneous to the actual described learning activities. This means keep the list of materials in line with what you actually plan to do.

5. **The instruction** in which the teacher will engage is not efficient for the level of intended student learning. Efficiency is a measure that means getting more done with the same amount of effort, or the same amount with less effort. With so much to be learned, it should be obvious that instructional efficiency is paramount.

6. **The learner activities** described in the lesson plan do not contribute in a direct and effective way to the lesson objective. Don't have your learners engaged in activities just to keep them busy. Whatever you have your students do should contribute in a direct way to their accomplishing the lesson objective.

A lesson plan that contains one or more of these mistakes needs rethinking and revision. Below is a rationale and guide to help you develop effective lesson plans and avoid the six common mistakes.

The purpose of a lesson plan is really quite simple; it is to communicate to oneself. The lesson plans a teacher develops serve as a guide in organizing materials for the purpose of helping your learners achieve intended learning outcomes. Whether a lesson plan fits a particular format is not as relevant as to whether or not it actually describes what you want, and what you have determined is the best means to an end. A key principle in creating a lesson plan is specificity**.** What process one uses to get to a destination depends on available resources and time. If the purpose of a

lesson plan is to communicate, then, in order to accomplish that purpose, the plan must contain a set of elements that are descriptive of the process.

Good lesson plans do not ensure students will learn what is intended, but they certainly contribute to it. Think of a lesson plan as a way of communicating, and without doubt, effective communication skills are fundamental to all teaching. Lesson plans also help new or inexperienced teachers organize content, materials, and methods. When you are learning the craft of teaching, organizing your subject-matter content via lesson plans is fundamental. Like most skills, planning gets better when the teacher thinks more of ways of improving it and teaching based on feedback from your students, their parents, and other teachers. Developing your own lesson plans also helps you own the subject matter content you are teaching, and that is central to everything good teachers do (Kizlik, 2008). The lesson planning process can be represented as follows:

Input ⟶ process ⟶ output

The diagrams that follow shows the lesson plan process.

THE LESSON PLAN

1. Preliminary Information

(a) the grade level of the students for whom the plan is intended;

(b) the specific subject matter;

(c) the name of the unit of which the lesson is a part; and

(d) the name of the teacher.

2. The Parts

- an input (information about learners and necessary resources).
- and the actual assessment procedures (tells the teacher how well students actually attained the objective).

Input - Pre-Lesson Preparation

Information about:

- the age and grade level of the learners, and prior knowledge
- goals
- the specific content
- learner characteristics
- the amount of time you estimate it will take to implement the lesson.
- how you will acquire the physical materials required

Process - Lesson Planning and Implementation

- This is the actual plan. It provides a description of:
- Instructional goals
- Objectives / learning outcomes
- Content
- Materials
- The teacher's instructional activities / procedures.
- What the learners will do during the lesson – learner activities.
- How will the learning be measured? This means a description of the assessment / evaluation procedure at the end of the lesson.
- Follow-up activities to reinforce and extend this lesson, e.g. homework, assignments and projects.

Output

This means a description of what the students are supposed to learn. An end (the objective and the learning prerequisites),

5.2.2 Post-Lesson Activities - Lesson evaluation and revision

Self-assessment is done after the lesson is presented to address the major components of the lesson plan, focusing on both the strengths, and areas of needed improvement. The information will be useful for planning future lessons. A good idea is to analyze the difference between what the teacher wanted (the objective) and what was attained (the results of the assessment). Of course, there is an immense difference between being able to plan and actually being able to carry out the plan. However, if the teacher has thought carefully about where he or she is going before writing out the plan, the chances of both the teacher's and the learners' success, is much greater (Kizlik, 2008).

5.2.3 Overall organisation of the plan

Related criteria for the overall organisation of the lesson plan are: continuity, sequence, progression, and time budgeting. It is not necessary or advisable that a plan be structured according to some rigid formula, but it should definitely reflect a systematic progression toward the achievement of the lesson's outcomes. The 'five formal steps' attributed to the German psychologist and educationist, Johann Friedrich Herbart (1776 - 1841), is an example of such a formula. While it most likely would not be appropriate to apply them as a strict method for lesson planning, the 'steps' are useful in different ways. They identify dimensions of learning activity that are important to keep in mind in most kinds of teaching and should be considered accordingly (www.ukzn.ac.za/musiced/lesson_planning.htm).

The Herbartian Steps

Preparation

In this case, 'preparation' does not refer to what the teacher did before the lesson, i.e. how s/he prepared for it. Rather it refers to the manner in which s/he prepares the mindsets of students at the start of the lesson for the new knowledge, concepts and skills that are to be introduced. There are many ways in which this can be done, for example:

- stating what the topic/theme is and/or stating what the expected outcome(s) for the lesson is/are;
- recalling what was learned in the previous lesson and indicating how this will be added to and applied;
- asking questions based on what students already know or can do, these leading to a key question, or task, whose solution/completion becomes the focus of the lesson. In some cases, a single question (without leading questions) will suffice;
- sharing an anecdote (a short narrative, usually of something the teacher has experienced) that arouses interest around the theme/topic of the lesson to follow. This could alternately be a news report, a legend/fable, or a scenario that presents a problem whose solution becomes the focus of the lesson; doing an activity of some kind to bring about an appropriate mindset; (e.g. watching a video) .
- attending to work assigned in the previous lesson;
- doing warm-up exercises relevant to activity that will follow.

Presentation

This is where learners are guided in the acquisition of new forms of understanding and skill, which, according to the foregoing discussion, should involve the learners as active agents, even though explanations, demonstrations and other forms of facilitation will be required of the teacher.

Association or Comparison

The principles of perception, integration, and outcomes-based education highlight the importance of making connections between what is being presented in the lesson and what learners have already acquired in the way of understanding, skills, and experience. Especially important, from the OBE perspective, are the ways in which connections are made between ‘disciplines’ or learning areas. Comparisons are a useful way of establishing connections. This is what is referred to as integration across the learning areas, for example, in science learners must be able to represent the data from their findings in a form of a graph; plotting a graph is a skill that they also learn in Mathematics.

Generalisation

As a step, this is where students would be helped to formulate general concepts, principles, rules, procedures or key points based on what has been presented or discovered through learning activity. This can be treated as a dimension of the learning experience that the teacher should facilitate when and where it may be appropriate.The potential for meaningful empowerment is obviously greater when learners arrive at generalisations for themselves with the teacher guiding them through appropriate but minimal interventions. For example learning outcome 1 in Natural Sciences requires that learners design a hypothesis and design an experiment to test it. Learners are expected to come up with a hypothesis question, apparatus and a procedure. This is after the learners have been taught the concept and also received some guidance from the teacher. At the end they discuss their findings and therefore acquire an understanding of the knowledge because they have done a practical application.

Application

This is where new concepts, principles, procedures, etc. are applied in some form of problem-solving activity and need not be the concluding step in a lesson. Often, the learners will be expected to apply these in some kind of task set as an assignment or a project. For example, in Natural Sciences, learning outcome 3 is achieved through learners applying their science knowledge to the society and the environment by obtaining an understanding of phenomena such as renewable and non-renewable energy sources, greenhouse effect, global warming, extinction of species, and all the other effects that result from human impact on the environment.

Time budgeting

Inexperienced teachers, and even many experienced teachers, need to develop a time budget for the different parts that make up the lesson, e.g. introduction, presentation, conclusion. There is no format that is applicable in all situations and, again, the detail of the plan will depend on a number of factors, e.g. the experience of the teacher, and whether the lesson is presenting new material or is a revision lesson. Less experienced teachers generally need to provide greater detail. If not actually included in a written plan,

the following are elements that the teacher needs to have thought out carefully in preparation for the lesson.

- ***Routine information*** - e.g. date, class, duration, subject, topic
- ***Lesson outcomes*** - stated concisely in terms of a specific behaviour or behaviours (actions) that will unequivocally demonstrate achievement
- ***List of required materials*** - the clear identification of all instructional materials, equipment and aids to be used. It must be ascertained ahead of time that all materials are available and in usable condition.
- ***Background information*** - a short abstract of what the students already possess in the way of relevant skills and understanding.
- ***How the lesson is to be introduced*** - Though this part of the lesson will take no more than a few minutes, it is crucial in preparing the students for what is to follow, for activating their interest, and for establishing a link with what has preceded the lesson. The introduction may introduce a thought question as a means of providing a focus.
- ***The main activities of the lesson*** - presented as a clear and logical sequence.
- ***How the lesson is to be concluded*** - How the lesson is concluded depends on several factors, but usually it is here that either a summary of key points or an opportunity for the application of new understanding and skills is provided, though such application may be planned as part of an assignment to be completed outside of class. No lesson should just "peter out". There should be a clear ending that has been planned for and for which time has been budgeted.

5.3 ASSESSMENT

Assessment is the process by which teachers and learners decide whether or not a learner is competent. A learner must show what he or she knows and understands and whether he or she can do whatever is required to demonstrate competence. Learning must integrate skills, values and knowledge. Learners therefore need to be able to think critically and creatively and should be responsible about the application of their knowledge. In each

learning area, there is a set of outcomes that defines what learners are expected to achieve; for each grade of learning there is a set of assessment standards that defines the level of knowledge, skills, attitudes and values learners are required to demonstrate as evidence that they have achieved each phase outcome to an appropriate depth and breadth (RNCS, 2003).

This means that outcomes remain the same from grade to grade while the assessment standards change. As the standards are grade-specific, they describe how conceptual understanding is meant to progress in each learning area. The main purpose of assessing learners is to enhance individual growth and development, monitor the progress of learners and facilitate their learning (RNCS, 2003). Teachers have to design assessment tasks in the form of research projects, experiments, assignments and tests. The standard of assessment is largely determined by the teacher's subject-matter knowledge, experience, and the type of resources used.

5.4 COLLABORATIVE PLANNING

The South African National Curriculum Statement explicitly encourages teachers to formulate cognitive objectives and align them with the established state and national curriculum standards to ensure specific expectations. These standards provide the basis for and guidance in making educational decisions.

Branch (1994) reported that teachers rarely discuss objectives or lesson plans with other teachers or supervisors in the school. The study found that most teachers lacked even basic knowledge to implement an instructional development approach. It seems likely that highly certified teachers with lengthy experience were reluctant to admit their lack of knowledge and expertise in an area they felt they should know about. Only a few of them were able to develop and classify behaviourally stated instructional objectives. Kennedy (1994) found that some of the most highly educated teachers believed that the use of behaviourally stated instructional objectives was restrictive.

Collaborative planning then becomes crucial, as teachers can share experiences, resources, planning and teaching methods, a progression of scientific concepts from one

grade to another. For example, the Grade 8 teacher expects the Grade 7 teacher to have covered all the knowledge in the learning programme for that grade, as it provides the essential skills for learners proceed to Grade 8. Therefore teachers cannot operate only as individuals. Tests set by teachers within a phase (for example, Grades 7, 8 and 9) can be moderated by all the Science teachers together, so that they can ask questions and get clarity if there are any missing concepts or if certain parts were not treated. What can work for teachers is to collaborate with other teachers teaching the same subject in a phase, to check the standard of the work, as well as to share ideas on how to improve on one's performance. This should include the Head of Department, even in instances where the Head of Department is not a Science specialist. It would be futile to depend on one subject specialist at the district level to monitor and moderate all the teachers' work in every school, in every grade in the whole district.

5.5 TEACHER SPECIALISATION

Meeting both the planning and teaching demands of OBE is still a challenge for teachers in terms of the various subjects they have specialised in, because in most cases in the General Education and Training (GET) band, teachers have to teach learning areas they have no specialisation in. Research findings from the recent research conducted by the Education Department on educator supply and demand in the South African education system has revealed that there is an acute shortage of Science teachers, because many of them are leaving the system (Education ELRC, 2005). Another issue is that teachers who are declared 'additional' in terms of the school's curriculum requirement may be reluctant to be deployed to other schools, but rather choose to remain and take up a new subject that they have not qualified for. Currently, there are no systems in place to take this teacher on board, it is up to the teacher to take the initiative to learn, to the detriment of the learners.

The learning area Natural Sciences is an integration of four Science subjects. Teachers who are Life Sciences specialists tend to focus more on 'Life and Living' and enjoy teaching it more than other themes. Physical Sciences specialists prefer 'Energy and Change' and 'Matter and Materials'. Geography specialists would teach 'Planet Earth and

Beyond' with a clear understanding of the concepts. It is a challenge for teachers as they implement the curriculum to study and refer to varied sources to develop competence in all scientific concepts and themes.

5.6 RECOMMENDATIONS

On the basis of the findings that the participant teachers in the study do not view planning as a basic psychological process which allows them to visualise the future, neither do they consider the framework that they construct, in the form of a work schedule or lesson plans, as a tool that will guide their future actions. I therefore make the following recommendations:

1. Planning for lessons forms part of the roles designated for teachers as curriculum interpreters and implementers. It is prescribed by curriculum policy, and during the training on the National Curriculum Statement, teachers were given an orientation to planning, and guidelines were provided on how to develop learning programmes, work schedules and lesson plans. Therefore, teachers are expected to use them to structure their planning.
2. Time management in crucial for effective teaching. It means certainly controlling the way time is used. Effective teachers systematically and carefully plan for productive use of instructional time.
3. One of the primary roles that a teacher performs is that of designer and instructor. Teachers at every level prepare plans that aid in the organization and delivery of their daily lessons. These plans vary widely in the style and degree of specificity. Some instructors prefer to construct elaborate, and detailed outlines; others rely on the briefest of notes. Regardless of the format, all teachers need to make wise decisions about the strategies and methods they will employ to help learners move systematically toward learner goals.
4. Teachers need more than a vague, or even a precise, notion of educational goals and learning outcomes to be able to sequence these outcomes or to be proficient in the skills and knowledge of a particular discipline.

5. The effective teacher also needs to develop a plan to provide direction towards the attainment of the selected learning outcomes. The more organized a teacher is, the more effective the teaching and learning. Writing daily lesson plans signifies being organized.
6. Planning for a lesson could begin by choosing a desirable lesson plan outline and sticking fairly close to it. Planning and classroom interactive decisions usually come once the teacher is in the classroom with the learners, having developed own instructional resources, and having tried out various strategies. Although fundamental lesson planning elements tend to remain unchanged, their basic formula is always modified to suit the individual teacher's lesson preparation or style of presentation.
7. The lesson plan is a dreaded part of instruction that most teachers detest. It nevertheless provides a guide for managing the learning environment and is essential if a substitute teacher is to be effective and efficient.
8. Lesson planning involves much more than making arbitrary decisions about ‘what I'm going to teach today’. Many activities precede the process of designing and implementing a lesson plan. Similarly, the job of systematic lesson planning is not complete until after the instructor has assessed both the learner's attainment of the anticipated outcomes and the effectiveness of the lesson in leading learners to these outcomes.
9. Even teachers who develop highly structured and detailed plans rarely adhere to them in lock-step fashion. Such rigidity would probably hinder, rather than help, the teaching-learning process. The elements of a lesson plan should be thought of as guiding principles to be applied as aids, but not blueprints, to systematic instruction. Precise preparation must allow for flexible delivery. During actual classroom interaction, the teacher needs to make adaptations and to add artistry to each lesson plan and classroom delivery.
10. Teachers should plan collaboratively and share experiences within departments with other teachers offering the same learning area at school level aimed at policy interpretation, especially the learning outcomes, assessment standards and core-knowledge, so that teachers can have a clear understanding of scientific planning and teaching strategies, and could even avoid excessive dependence on learner guides.

11. Teachers should review published texts as a way of developing strategies for multiple referencing and the identification of relevant resources.
12. Learning area monitoring and moderation at school level, to assist with the control of work to attain the required standards is essential. This will also help to ensure that all the content is covered in all the Natural Sciences knowledge areas as indicated in the learning programme.
13. Lesson plans and learners activities that have been developed and filed, can be reviewed and improved for future enactment. It means that the time and effort invested in conscientiously referring to the prescribed core knowledge and concepts, as well as to the various sources, in order to select learners' activities that will address the learning outcomes, will not be in vain. Refining and fine tuning in the following year will not cost a lot of time. Time could rather be devoted to including new concepts and setting new assessment tasks, such as tests, projects and exams.
14. Worksheets on specific experiments that the teacher will carry out with the learners to in all the knowledge areas, could be organised, such that as part of the year plan, the teacher already knows as to which experiments will be done as well as the apparatus and chemicals needed. It can also be ensured that these essential resources are made available in advance.
15. At school level, it is important to check the allocation of time specifically for Science practical work in a week, with monitoring attached to check whether this these periods will be utilized as planned for scientific investigations or experiments. The practical of science cannot be overemphasised. Both teachers and learners can use the resources available to them and some means could be made to purchase laboratory apparatus and chemicals from the school's budget allocation.
16. The teaching of Natural Sciences in its scientific nature demands that learners be engaged in hand-on activities in the form of investigations or experiments such that they observe, interpret, analyse and apply scientific knowledge and skills. It is imperative that the lessons be planned for be enacted in the classroom as envisaged.
17. Curriculum support and teacher development should be geared at helping teachers adapt to the NCS within an outcomes-based context such that their experiences, knowledge, skills can be enhanced towards an applicable understanding and interpretation of the curriculum.

To change the status of and improve Science learning, substantial attention and time must be invested in promoting the thorough development of detailed and well thought out written lesson plans. Teachers offering Natural Sciences are faced with the responsibility of ensuring that the learners' potential is developed optimally, in order to built a nation that upholds its values, understands science as a phenomena, and live a sustainable way. All the learners in the GET band, from Grades R to 7, have an opportunity and an ability to study Natural Sciences and acquire scientific skills and knowledge.

5.7 CONCLUDING REMARKS

It is essential that teachers, particularly in Natural Sciences understand the necessity to plan for their lessons and develop learning programmes in an outcomes based curriculum, such that their decisions are organised and structured for classroom instruction. What can be learned from this study is that to a certain extent teachers do plan, and also make an effort to translate their lesson plans into classroom practice. What it means for better planning practices as well as implementation, is that a clear understanding of how to plan and the necessity thereof, is required. The enactment of the lesson is a significant part of the process. This can be achieved through organised curriculum interpretation, through specialized INSET training in planning and enactment of plans. Teacher collaboration, both at school and cluster levels, through workshops that are directed towards teacher development, would instil the culture of planning as a measure that equips teachers with both the practical and pedagogical knowledge of developing the full potential of the learners. This can also be an initiative coordinated by teachers themselves, in conjunction with other education support structures, both internally and externally.

The difficulty of changing teachers' professional knowledge and practice is well documented. Through teacher training and development, however, there appears to be some hope in the opportunities created for reflection and practicing amongst teachers. What it means is that teachers are working in isolation and have no opportunities provided for them to receive feedback on their value, worth and competence. Even though some training programmes are already in place in most of the Provinces, there is a need to

customize the training needs of teachers, with more attention to curriculum issues, such as lesson planning and classroom practice.

What is lacking is for teachers to understand what is forthcoming in the future, regarding their responsibility to develop young South Africans into citizens who are knowledgeable about science and understand the sustainable use of resources. The learners are the future engineers and decision-makers in Parliament or internationally, who will influence the sustainable use of the Earth's resources. We live science. We observe phenomena. Why global warming? Why climatic changes? Why extinction of species? Why load shedding of electricity? Why the need to install solar geysers? Why the need to reuse and recycle? Are we headed for the next mass extinction?

The school management team is structured in such a way that each learning area or subject has an experienced teacher who supervises, controls and offer guidance in terms of the curriculum specifications of that learning area. Therefore, there is a need for head of departments (HODs), and principals to institute more efficient monitoring and evaluation mechanisms of teacher planning. The areas in which teachers need guidance can be developed, and programmes for development can be organized, as part of the integrated quality management system (IQMS), which advocates setting aside time for both personal and professional growth of teachers.

A standardaized approach for all teachers in how to plan can be recommended, in the sense that the same curriculum guides were provided to teachers and the NCS training instituted by the Department of Education was uniform. The core-knowledge is prescribed by policy, but what remains a challenge is to design learning and assessment activities that will address the learning outcomes in an integrated manner. Developing exemplars of lesson plans, learning activities and assessment tasks that teachers can study, adapt, implement, share ideas and reflect on, can improve the teaching practice. Writing lesson plans can be recommended as a way of providing an organized unit that can be reflected on and improved..

In comparison, the findings of this study does concur with the existing literature on teacher planning and enactment, in relation to teachers' decisions about planning elements, including learning outcomes, content, learning and assessment activities, resources and materials. Interactive decision-making is integrated in classroom practices because learner participation and involvement is one of the factors defining a teacher's curriculum decision-making ability. What is different in the findings is that, teachers do plan, but not on a regular basis. Lesson plans may be written out and sometimes not. The selected learning activities sometimes do not ensure full acquisition of the prescribed learning outcomes, knowledge and skills, because of lack of the teacher's pedagogical knowledge to align these elements. Another finding is that the time on task is a challenge, hence to teach to complete the knowledge areas, might compromise other concepts, or they may not be taught at all.

There will be challenges in meeting the planning and teaching demand of OBE, which necessitates that teachers in the system takes an initiative to learn and improve their practices as an initiative of their own ability. Even though training at Departmental level has been inadequate, understanding and valuing the need to plan and striving to enact these lesson plans in an organized manner, will lead to improved classroom practice. Lastly, contact time could also be utilized effectively because planning means being sure of what needs to be done; hence it also reduces the ambiguity of not knowing how to handle either the subject matter or the learners.

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APPENDIX 1: LESSON PLAN FORMAT

THUTO MIDDLE SCHOOL

LEVEL 3: LESSON PLAN DATE: 17 July – 28 July 2006

GRADE: 7 TIME / DURATION: 2 Weeks

CORE KNOWLEDGE:Energy and change–Changing stored energy to other energy types

Learning outcome and Assessment Standard	LO 1 AS 1,2, 3 LO 2 AS 4		
Integration	Languages, Life Orientation		
	ACTIVITY 1	ACTIVITY 2	
Teaching style / description of activity Guides learners by asking them questions to understand the term energy, e.g. Where do plants get energy from? Where do people get energy from? Can learners come to school daily without eating food?	- Learners find out what energy is and why we need energy. - Learners learn about the main source of the Earth's energy. - Learners look back at the form of energy that they learned in the past year. - Learners learn the collection between work and energy. - Learners investigate the different forms of energy using the given resources.	- Learners identify the different forms of energy, e.g., 1. Potential energy - stored Chemical energy – battery and candle. Elastic potential energy – catapult. Gravitational potential energy – mountain climbing. 2. Kinetic (movement) energy - Learners cut out different pictures from magazines and paste them on their books, and identify the forms of energy in each picture.	**Special needs of learners** Slow learners will be given more time to accommodate them in order to complete the given tasks.

Resources	Candles, matches, brick, methylated spirit		
Assessment	Self (Group)		

APPENDIX II

Exemplar Work Schedule Grade 7

LOs and ASs	Core concepts and knowledge	Learning activities	Integration	Resources	Assessment
LO1: AS2 Conducts investigations Collect data Record data Interprets information LO2: AS3,AS4 Applies and interprets knowledge • Identifies key ideas • Translate information • Apply concepts LO3: AS1 Compare and interpret differing events.	Core knowledge: Energy and Change • Stored (potential) energy – examples of potential energy • Potential energy can be released as kinetic energy (energy of motion). e.g. 1. released spring. 2. faster motion of particles of hot gases. 3. body movements.	Learners will: • Present what potential energy is and give examples. • Investigate how potential energy changes to kinetic energy by using a released spring. • Investigate motion of particles of gases when heated.	Technology LO1: AS 1&3 LO3: AS 1	pictures books charts people spring elastic bands ice cream sticks cardboard coke cans	Investigation Presentation

APPENDIX III

Exemplar Lesson Plan Grade 7

<table>
<tr><td colspan="2">Learning Area: NS Grade 7
Duration: 7 hours Date: Week 1 and 2</td></tr>
<tr><td>Learning outcomes and Assessment standards
LO1: AS2
Conducts investigations
Collect data
Record data
Interprets information
LO2: AS3,AS4
Applies and interprets knowledge
• Identifies key ideas
• Translate information
• Apply concepts
LO3: AS1
Compare and interpret differing events.</td><td>Integration:
Tech
LO1: AS 1&3
LO3: AS 1</td></tr>
<tr><td>Looking backwards at:
Sources of energy and systems that store energy.</td><td>Looking forward to:
Design test and find out different kinds of systems.</td></tr>
<tr><td colspan="2">Context: Transportation
Core knowledge and concepts:
Energy in systems
• Stored (potential) energy – examples of potential energy
• Potential energy can be released as kinetic energy (energy of motion). e.g.
1. released spring.
2. faster motion of particles of hot gases.
3. body movements.</td></tr>
<tr><td colspan="2">Learning, teaching and assessment activities:
Learners will:
• Present what potential energy is and give examples.
• Investigate how potential energy changes to kinetic energy by using
❖ a released spring (following a given procedure).
❖ Motion of particles of gases when heated (following a given procedure).
❖ Body movements(following a given procedure)

Identify situations / cases where transport systems convert potential energy to kinetic energy</td></tr>
</table>

Forms of assessment: Investigation Presentation	**Resources:** Pictures, books, charts, people, spring, elastic bands, ice cream, sticks, cardboard, coke cans
Expanded Opportunities Design systems that transfer energy to surroundings (e.g. dragsters/ creepy crawlers)	*Teacher reflection* Teachers will note: How the lesson plan could have been presented differently. What impacted on experiments done Other examples that may have been used. What was good / weak about the Learning Unit. Concepts that have not been dealt with effectively.